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17 DISASTER REDUCTION AND THE LIMITS OF EXPECTATION: A CASE STUDY FROM THE INDIAN HIMALAYA

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ABSTRACT

In November 1989 a major section of the hillside collapsed below the village of Sapni in Kinnaur District of Himachal Pradesh in the Indian Himalaya. This paper documents events relating to the 1989 landslide and the resulting interaction between the community and the district government. The response of the villagers involves ritual propitiation of a village deity - the principal authority in the village. With respect to natural hazards, the significance of these rituals lies in their role as a vehicle for community decision making: firstly, by instigating discussion within the community; and secondly, because association with the deity legitimises any decisions taken. This institutional response to natural hazards is one aspect of a coping strategy that has evolved amongst farming communities in one of the most disaster-prone regions of the world.

The case study illustrates a range of academic and professional perspectives, including recent work by political economists, sociologists, social anthropologists, engineers, geologists, geographers, and local administrators. Their differences are outlined in the key section Analyses of Risk, and the case study is used to demonstrate that each discipline has an integral but limited part to play in analysing risk and risk perception. This is to be expected, since decisions which satisfy the demands of one perspective often entail unavoidable risks from a second perspective. In Kinnaur, the collective effort required for disaster reduction is made possible largely through local government initiatives. But, from the point of view of self-interest, the only decision-making institution able to balance potential losses and gains must necessarily be at village level. This situation and its implications for establishing successful disaster reduction strategies amongst similar mountain communities are explored in the concluding section of the paper.

INTRODUCTION

Geology and Climate

The villages of Kinnaur, one of the tribal areas of Himachal, are situated amongst snow-peaked mountains and deep river valleys. The dominant feature of this landscape is the Sutlej River gorge, which enters Kinnaur from Tibet to the east. The Daula Dhar mountains separate Kinnaur from Uttar Pradesh to the south. To the west lie the fertile valleys of districts Kullu and Shimla, and to the north the high altitude desert region of Spiti. The geological setting of this area is described by Wadia (1993).

This region of the western Himalaya has three distinct climatic zones (Fig. 1): wet temperate (monsoonal), to the west of Kinnaur; sub-humid to humid temperate (transitional), in lower Kinnaur; and semi-arid to arid temperate (cold desert), in upper

Kinnaur. Sapni village is situated in the transitional zone, at the confluence of the Sutlej and its major tributary the Baspa River. In this zone, snowfall is usually high from December to February (often up to several feet in the village) with occasional snowfalls as late as mid-March. From April there are scattered showers of rain, until the arrival of the south-west monsoon which brings torrential, but unpredictable, rainfall between July and mid-September. The average annual precipitation in this zone varies between 200 mm at the valley floor and up to 800 mm in the higher reaches. Minimum winter temperature falls to about -8 deg. °C in January and the mean maximum temperature is 28 deg. °C during May/June. (Wadia, 1994).

The Hindustan-Tibet road (National Highway 22) follows the Sutlej River valley from Shimla through Kinnaur district and on to Spiti. Officially NH22 is open all the year round. In practice, the road is often closed by landslides and rockfalls. These are most frequent during the monsoon period (July to mid-September), and in early spring (March and April) due to rain and/or melt water. The road is also occasionally blocked by glacial activity or heavy snowfall during the winter and early spring (December to April), and by river flooding during the spring melt or monsoon periods. Landslides and rockfalls are also a hazard on village link-roads and footpaths.

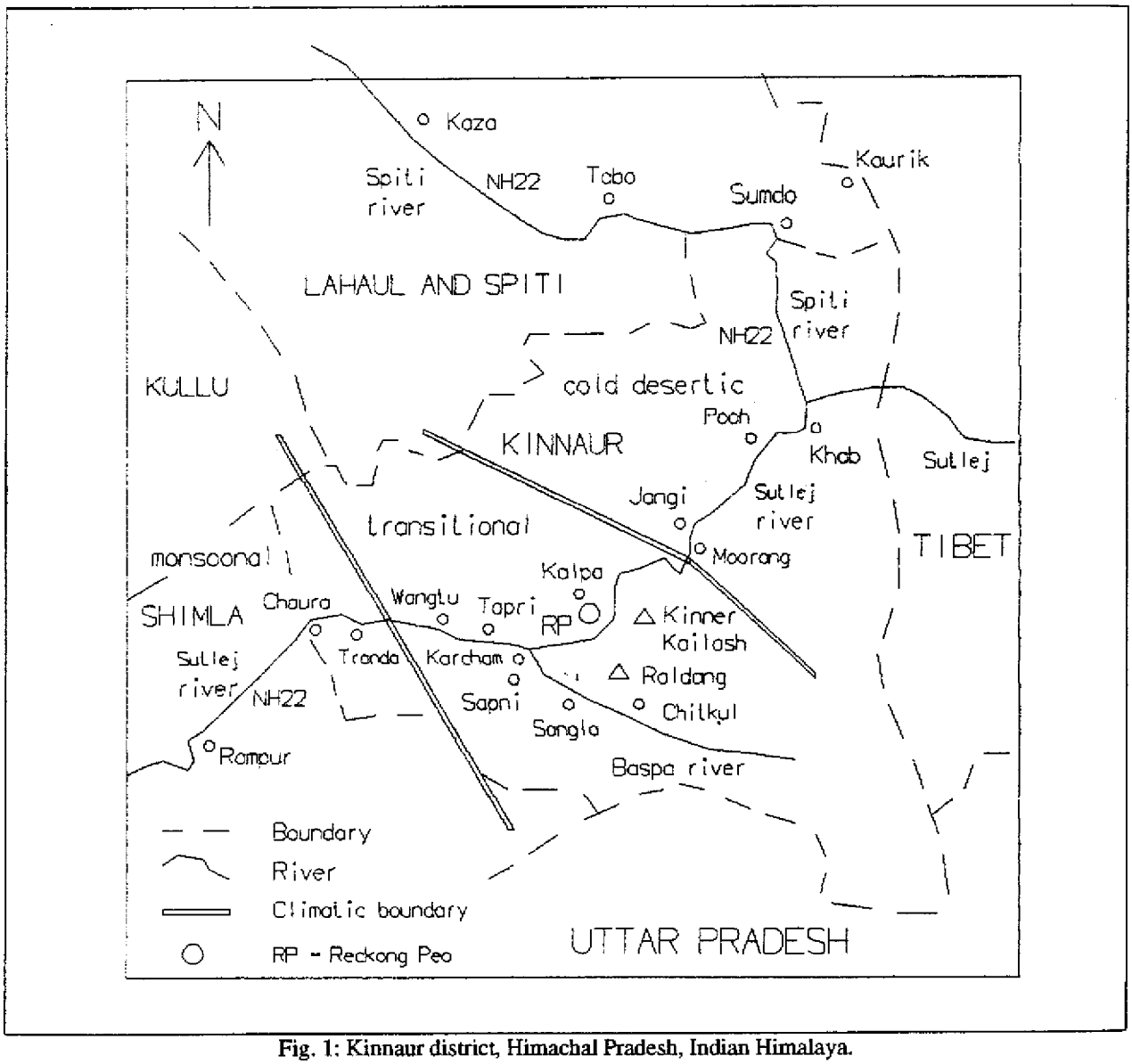

Fig. 1: Kinnaur district, Himachal Pradesh, Indian Himalaya.

Village environment

Sapni village is located high on the east-facing side of the Baspa valley, above the roadside settlement of Karcham (Fig. 2). From Karcham, it takes one and a half hours to walk to the *dogris* (farm houses) amongst the lower terraces (an area known as Shenaden), and a further two hours up to the village proper. Above the village are the high altitude fields (*kanda*), and alpine pastures (*pabo-kanda*). The subsistence land use strategy is characterised by seasonal vertical transhumance (for those with *dogris* at Shenaden and in the *kanda*), and by the individual ownership of agricultural plots and apple orchards. A variety of crops are planted at different elevations and separate locations. Pasture lands are used on a communal basis, with shepherds employed during the summer months to tend cows, sheep and goats. Before winter sets in, the shepherds migrate with flocks of sheep and goats in search of pasture, and the remaining livestock are kept in the village or at Shenaden.

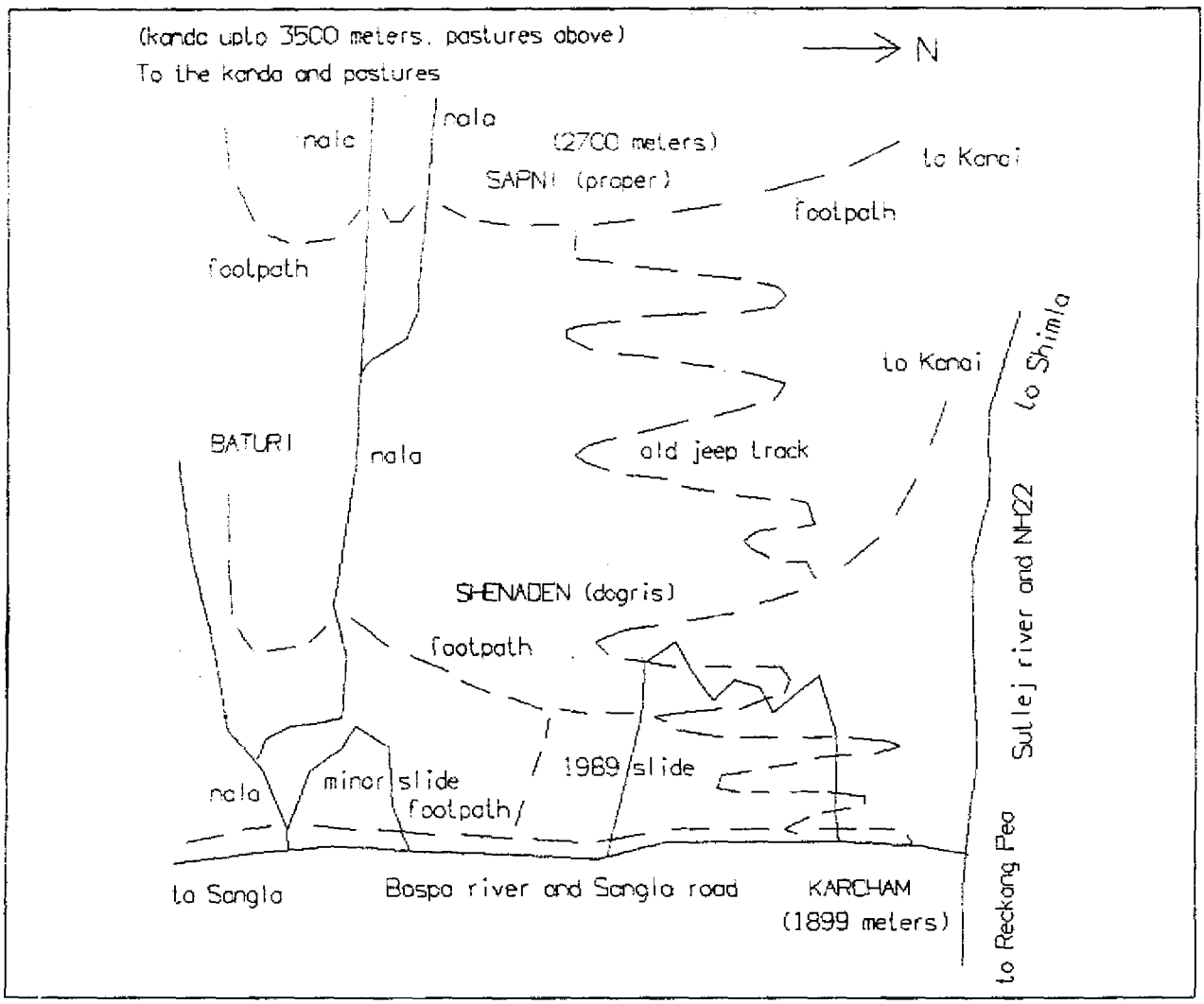

Fig. 2: Sapni village.

Some notes on religion and mythology relating to natural hazards

In lower Kinnaur, the Buddhism of Tibet and Spiti (which is predominant in upper Kinnaur), and the Hinduism of neighbouring Shimla and Kullu districts, find a common home. In Sapni the three village deities (the principal deity is the *Piri Nag*, second in rank is his younger brother the *Bairing Nag*, and third their younger sister the *Piri Nagini*), are believed to pay homage to the Hindu pantheon of gods, in particular to Shiva and Indra. Durga is also worshipped for safety from natural hazards - most notably at shrines on the bus routes, for safety in reaching a destination. There is no Buddhist *gompa*

(monastery) in the village, but lamas from Kalpa or Sangla often visit the village by invitation. The rituals that they are requested to perform on such occasions have parallel Hindu equivalents, the most important being the exorcism of malevolent spirits (*khunkch*). In cases where spirit possession (always of a young woman) has already taken place, or if there is illness or hostility within a particular household, the village deities are approached; but when a sense of spiritual well-being in the household is sought for, the lamas are invited. While the village deities are considered the highest religious manifestation in the village, each household also has its own small Buddhist shrine or displays a small stupa (*chosten*) built into an outer wall or above the gateway.

In addition to Buddhist and Hindu beliefs, the practice of nature worship takes place in the household. This is usually in the form of grace at meal times, and reflects the Kinnauras identification with, and love of, the natural world about them. The principal nature-gods are *Aagni Dev* (fire), *Varan Devta* (river), and *Pavan Dev* (wind).

Throughout Himachal, including Kinnaur, popular myths attribute earthquakes and landslides to the movement of a great animal which is supposed to be carrying the earth. Examples include Shivas *nandi* (bull) adjusting the earth between his horns, and a great horse shivering its back in irritation. But most commonly these hazards are attributed to a giant snake moving just below the ground. There is also an association made between such snakes and the village deities. In Sapni, the *chironing* (history of the *Piri Nag* in verse, which is sometimes recited in the village) specifies the transformation of the *Pirio Nag* from a snake into gold, which is finally shaped by a village *sunar* (goldsmith) into the *suriya* (face-masks) which adorn the existing body of the *Piri Nag*. The attribution of natural hazards to village deities is described with reference to the case study now presented.

THE SAPNI LANDSLIDE OF 10TH NOVEMBER 1989

Local topography and a description of the slide zone

Figure 2 shows Sapni landslide in relation to the village. The exposed rock formation around the village is consistent, dipping at an average slope of 33°E, with a north-south strike (i.e. planes are parallel with the east facing hillslope on which the village is located). Around Shenaden it is more difficult to pick out the rock formations; there is a greater depth of top soil and ancient debris. The area of Sapni landslide, being close to the river, is steeper and prone to mass movement. It is apparent that local deforestation and road construction have accelerated the recent collapse of these slopes; but this instability is also part of a natural process of erosion. The location of villages and terraces, above these slide zones, suggests adaptation to these conditions.

Sapni landslide is located on the left bank of the Baspa river about 1 km upstream of Karcham. The base of the slide runs for about 730 m along the river, and the slide zone extends about the same distance upslope. The volume of debris can be crudely estimated to have been two and a half million cubic meters. The head of the slide, which is within a few feet of the *dogris* in Shenaden, is apparent as an earth bank ten meters high. The lower part of the slide zone is steeper, resembling a scree slope with unstable boulder debris, and outcrops of fractured rock. Young poplar trees are growing here, planted by the forest department to stabilise the land. Until reconstruction of the link road started in September 1995, the path which crosses this slope was still in use (Fig. 2).

The response of local officials

Reconstruction of the link road was completed in May 1996 (administrative records, concerning the cause of the landslide and reconstruction of the road, are given in the appendix). During informal conversations at Karcham Public Works Department (PWD), senior officials voiced the opinion that no geologist could offer advice on such a slope; the fractured condition of the rock and ancient debris is too complex, and so detailed road planning is useless. The only practical guideline that could be taken was to avoid, as far as possible, building the road over the area of the recent landslide, which might still be active. The possibility of the road collapsing again is shrugged off, "If it fails then we'll build it again".

The response of the villagers

The Sapni landslide took place on 10th November 1989. The weather is usually fine at this time of year, with clear skies. But, with winter approaching, the air is chilled and dry, and, with the harvest complete and most of the *kuuls* (irrigation ditches) no longer in use, the landscape is somewhat desolate in appearance. Only the evergreens (deodar, kail and *baan*) retain their colour. Above the village, the *kanda* are barren and the earth is dusty and parched in colour. Higher up, the pastures are covered with new snowfall, and the shepherds have returned to homes nearer the village, or they have migrated.

Late October and November are devoted to the collection and storage of winter fodder (corn and basil stems, and grass), and to the transport of apple boxes from the village to lorries down at Karcham. Pumpkins, tomatoes and chillies are left to dry on the roof-tops, and dried nuts (almonds and walnuts) are sorted and shelled. At this time of the year almost everyone still lives in the village, but an increasing amount of time is spent at the *dogris* in Shenaden where the winter months will be passed. Three of the five *dogris* located right at the head of the slide were occupied at the time of the landslide.

The initial landslide took place in the early hours of the morning, but the period of instability continued for several days. Minor slumps and rockfalls seem to have taken place up until June 1990, seven months after the first major landslide. Once the initial shock of the landslide was over, the problem was discussed amongst the villagers, and the *panchayat* (the administrative area under one headman, which is made up of the three villages Sapni, Baturi and Kanai) wrote to the District Commissioner in Reckong Peo and to the Chief Minister in Shimla. These letters were primarily concerned with the loss of the link-road. One land-owner told me: "Our road was gone; we now had to carry our own goods up to the village, and it had become difficult to transport the apples from the orchards to lorries below." Subsequently, the forest department planted poplar trees to stabilise the exposed slope and wired off the slide zone, and the PWD constructed a cable-pulley for transporting apple boxes from Shenaden to the road near Karcham. But, without a link-road, the village is unable to take full advantage of the present growth in apple sales.

In May 1990, with minor landslides and rockfalls still active, the villagers approached their village deity, the *Piri Nag*. On such occasions, always a Sunday, the whole village gathers in and around the *santhang* (courtyard of the temple complex). The *devtas* (gods) and *devi* (goddess) are carried aloft the shoulders of two Rajput men, one either side of a palanquin (*zamanang*). With the *zamanang* resting on the ground the deities stand about four feet high. But raised on the shoulders of their bearers they are above the onlooking crowd. Beneath the long poles of the *zamanang*, silk drapes cover the lower body of the deity. Above, the body is hidden by a thick mop of black yak hair called the *chamarang*, but many life-like face masks (*suriya*) made from gold and silver can be glimpsed as the *chamarang* moves.

Hereditary musicians of the *lohar* (goldsmiths and blacksmiths) community play drums (*nagara* and *dhol*) and cymbals (*ban* and *gubjal*). At intervals a long haunting note is blown on the *kanal* (a long, silver horn), and Rajput men blow on the *narshronga* (or *ronshing*) (a long, curved, silver horn). In front of the deities, as they circle the *santhang* anticlockwise, two *chonri* of white yak hair are used to purify the air, and two ceremonial mace or sceptres (*chari*) are carried before them.

Most of the women and some of the men gather on an earth bank above the *santhang*, and the *santhang* itself is crowded with activity. The *Piri Nag* is petitioned on behalf of the whole village by the hereditary *mukhya* (or *mathas*), the senior authority dealing with the *Piri Nag*. The *mukhya* converses through the hereditary medium known as the *mali* (or *grokch*). The deities circle the *santhang* abreast of one another and anticlockwise. The *Piri Nag* is to the outside with the *Bairing Nag* on his left and, following her construction, the *Piri Nagini* on the inside. The *mukhya* addresses the *Piri Nag* from the outside of the circle. The response of the deities is often dramatic; the *zamanang* bounce (indicative of a positive response) or twist (negative) on the shoulders of their bearers, or twist together as though the deities are conferring amongst themselves.

When the *Piri Nag* was approached about the landslide in May 1990, the *mukhya* asked what should we do? what has happened ? The reply came that the *Piri Nags* sister goddess (the *Piri Nagini*) had been residing at the site of the landslide, and had been angered by desecration of the land around - rubbish tipped over the hillside and the construction of the road. The *Piri Nagini* now wished to emerge, and the villagers were therefore requested to construct a physical icon in the same form as the two existing *devtas*. Subsequently, several meetings took place in the village. The villagers do not have blind faith, and consultation of the *Piri Nag* is usually followed by open debate.

The majority of men were reluctant to pay for the new *devi*. One man told me: "We already had two gods, what use would another one be? We do not have blind faith." But he said that the *mahila mandal* (the womens council) had taken the initiative, because it was a female *devi*, and the existing deities were both male *devtas*. Another man of authority told me that the village elders had also been in favour of carrying out the *Piri Nags* demand. He had been very much against this, and put forward the case that the landslide was a result of unstable rock and careless road construction, not due to the power of some *devi*. But the elders said that many years ago a similar catastrophe had been faced. The *Piri Nag* had been approached and had stopped the destruction, and, in a veiled threat, the *Piri Nag* had also predicted the *devis* appearance. The elders said that in the scientific age the villagers had not given proper respect to the *Piri Nag*, and must now carry out his wishes or face further consequences.

The women of the *panchayat* took the initiative, and made a collection of money and jewellery to be melted down and made into *suriya* for the *devi*. The villagers say that a month after the *Piri Nag* had been approached all landslide activity ceased. The remaining silver required was purchased in a trading town, Rampur, and the leading *sunar* in the village set about the task. The work was completed during 1991.

BASIC NEEDS AND PERCEPTIONS OF RISK RELATING TO NATURAL HAZARDS

Basic needs and government schemes

Table 1 describes some of the important government schemes operational in Kinnaur, and Table 2 lists projects implemented in Sapni village.

There is a unanimous feeling about the most urgent basic needs in the village. Firstly for a link road from Karcham, and secondly for reliable irrigation. The existing water tank in the village is too small and leaks, and, since the irrigation *kuuls* are fed by glacial melt water, nothing can be done if the source dries up. The critical period comes after the monsoon rains, and before winter sets in. These two needs have, in fact, received a significant proportion of government grants to the village (Table 2, *Note* 1). In particular, the link road was constructed between September 1995 and May 1996.

One of the large land owners in the village told me that there were plans to build a tank for irrigation. But nobody in the village will work unless the government gives them money. However this apathy over large projects does not extend to day to day chores. There are three *kuuls* in the village, one flows through the village and two supply Shenaden. The irrigation department has reinforced some sections with concrete, and laid down plastic piping where the routes are susceptible to damage. Small sink tanks have been installed to prevent silt building up in the pipes, and before each sink tank the villagers have built a grill of sticks to stop twigs and leaves. Despite the difficult mountain terrain the *kuuls* are maintained by the villagers themselves prior to their use. The responsibility of repairing both *kuuls* and drinking water supplies is shared by those who make use of the facility. If more serious damage is found then the irrigation department representative in the village is asked to help. More extensive repairs, and the construction of new *kuuls*, also provide an opportunity for villagers to hire themselves out as wage-labour, which is paid for under the governments Employment Assurance Scheme.

Common types of short-term misfortune include the loss of livestock and low harvests (resulting in a poor nutritional diet). For poorer families, one option is to apply to the government. Compensation is unlikely to be received directly, but funds are made available through various government schemes. These include grants for housing, sanitation, smokeless *chulas* (stoves), subsidised goods (rice, wheat flour, sugar and kerosene), as well as financial aid via Integrated Rural Development Programme grants and loans. Applications to the government are made via the *pradhan* (headman) and *patwari* (land registrar), who can speak directly to the District Commissioner in the district capital, Reckong Peo. These schemes are intended to support long term development. In the village ten families (8 Scheduled Caste and 2 Scheduled Tribe) have received IAY housing benefit (15,800 rupees), 96 (41 SC, 55 ST) rural sanitation benefit (1,500 rupees), and 116 (96 SC, 20 ST) IRDP grants (6,000 rupees plus loans at 4 % per annum).

The government also has a natural calamities fund which covers damages (to buildings, irrigation ditches etc.) caused, for example, by rainfall. Statistically the three sub-divisional blocks in Kinnaur (Nichar, Kalpa and Pooh) receive approximately equal funding from each of the government schemes given in Table 1. The exception to this is the natural calamities fund, 60 % of which has gone to Kalpa block (in which Sapni is located) during the period 1989-90 to 1995-96. This may be a reflection of climatic and geological factors, although the relationship is not straightforward (see sub-section on Landslide Hazard Mapping below).

Although there is no traditional welfare system now operating within the village itself, most families in the village have adopted a livelihood strategy that ensures that some source of cash income is available to them (traditional crafts include carpentry, weaving, tailoring and metal-work, as well as manual labour in the fields). This is necessary to supplement subsistence produce and rationed goods. The government Employment Assurance Scheme also guarantees 100 days of labour during the lean agricultural season (mostly through the various construction projects in the village itself) for the members of poorer families. Each *panchayat* has a register of unemployed and under-employed. However, in Sapni village, which has a population of 800 (1991 census), only about twenty to forty people need to make use of the scheme.

Name of Scheme	Executive Agency	Admin. Agency	Year of inception	Funding	Notes
'Nucleus Budget'	BDO etc.	POITDP	1979-80	State	District or sub-district level reserve fund.
'Jahawalal Rozgaar Yojanaa':	———	PODRDA	———	80 % GOI 20 % State	30 % to A+B (approx. 50:50) 70 % to C (80 *panchayat*:20 district)
A) *'Indira Awaas Yojane'*	villagers	as above	1990-91	as above	15,800 rupees given to SC and ST families living below the poverty line towards house construction, latrines and smokeless *chulas* (stoves).
B) 'Million Wells' - *kuls*	BDO/ villagers	as above	1989-90	as above	Established in the plains (hence name) but used for *kuls* in Kinnaur. Projects implemented by BDO but maintained by the village.
C) 'District/*Panchayat* Share'	———	as above	1989-90	as above	*Panchayat* share allocated on the basis of population as a percentage of the district population. District share goes to *panchayats* at the discretion of the DC.
D) 'Operation Black Board' Primary schools only	BDO	as above	1991-92	as above	BDO work on primary schools only.
'Natural Calamities'	BDO etc.	Sadar Kamungo	1979-80	GOI to state	Used to offset losses and damage due to rainfall, snowfall, etc.
'Employment Assurance Scheme'	villagers	PODRDA	1994-95	80 % GOI 20 % State	To ensure 100 days of casual manual labour during the lean agricultural season. DC receives 75 lakh per year to give *panchayats* who have a register of unemployed and under employed.
'Special Central Assistance'	———	POITDP		GOI	Supplements the Tribal sub-plan strategy (1974-75), established for development blocks of 50 % or more tribal population, and the Special Component plan (1979-80) for development relating to the scheduled caste population.
'Community Development'	BDO etc.	POITDP	1960-61	State	Grants of up to 50,000 rupees are available for *mahila mandal*, sanitation, *mandir* construction etc. Administration moved from Kalpa to Reckong Peo in 1988-89.
'Minor Works Irrigation'	IPH	POITDP	1991-92		Executive agencies implement and maintain.
'Minor Works Education' Primary, middle and high schools	BDO/PWD	POITDP			PWD works on the construction of Middle and High Schools.
'Vikash Main Jan Satyog'			1993-94	85 % State 15 % village	New scheme in Kinnaur. DC can sanction schemes up to the cost of 1 lakh rupees.
Rural sanitation	villagers	IRDP	1990-91		1,500 rupee grant for the construction of latrines.
IRDP grants and loans	———	IRDP		GOI	6,000 rupee grant plus credit at 4 % per annum to IRDP listed families.

BDO=Block Development Office. POITDP=Project Officer Integrated Tribal Development Programme. SC=Scheduled Caste. ST=Scheduled Tribe. PODRDA=Project Officer District Rural Development Agency. GOI=Government of India. Sadar Kamungo=Land registrars' office. IPH=Irrigation and Public Health. PWD=Public Works Department. IRDP=Integrated Rural Development Programme.

Table 1. Some of the government schemes operational in Kinnaur (DC Office, Kinnaur).

Year	Scheme description	Amount sanctioned	Name of Scheme
1979-80	r/o primary school	20,000	'Nucleus'
1980-81	c/o *mahila mandal* building	9,835	'Nucleus'
1981-82	c/o primary school	25,000	'Nucleus'
1982-83	c/o *panchayat* building	15,000	'Nucleus'
ditto	r/o *gram sewak* (social worker) hut	10,000	'Nucleus'
1983-84	r/o government middle school	10,000	'Natural calamities'
ditto	c/o additional room *patwarkhana* (land registrar's office)	21,000	'Natural calamities'
1984-85	c/o street pavement	25,000	'Nucleus'
ditto	r/o *mahila mandal* building	5,000	'Natural calamities'
1985-86	r/o government primary school	30,000	'Natural calamities'
1987-88	r/o government primary school	10,000	'Natural calamities'
1990-91	c/o cable pulley for apple boxes	50,000. Not started	'Nucleus'
1991-92	abutment for cable pulley	30,000. Not started	'Nucleus'
1992-93	c/o additional room for *mahila mandal* building	50,000	'Nucleus'
1994-95	r/o Nag *devta* temple	300,000. Not started	'Natural calamities'
1995-96	r/o jeep road Karcham-Sapni	500,000. Work in progress	'Natural calamities'
ditto	r/o roads	500,000. Work in progress	'Natural calamities'
ditto	c/o village meeting site	70,000 (69,247 spent)	'EAS'

Notes:

1) 5 projects for the construction and repair of **irrigation** *kuuls* were funded by the Nucleus Budget between 1981-82 and 1990-91; 5 by the Natural Calamities fund between 1987-88 and 1993-94; and 4 by the Employment Assurance Scheme between 1993-94 and 1995-96. Total amount sanctioned was 4,72,700 rupees.

2) 5 projects for the construction and repair of **bridal paths** were funded by the Nucleus Budget between 1981-82 NS 1989-90; and one by the Natural Calamities fund in 1987-88. Total amount sanctioned was 1,30,000 rupees.

3) There have been 10 (8 SC, 2 ST) recipients of 'IAY' **housing** benefit (15,800 rupees); 96 (41 SC, 55 ST) recipients of rural **sanitation** benefit (1,500 rupees); and 116 (96 SC, 20 ST) recipients of **IRDP grants** (6,000 rupees plus loans at 4 %).

Table 2. List of recorded government grants to village Sapni.

Local perceptions of risk relating to natural hazards

Although vocal about the need both for a road and for irrigation, there is a general reluctance to talk about beliefs concerning risk relating to natural hazards. When I posed the question about landslides for example, I was repeatedly told that they were not a problem, or that they were not dangerous. The headmaster at the government high school in the village told me that students learn basic facts about the cause of landslides at school as part of the regular curriculum. But neither the children nor the *gram sabha* (village council) express concern about natural calamities. If discussed at all, landslides would usually be mentioned as a cause of inconvenience, such as disrupting a bus journey or the transport of goods. But there were occasions when I could observe for myself the reactions of the local community.

On one such occasion, during the monsoon, I witnessed a rockfall in the village of Boring Sarang, near Sangla. Suddenly from behind the house came the crack of rock on rock and the crash of splintering deodar. Boulders the size of a car had fallen several hundred meters from the ridge above. Fortunately the rocks had not reached as far as the houses, which were a hundred yards or so from the cliff face. Within minutes of the rockfall a dozen men and boys and one or two women were busy gathering the wood debris (as firewood), some of them high on the slope, moving amongst the loose rock to pick up the bigger splinters and stack them in piles. One man was measuring the larger trunks (to use in house construction), using an axe to chop off unwanted branches, while others placed small piles of stones on trees which were to be claimed later. The rock was of the kind used for building houses, and manageable blocks of stone were also taken up on wooden back packs. Within two hours a PWD workforce, together with blasting equipment, was clearing the Sangla road above. There is little difference between the work of building or widening the roads and the job of clearing landslide and rockfall debris. The workforce are high up on the rock faces prising loose stones away, or at the road splitting boulders with pick axes or jack hammers, while the mechanical diggers shovel debris over the side. By the late afternoon they had cleared the road, and the event was forgotten.

In the village I stopped to speak to a young lawyer, a graduate of the state university in Shimla. He had been in the village at the time of the rockfall and had been appalled to see men and women (some from his own family) rush to gather the timber and rock debris. "They have no education, the area was still dangerous. Ninety percent of the people are illiterate, they can only write their names. If you and I went to the *gram sabha* (village council) to talk about the environment, or the problems of women and the elderly, they would say, what are these people talking about ?" Reasons for this difference in threshold levels of acceptable risk are discussed in the next section.

During periods of bad weather, while walking to and from the village, it is commonplace to have to cross similar slopes of unstable rock in heavy rainfall. But the villagers rarely entertain negative thoughts about rockfalls and landslides; for them there is no sense in worrying about something that might or might not happen. To me they expressed this as a matter of fate, and a matter of faith in God. Fear was a symptom of weak faith. Since this profession of fatalism is inconsistent with their knowledge of the physical environment and with their dexterity as craftsmen and farmers, I explore alternative lines of reason in the following section.

ANALYSIS OF RISK

The natural sciences: Landslide hazard zonation in Kinnaur

A landslide hazard zonation (LHZ) map divides the land surface into zones of varying degrees of stability, based on an estimated significance of causative factors in inducing instability. (Anbalagan, 1992). Anbalagan, who has extensive field experience of the Indian Himalaya, supports the analytical use of facets - selected units of hillslope - as opposed to the use of arbitrary square units. He includes amongst his parameters: lithology (i.e. susceptibility to weathering and erosion, and shear strength), relationship of structural discontinuities (such as bedding planes) with slope, slope morphometry (i.e. frequency of occurrence of particular angles of slope within a facet), relative relief (height between ridge and valley floor for an individual facet), land use and land cover, and surface ground water conditions.

It should be noted that these parameters are relatively easy to establish through surface observation. A geotechnical engineer or soils mechanic specialist, on the other hand, would require details relating to subsurface ground water and shear strength conditions. These parameters would then be used in the rigorous calculation of site-specific factors of safety (probabilities of failure) for a given landslide mechanism. In many countries, such as Japan - if, for example, a major trunk road is threatened by slope instability - it is economically feasible to carry out such site investigations and analysis, and then construct elaborate drainage schemes to stabilise those slopes. In a rural village environment

where subsurface conditions are difficult to determine (as in the case of the Sapni landslide), such detailed analysis is not usually cost effective. It is important to recognise however, that this kind of detailed analysis provides much of the insight into failure mechanisms that complements field experience when LHZ maps (giving facet-wise factors of safety) are made (see also Mehrotra et al, 1994) and cost effective solutions are sought.

A methodology similar to that described by Anbalagan has been used to map landslide hazards in Kinnaur by a team from the Wadia Institute of Himalayan Geology (Wadia, 1993). The data required for this investigation were obtained from toposheets, IRS Geocoded Imageries (on 1:50,000 scale) for November 1990 and extensive field survey. Geological data were obtained through mapping of the area on 1:50,000 scale. 18 significant rock units were recognised, and over 2000 structural measurements taken (such as bedding planes etc.), as well as direct observation of hillslope hydrology. In an area of 780 sq. km, 450 facets of between 0.5 and 5.0 sq. km were delineated.

The investigating team concludes that: "There exists a high degree of relationship between the major and active landslides present in the area and the very high and high landslide hazard prone zones depicted on the LHZ map... The areas lying in very high hazard zone are those which are active almost throughout the year such as around Akpa. Those which are active only during certain periods i.e. during rainfall, snowfall, snowmelt also lie in the high hazard zone such as around Sapni and [Reckong] Peo... It has been observed that highly jointed crushed and pulverised rocks along the thrust and fault are characterised by high and very high hazard zone, that is the impact of Karcham and Vaikrita thrusts around Karcham...Towards the monsoonal zone stability of hillslopes further decreases".

It is apparent that the Wadia LHZ map, while providing statistical support for the teams conclusions, has two major limitations. Firstly, village-wise assessment of needs is at present beyond the scope of such maps. Secondly, although the value of LHZ maps might anyway be claimed to lie in macro-economic investment and planning, the conclusions of the Wadia team have not discouraged a high level of investment in hydro-electric power schemes in Kinnaur.

The need for village level decision-making and the manner in which risk is politicised (i.e. the argument that statements of probability or of high or low risk are meaningless because decisions or perceptions relating to risk should not be taken out of their socio-political context) are discussed below.

The social sciences: defining access, risk and danger

There is a substantial body of work on landslides as physical hazards. In recent years various schools of thought have evolved to complement this body of work, focusing on political-economic and social aspects of landslides. Blaikie et al, for example, set themselves the task of addressing the "gaps in knowledge concerning the linkages of underlying [political-economic] causes or pressures on vulnerability". Vulnerability is defined as "the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist, and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someones life or livelihood is put at risk by a discrete and identifiable event in nature or in society". (Blaikie *et al*, 1994: 9).

From a practical point of view this approach addresses the critical issue of administrative inter-action with village-based institutions, for which the Sapni case study provides an example. Although a special natural calamities fund exists, in practice a balance is found between meeting the costs of short term relief and long term development. When anti-poverty programmes are combined with improvements in education and other social benefits, the resulting stability can in turn lead to a gradual change in the threshold level of acceptable risk from natural hazards. This change in threshold levels was apparent, for example, in the reactions of villagers of different socio-economic status to the rockfall I witnessed at Boring Sarang. It is a change based on experience of tangible improvements in lifestyle, not simply on discursive knowledge (which is the basis of much disaster reduction work).

The importance of this balance is stressed by Blaikie *et al*, (1994) through their concept of access. The way in which access changes over time, and the implications of this for different people, is also crucial. Long-term or intergenerational social changes must be analysed rather than just the immediate impact of a relatively sudden event like a famine or an earthquake. Access also characterises the daily process of earning a living in normal conditions, under which each person has a different set of resources, and therefore has a different range of constraints and choices of livelihood, commensurate with those resources. (Blaikie *et al*, 1994: 49).

In Sapni the basic need for a road presents a paradox which is obscured by the vulnerability framework just described. Road construction is known, not least by the villagers themselves, to accelerate the process of hillslope erosion and increase the risk of landslides. In

effect, the villagers have chosen to ignore this risk. As individuals they express an attitude of fatalism, and collectively they appear to have given little thought to the consequences of their plans. But to accept this at face value would be to trivialise a more complex issue. The sociologist Niklaus Luhmann, in discussing decision-making and its consequences, writes that "There are then two possibilities. The potential loss is either regarded as a consequence of the decision, that is to say, it is attributed to the decision. We then speak of *risk* - to be more exact of the risk of decision. Or the possible loss is considered to have been caused externally, that is to say, it is attributed to the environment. In this case we speak of *danger*." (Luhmann, 1993: 21-22). It is apparent that in Sapni the 1989 landslide has been accepted as a danger, in Luhmanns terminology, and not as a risk.

Luhmanns distinction between risk and danger, explains the role of the institution of the *Piri Nag* with respect to natural hazards. In the village a distinction is made between dangers, which are beyond the mitigating means of the community, and risks, about which something can be done. Ritual acts associated with natural hazards emerge, not as a manifestation of superstition, but as a means of formally accepting something as a danger (to be ignored). The community comes together and, expressing solidarity in their support of the *Piri Nag* (the icon of Sapni culture), individual members are able to set aside their personal anxieties.

This perhaps explains another enigma that preoccupied me during my stay in the village: when I spoke to individuals they would discuss quite accurately the nature of sandy soils and heavy rainfall that made the surrounding slopes susceptible to landslides, but collectively the village had attributed just such a landslide to the *devi*. As Wittgenstein comments on rain rituals, "Apart from any interpretation its queer pointlessness could make us uneasy," (quoted in Humphrey and Laidlaw, 1994: 266). In Sapni, accepting a particular natural hazard as a danger, i.e. beyond their means of mitigation, is simply a way of getting on with the chores of daily life without undue stress from events that might or might not happen. This coping strategy is formalised, as described above, through ritual attribution to a *devta* or *devi*. In the past, when physical causes were not understood, one function of the *Piri Nag* was to provide an explanation for natural hazards which need not be explained in turn. Today, rituals associated with natural hazards capitalise on this existing authority.

This analysis goes some way towards explaining the apparent fatalism of villagers towards landslides, but does not yet explain their choice to campaign for the potentially disastrous construction of a road. The social anthropologist Mary Douglas suggests that perceptions of danger should be allocated "among the unintended consequences which regularly follow when the social unit adopts a certain political regime" (Douglas, 1992: 64). In Sapni, for example, the dominant concern is not over the risks posed by landslides, but to protect and promote the major form of cash income to the village. Thus Douglas concludes that "this sort of analysis takes the focus off physical dangers and turns it inward to the state of trust in political life" (Douglas, 1992. 77). Douglas, in explaining why this should be so, also expresses a warning for disaster-reduction initiatives which do not take account of more basic needs. "To invoke very low probabilities of a particular dangerous event makes surprisingly little difference to the understanding of choice. This is not because the public does not understand the sums, but because many other objectives which it cares about have been left out of the risk calculation" (Douglas, 1992: 40).

Three quite different meanings have been given to the word risk. Douglas sees the cognition of risk as a socio-political consequence. In Luhmanns work, on the other hand, the obsession with extremely improbable but potentially severe damage or loss "lies uniquely in the expansion of the decision-making potential, in its more complex ramifications, in its greater wealth of alternatives" (Luhmann, 1993: 46). This is in contrast to the vulnerability framework of Blaikie et al which stresses the need to *improve* access and not the *consequences of* access. Luhmanns' viewpoint thus covers the difficult issue of self-interest (the paradox of roads and landslides), but not the manner in which improvements in lifestyle can change the threshold level of acceptable risk - which is the key to disaster reduction.

CONCLUSION

In discussing the cognition of risk, Mary Douglas states that her task is "to expose different types of unintended consequences which control perception and to classify them according to the types of officially recognised institutional forms from which they emanate" (Douglas 1992: 64). Douglas is referring to the manner in which political affiliations control perception of risk, but a similar situation is apparent in the wider field of natural disaster reduction. This situation arises from differences in the way that academic and professional disciplines define risk: in other words, the definition of risk from which each discipline takes its stance is not the same definition of risk. Bjonness (1986), for example, working as a social anthropologist amongst the Sherpas in Nepal, describes the communitys cognition of natural

hazards (which has similarities with that of the Sapni community described in this paper) as incompatible with western (i.e physical) mitigation methods.

The sociologist Niklaus Luhmann makes a similar point with regard to differences in the definition of risk. Luhmann considers that in modern societies the loss of multifunctional systems (i.e. institutions responsible for all aspects of social life) "actuates unforeseeable risks, which can result from the fact that risks acceptable in one system may have unpredictable effects on other systems... And it is not least of all this situation that provides one of the reasons why the future is opaque to us and why we see it in terms of potential and possibly no longer controllable losses" (Luhmann, 1993: 81-82).

Do these differences in the definition of risk create impossible obstacles? The case study presented in this paper suggests otherwise, and that in Kinnaur a successful strategy is evolving for dealing with both natural hazards and more basic needs. Two features of this strategy stand out. Firstly, the process of decision making with respect to natural hazards and more basic needs takes place at village level. It is this which enables the process to act as what Luhmann has termed a multifunctional system. Secondly, the analysis of risk and risk perception - leading to an effective disaster reduction strategy - is *dependent* on (and not restricted by having) more than one definition of risk. Recognition of this fact requires a long-term view: when anti-poverty programmes are combined with improvements in education and other social benefits, the resulting stability (which reflects a reduction in vulnerability) can in turn lead to a gradual change in the threshold level of acceptable risk from natural hazards. It is a change based on experience of tangible improvements in lifestyle, not simply on discursive knowledge. Changes in the level of acceptable risk feed back into village level decision making, and this, in turn, redefines the objectives of government schemes.

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APPENDIX

Administrative records (PWD, Karcham, 1996)

Initial approval for the Karcham-Shaung-Sangla (KSS) road was given by the Chief Engineer, Himachal PWD (Bridges & Roads), Shimla on 26th September 1978. The estimated cost for the road was given as 28,64,000 rupees. Work was started under the Kalpa

division of HPPWD in 1978, and transferred to Karcham division (B & R) after its creation on 1st November 1980. Road construction involved blasting and jumper-work (use of crow bars). The road from Karcham to Shaung was completed in the financial year 1984-85, at a cost of 49,84,602 rupees. This figure was subsequently revised to 50,19,500 rupees in 1986, by which time the road had been abandoned below Shaung; the remaining section of road being considered of insufficient potential use.

On 30th June 1988, 7,60,365 rupees were accorded to Karcham PWD via the District Commissioner (DC), Kinnaur, to carry out maintenance work on the road. 4,28,000 rupees had been spent when on 10th November 1989, a section of road 730 meters in length (alongside the Baspa river) was lost in a major landslide (Fig. 2). The slide took place below the area know as Shenaden, where inhabitants of Sapni have *dogris* (farm houses), terraces and apple orchards.

The Audit analysis issued in 1990-91 comes under the title Idle and unfruitful investment on incomplete roads for 1990-91. The Audit suggests that failure took place due to sandy and loose soils susceptible to landslides during the monsoon and winter seasons, and criticises the lack of an adequate road survey, and lack of consultation of a specialist geologist. The financial losses incurred as a result of the slide were estimated to be 17,65,514 rupees.

Karcham PWD reacted by drawing attention to the fact that the road, completed in eight years over what was known to be extremely difficult terrain, had been constructed for the benefit of the villages of Sapni, Brua, Shaung and Chansu. Furthermore the road had been stable for a period of three years after completion. The slide had taken place due to the inherent fragile topographical structure of the hillside, and should be attributed to natural disaster and not to human error. In addition, the instability had been initiated by sinking of the land below the KSS road to[wards] the river bed of [the] Baspa and not from above the KSS road as pointed out in the Audit. After parts of the remaining road came in to use below Brua, following construction of a bridge there to link with the main Sangla road, a revised estimate of the losses was given as 8,99,004 rupees.

In the most recent documentation Karcham PWD, reports that, "The issue came for discussion in the 25th meeting of the Tribal Advisory Council on 30th October 1995... the Honourable Chief Minister (CM) (chairman of the TAC) [gave the] order to restore the jeepable road to village Sapni by 15th April 1996". The estimated cost given by Karcham PWD for restoration of the Karcham-Sapni road is given as 21,83,000 rupees, and the 1989 event is attributed to rain-damages. The report states that, "The contention of the Audit is totally incorrect. The road is a basic necessity and not an economic investment". The need for the road is given as: transportation of essential commodities; the need for basic medical facilities; and that the people do not get full value for their labour and produce including an estimated potential 80 truck loads of apples.