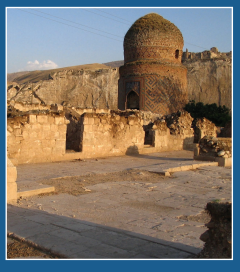

Displaced Heritage

Responses to Disaster, Trauma, and Loss

Edited by Ian Convery, Gerard Corsane and Peter Davis

The International Centre For Cultural & Heritage Studies
Newcastle University

Village Heritage and Resilience in Damaging Floods and Debris Flows, Kullu Valley, Indian Himalaya

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Village Heritage and Resilience in Damaging Floods and Debris Flows, Kullu Valley, Indian Himalaya

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Introduction

Heritage is shaped, and reshaped, by the impacts of natural hazard events that are common in mountains. This chapter examines the heritage–resilience relationship through villages in the Phojal Nalla catchment, in the Kullu Valley of the Indian Himalaya (see Fig 19.1) in the context of a 1994 flood event. The Valley is rich in many forms of heritage, including vernacular architecture, material culture, and custom and religion.

Current definitions of heritage are complex and disputed; nonetheless, understandings are drawn from Smith (2006), Sorenson and Carman (2009) and Harrison (2013), where heritage may comprise: (1) objects, places and societal practices; (2) tangible (ie objects) and intangible (ie socio-cultural practices) contributors; (3) officially recognised and unofficial contributors; and (4) an entity that is intertwined and continually created. Of these, intangible heritage is particularly relevant, since it sees people as unofficial heritage creators through their thoughts, knowledge and approaches to life. This type of cultural heritage may arise in response to actual loss and perceived risk, enabling the past to inform understanding of, and engagement with, the present and the future. Intangible heritage can take many forms: art, dance, food, language, music, oral histories, religion and virtual media.

It may seem somewhat unusual to be discussing heritage and resilience together in relation to flood events, but heritage is an important resource that can contribute significantly to strengthening community resilience. The definition and utility of the resilience concept has been heavily debated (Cutter *et al* 2008; Brown 2014). In the context of communities subject to hazards, it is frequently discussed in association with societal vulnerability (a potential for harm). Resilience is often seen as a positive condition, opposite yet interlinked to vulnerability – a negative condition. Cutter *et al* (2008, 599) define resilience as:

> the ability of a social system to respond and recover from disasters and includes those inherent conditions that allow the system to absorb impacts and cope with an event, as well as post-event, adaptive processes that facilitate the ability of the social system to re-organise, change, and learn in response to a threat.

To improve community resilience, an understanding of contributing factors is necessary. Capital is key in developing and maintaining resilience where economic, social and environmental resources facilitate coping (during event) and adaptation (after event). Strong capital may

include: (1) economic – diversified employment, wealth and robust infrastructure; (2) social – active community networks, female empowerment, accessible education and health provision, low levels of corruption and strong governance; and (3) environmental – biodiversity, local energy, water and food supplies, sustainable environmental management and an array of hazard mitigation and preparedness measures (Gardner and Dekens 2007; Cutter *et al* 2008; Collins 2009; Wilson 2012). Implicit here is the ability for people to learn before, during and following a hazard event; the application of this learning enables diversity and self-organisation, which are important facets of a resilient community (Gardner and Dekens 2007). Intangible heritages provide a means for observation, experiences and memories to be shared and repeated, facilitating intergenerational learning, thus focusing the link between heritage and resilience through learning. Maintaining heritage, and in particular the traditional knowledge accumulated over centuries, is therefore likely to result in increased community resilience, helping communities to better withstand natural hazard events such as earthquakes, floods or slope instability processes.

The Context: Kullu Valley and Phojal Nalla Catchment

Kullu Valley

The Kullu Valley, within the Kullu District of the State of Himachal Pradesh, is the uppermost 90km of the Beas River. Though narrow (2–3km), the area of physical and social influence extends into tributary catchments, of which Phojal Nalla is one (see Fig 19.1). Upstream of the Pandoh Dam, the Beas River catchment covers 5278km^2 and rises from 890 to 6632m ASL (above sea level). The primary water sources are rainfall (65%) and snow and glacial melt contributions (35%) (Kumar *et al* 2007). Particularly important to understanding the hazardous setting is the summer monsoon season. This is characterised by multiple rainfall episodes (including long-duration and high-intensity), which influence slope instability and stream flow. Tectonically, the area lies within the Pir Panjal Himalaya and is seismically active with ongoing uplift (Valdiya 2002). In contrast, active erosion processes are evidenced by valley incision, high fluvial sediment yields and a variety of glacial, paraglacial, colluvial and alluvial landforms (Owen *et al* 1996; Sah and Mazari 2007). The valley-side fans are particularly prominent and of importance to the livelihood of the Kullu Valley (Gardner 2002).

The natural and social contexts enable understanding of the regional hazard, vulnerability and risk relationship. Hazards that impact the area include: earthquakes (Chandel and Brar 2010), floods and debris flows (Gardner 2002; Sah and Mazari 2007), slope instability (Sah and Mazari 1998), snow avalanches, wildfires and crop infestations. Hazard event impacts vary in size, ranging from regional-scale disaster (eg 1905 Kangra earthquake) to more localised and frequent floods, debris flows and slope instability. Of the latter, the 1894 Phojal Nalla landslide-dam outburst flood and debris flow event has been one of the most significant in terms of loss of life among people (indigenous and migrant populations) and livestock (Gardner 2002). The vulnerability of migrant populations to floods and debris flows in the Kullu Valley continues to be substantial (Sah and Mazari 2007).

The social, economic and political history of the Kullu Valley is complex (see Harcourt 1972; Agnew 1899). These contexts, alongside present conditions, influence hazard, vulnerability and risk. Strong village-based governance and land-use administration were present prior to British administration (1846–1947); as a consequence of British rule rural settlement and commercial

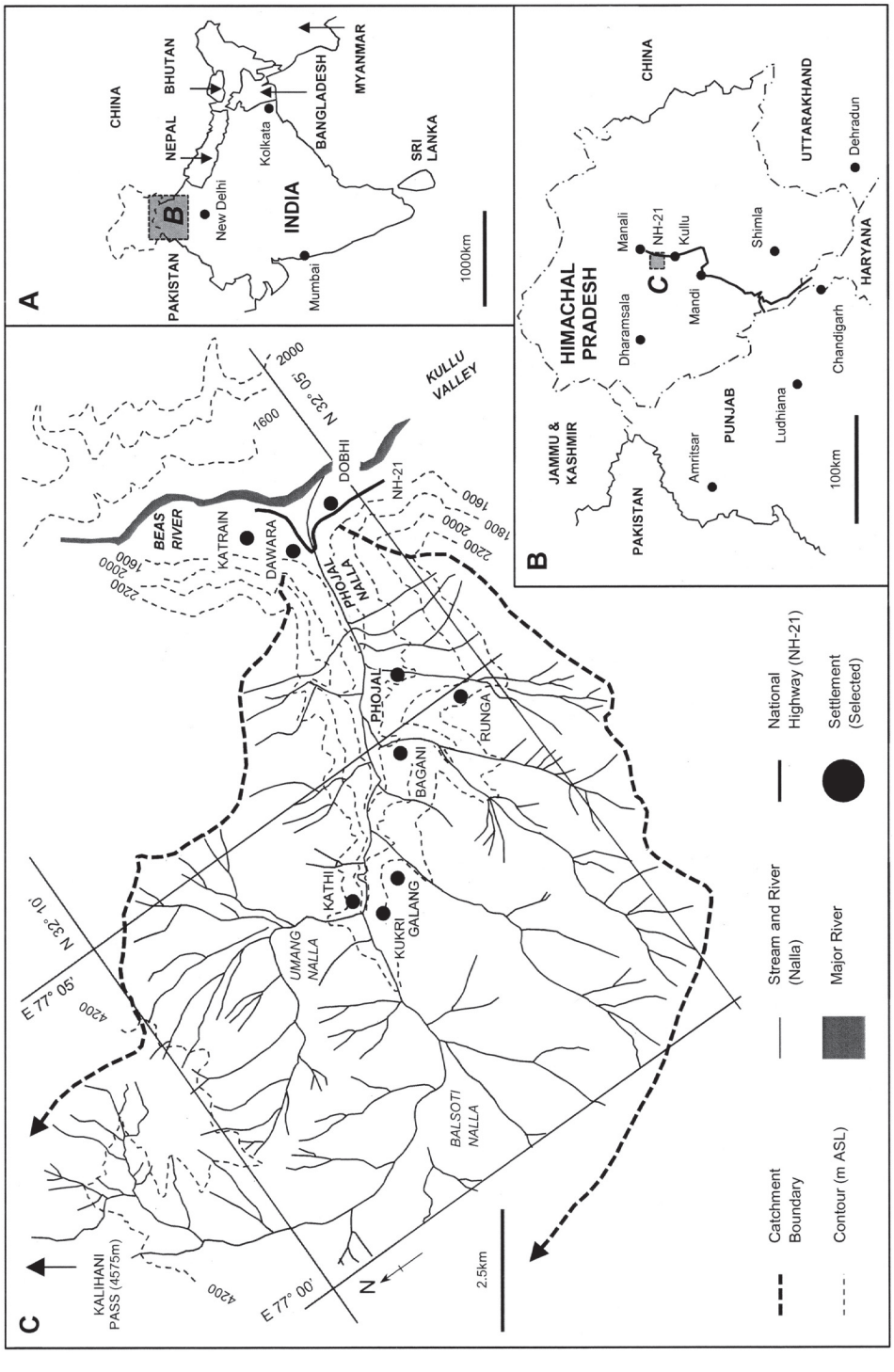


Fig 19.1. The geographical location of the Phojal Nalla catchment in the Kullu Valley. (A) India and surrounding nations, (B) Himachal Pradesh State and adjoining administrative areas, (C) Mid and lower extents of the Phojal Nalla catchment (adapted from HPSEB 1998).

extractive land uses expanded. The Kullu District has a resident population of 440,000 of whom 90% are rural dwelling (Census of India 2011). Literacy is relatively high (80%), though the gender gap is 18% (female lower). Religion is dominated (96%) by Hinduism and a strong attachment to village deities (Dhumal and Ahuja 2012). The Kullu Valley also has a significant semi-permanent/transient population related to transhumance, trade, economic migration, pilgrimage and tourism. Of these, the growth of tourism has been exponential from c. 10,000 in 1964 to c. 1 million in 2004 (Singh 2008).

At the state level, economic activity comprises: agriculture and horticulture (most important), tourism, transportation, small industries (hydro-electric power – HEP), local commerce and administration (Balokhra 2007). Baldi (2012) suggests a trend of economic diversification in which the role of agriculture and allied industries is declining, whereas industrial and services sectors inclusive of tourism are growing.

This combination of population dynamics and socio-economic change has elevated the vulnerability and risk in the region: settlements have grown beyond traditional village arrangements; roads have expanded and land uses are increasingly commercialised (Gardner 2002). As will be discussed, such changes have impacted on the reproduction of heritage within the region.

Phojal Nalla catchment

The catchment (see Fig 19.1C and 19.2) upstream of the NH-21 Dobhi Bridge ranges from 1485m to 5100m ASL, over 130.8km^2 (HPSEB 1998; BEHEPD 2009). Between Phojal and Dawara, the Phojal Nalla is a steep gradient bedrock/boulder bed river where floodplain segments contain palaeochannels and terraced boulder deposits. The channel corridor is heavily vegetated, locally cultivated, and has local channelisation and irrigation offtakes. Current construction works relate to hydro-electric power generation and transmission.

Mean annual rainfall at nearby Katrain (1962–2009) is 1124 ± 248mm (1σ); and the monsoon months July (160 ± 82mm, 1σ) and August (156 ± 78mm, 1σ) are the wettest (Jangra and Singh 2011). Flows are perennial, and discharge records at Dobhi Bridge (1967–1983) range 0.63 to 41.27 m^3 s^{-1} (BEHEPD 2009). However, palaeo-deposits and 19th-century flood accounts (Forbes 1911; Chetwode 1972) all suggest larger flow magnitudes; for example the disastrous event of 1894 (Gardner 2002).

People reside in small settlements up-catchment (Phojal c. 550 people). More sizeable are Dobhi and Dawara, where migrant populations have settled alongside the Phojal Nalla (see Fig 19.2D). The indigenous population are an 'ecosystem people', traditionally reliant upon their environment for much of their food, fuel and resources, but are also dependent on a wage economy (Berkes *et al* 2000).

METHODS: AN INTERDISCIPLINARY APPROACH

An interdisciplinary approach was undertaken to describe environmental characteristics and the heritage–resilience condition. The methods include: (1) walkover observation and GPS mapping of hillslope and channel attributes; (2) semi-structured interviews (n=28) with villagers and officials were conducted in Hindi and translated to English; and (3) archive searches in India and the UK.

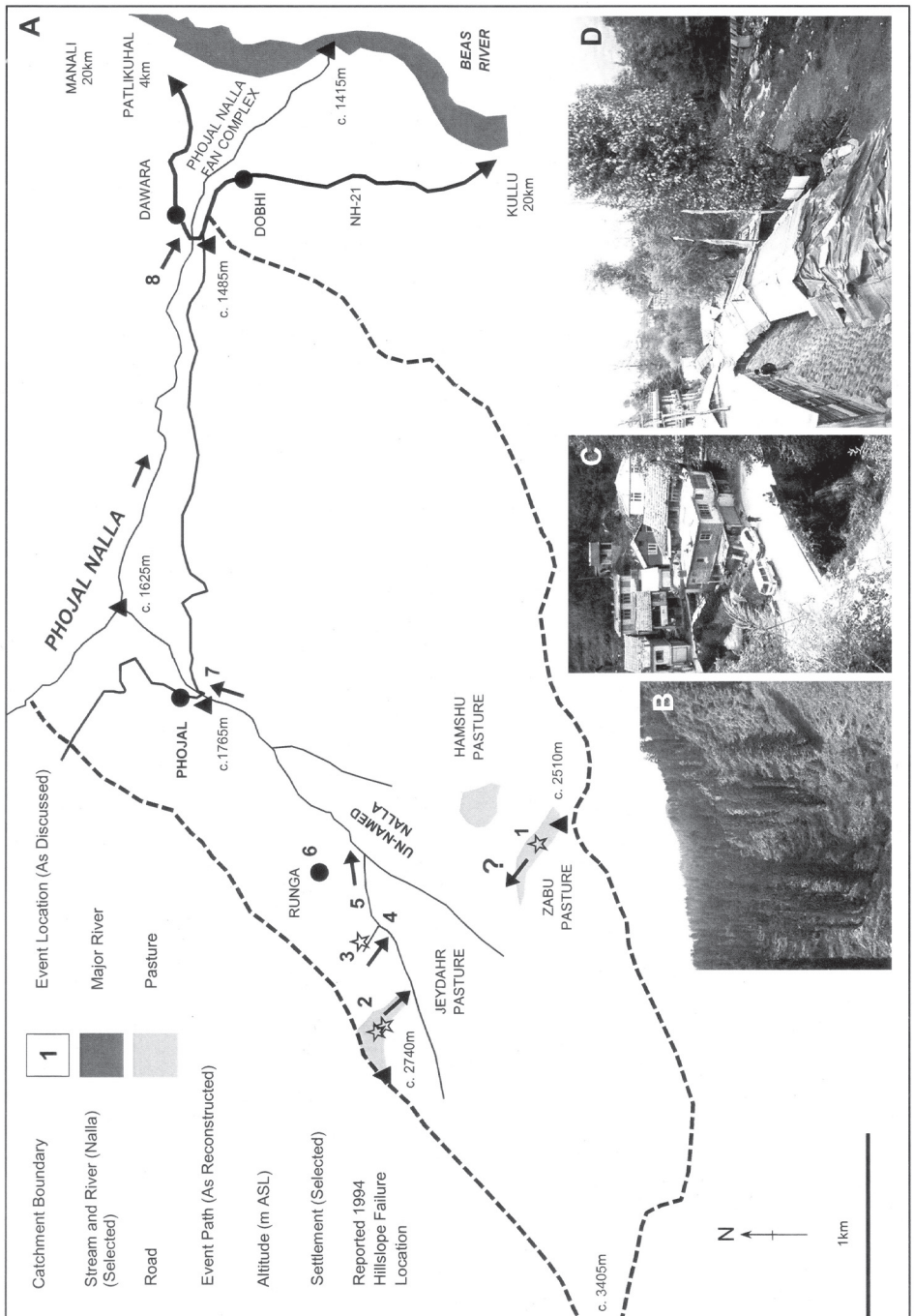


Fig 19.2. 1994 Event path between Jeydahr/Zabu to the Beas River. (A) Event sub-catchment, (B) Forested slope and stream bed [Event location 5], (C) Road bridge and stream in Phojal village [Event location 7], (D) Informal dwellings on the left bank of the Phojal Nalla downstream of the NH-21 at Dawara [Event location 8]. (All October 2013).

The 1994 Flood: a Revised Account of a Natural Disaster Event

Existing knowledge of the 1994 event

Gardner and Dekens (2007) outline a debris flow in the 'lower reaches and confluence with the Beas River' in association with a 'cloudburst', impacting properties adjacent to the channel. Kuniyal *et al* (2004) suggest Phojal experienced two cloudbursts in 1994, resulting in 11 fatalities and damage to 21 temporary stalls, 5 water mills, 3 vehicles and 4–5ha of agricultural land. The Dartmouth Flood Observatory Archive (Brakenridge 2014) details a storm duration of three days (8–10 August 1994). Using new data, a revised synthesis is offered.

Timing and meteorological causation

Event timings are determined from interview (Table 19.1a) and documentary data (see Fig 19.3). A Runga farmer notes heavy rain for 2 hours, with event activity on 9 August 1994 at 22:00 IST (Indian Standard Time). In Phojal the Pradhan (Village Head) suggests heavy rainfall, with flooding at c. 02:00–03:00 IST following two days of prolonged rainfall; the shopkeeper indicates a storm duration of c. 3 hours. Fig 19.3 suggests event occurrence at 02:30 IST on 10 August 1994.

Physical impacts

The event path is reconstructed from interviews (Table 19.1a and 19.1b) and field reconnaissance (see Figs 19.2 and 19.4), beginning in the unnamed Nalla sub-catchment, south of Phojal Nalla, then continuing 2.8km to Dawara and then 1.6km down the fan to the Beas River confluence. From the Jeydahr pasture (c. 2740m ASL) to the Beas River confluence (1415m) is c. 8.1km.

Hillslope instability

The Runga farmer suggests three sites of instability: on Fig 19.2A at locations 1 (Zabu), 2 (Jeydahr) and 3 (stream side slope). The Jeydahr failures were notable, resulting in the loss of livestock, verified at the time by government veterinarians, whose records were subsequently lost in the September 1995 flood at Patlikuhal (Sah and Mazari 1998; 2007).

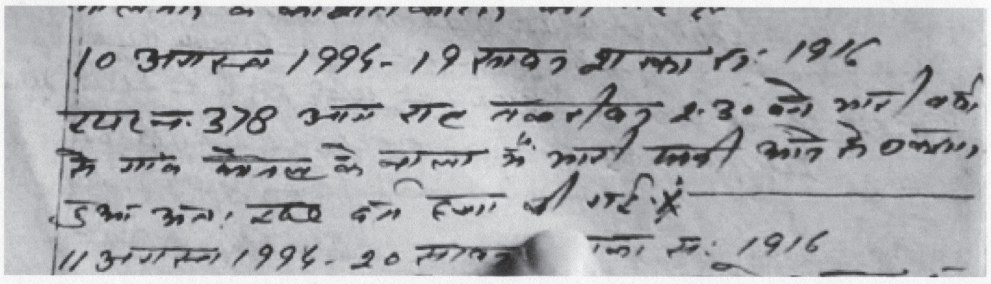
Fig 19.4 indicates two 1994 failure locations at Jeydahr: 1' and 2'. At 2' (2620m ASL) a scar remains (c. 20m × 5–8m; 31°; 160m^3); sediment transfer to the nearby stream (c. 275m) is plausible.

Slope-channel coupling

Accounts detail the transfer of materials from hillslopes to channels (Table 19.1a). The Runga farmer provides details for locations 1 and 3–4 (see Fig 19.2A). At location 1 the destruction of trees occurred and sediment from location 3 fell over a cliff into the stream at location 4 (see Fig 19.2A and B). In the aftermath, villagers planted trees to stabilise deposits (see Fig 19.2A, location 5).

Sediment-water flow characteristics

Correct identification of flow processes (eg fluvial or debris flow) is important for hazard and risk management; accordingly interviews (Table 19.1a) explored this. The Runga farmer reports ground-shaking (see Fig 19.2A, location 6), known to occur with debris flows (Arattano 2000) and an associated constant noise, which would be atypical for debris flows as they have pulsed



English Translation (Mohan, 2013):

'10 August 1994, this is another date [Hindu calendar system date: 1916]… *Whole night around 2.30 AM there was a heavy rainfall and it was in village Phojal and there are few other villages which are far away from here, and later there was a lot of damage...'*

Fig 19.3. Phojal village register entry for 10 August 1994.

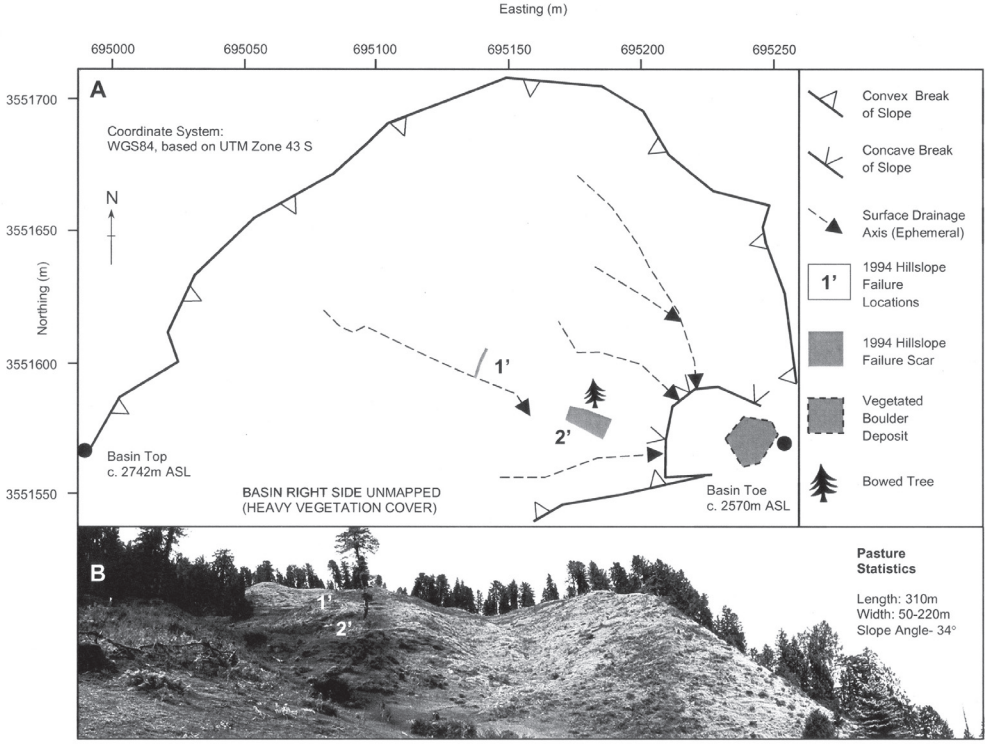


Fig 19.4. The Jeydahr pasture with 1994 hillslope failure scars. (A) Reconnaissance morphological map of the failure basin derived from smoothed GPS waypoint data, (B) Photo panorama looking upslope (20 October 2013).

Table 19.1a: Interview accounts from April and October 2013: timing, meteorological causation and physical characteristics.

1994 Event Question Theme	Location of Interview	Interviewee (Generalised)	Responses (Via Interpretation of Mohan, April & October 2013 [Phojal and Downstream] & Singh, October 2013 [Landslide & Runga])
Event timing	Runga	Runga Farmer	• '*He is saying 9 August 1994…in the night time…ten-o'clock* [In relation to slope failures]'
	Phojal Village	Pradhan	• *'That flood came in the month of August/September 1994…it came around, in between 2pm to 3pm, night'*
Meteorological conditions	Runga	Runga Farmer	• *'Yeh, rain…there was too much rain there. Heavy rain…*[lasted] *2 hours'*
	Phojal Village	Grandmother	• *'This lady is saying in 1994 when the flash flood came…due to the heavy rainfall'*
		Shopkeeper at Road Bridge	• *'…before this flash flood there was another flash flood came which is 90km away place from here…Some relatives made alert, there is a flash flood, and you also be careful'* • *'The water came with the cloudburst…the place where the cloudburst occurred in 2km away from here…That cloudburst was mainly for regular 3 hours'*
		Pradhan	• *'There was a heavy rain…there was a cloudburst'* [In April 2013 also said heavy/regular rainfall 2 days prior to this]
Hillslope failures and impacts	Runga/Jeydahr	Runga Farmer	• *'He is saying one place is Jeydahr, from start from landslide there…'* [Continued in conversation: Jeydahr was the largest site of hillslope instability in 1994] • *'This landslide…they are eating calves up there, that time some sheeps and cows also going* [downhill animated] *in this landslide'* [Continued in conversation: Jeydahr was visited and photographed in 1994 by the Kullu 'Animal Hospital Department' to certify livestock fatalities] • In conversation identifies three locations of hillslope failures in this event: Zabu, Jeydahr, and stream basin east of Jeydahr (location 3); at Jeydahr assuredly pin-pointed two failure locations from the 1994 event on the pasture
	Phojal Village	Pradhan	• *'…there is one village called Runga…and there was the landslide occur'*
Slope-channel coupling	Runga/Jeydahr	Runga Farmer	• In conversation indicated mud, rock and tree mixes transferred downslope to channels: – From failure at location 3, falling over a cliff to the channel at location 4; indicated was muddy at time, but now re-vegetated; locals also replanted vegetation from seed in event debris at location 5 – Material from Zabu moved through the forest to the stream below, knocking down trees
	Phojal Village	Pradhan	• *'When there was a landslide and that landslide came in the Phojal Nalla* [ie tributary of]… *the whole landslide mixed with water and that landslide/mud came into the Phojal Nalla'*

1994 Event Question Theme	Location of Interview	Interviewee (Generalised)	Responses (Via Interpretation of Mohan, April & October 2013 [Phojal and Downstream] & Singh, October 2013 [Landslide & Runga])
Channel sediment-water flow process type	Runga	Runga Farmer	• *'He say like very big noise…and his house is like shaking…not big shake but little…one noise, one noise'* [location 6]
	Phojal Village	Grandmother	• *'It was a sudden flash water, nobody was able to understand what happened…'*
		Shopkeeper at Road Bridge	• *'It was mixed with lots of debris, is the type of water was little blackish and lot many stones, boulders, pebbles, everything, and big long trees also came with that flash water…the water came with cloudburst, it was not very thick, it was not very viscous, but it was little thin…This person has seen the water from here with his torch light…'* • '*…before the flash flood there was a swift* [down channel] *wind was there…And after 5 minutes they saw the water coming*'
		Pradhan	• '*They saw sound first…continuous… and a lot of light because many stones were striking with each other…they were producing a small kind of light…sparks…because there was a heavy rain, and so far there is no record of the* [a] *fire… the whole* [?] *was having little shaking*' • *'In that flash flood there mud, stones, sand, big boulders…it was muddy…it was very very furious and very fast'*

Table 19.1b: Interview accounts from April and October 2013: physical characteristics continued and immediate economic impacts.

1994 Event Question Theme	Location of Interview	Interviewee (Generalised)	Responses (Via Interpretation of Mohan, April & October 2013 [Phojal and Downstream] & Singh, October 2013 [Landslide & Runga])
Channel water/ sediment yield and form dynamics	Runga	Runga Farmer	• Conveyance of material down to Phojal: *'Just straight away,* [but] *near the Phojal there is one space like…when the landslide is going down and everything is stopped there'*
	Phojal Village	Shopkeeper at Road Bridge	• *'…It was full of stream'* [subsequently pointed to bank top stage indicator – a coarse boulder deposit on the right bank margin downstream of the road bridge] • *'…earlier the flood area was very narrow. Now due to the flood it has become wider…'*
		Pradhan	• *'…It was muddy, it was continue for more two days. First it was heavy flash flood and later there was a continuous water supply was there…'* • '[River after the flood] *it has become bigger. A lot of debris…so it all deposit here…and still lying there in the same shape.'*
Village physical/ immediate economic impacts-Phojal	Phojal Village	Grandmother	• *'…many houses were there which were washed away and that time with that water…'* • *'Even a few vehicles were parked along the riverside – which were also washed away with that flash water…the flour mill it was also washed away… shops also; everything whatever was available in the shop, their things; everything was washed away…one big truck was also washed away in that'*
		Shopkeeper at Road Bridge	• *'…truck was blown away by that swift wind'.* The truck was found in the Beas River at Kullu 22 days later [Stated April 2013] • *'my building all finished…the whole house was washed away by the fast flowing water '* [Later confirmed as a 3 story building, located on right bank margin of the stream down of the road bridge] • The left bank side of the stream suffered the greatest damage [Stated April 2013]
		Pradhan	• *'Property was totally lost and totally damaged...'* [In April 2013 suggested 8-12 properties lost] • *'…agricultural land which was washed away, their orchards…and that was the apple season…they fill the boxes of the apple to import to the other parts of the country, and they saw those apple boxes also were washed away with that water'* • *'Round about 20 hectares of you can say 20 acres of the land from top to end is washed away…'* • 100-150 metres of road lost preventing road access to other villages for 12-16 months [Stated April 2013]
		Bank Manager	• Indicated the bank financed the truck which got washed away
Village physical impacts-downstream in Phojal Nalla	Dawara	Shopkeeper Assistant	• *'…one truck and few houses were washed away that flood, that night'* [Uncertainty where this applies to?]
		Shopkeeper	• *'…that night there were 2 trucks standing there, parked there, and they were washed away'* [Uncertainty where this applies to?]

sediment transfer. In Phojal, the accounts of the shopkeeper and Pradhan are similarly inconclusive. In support of fluvial flows, the Pradhan states it was 'muddy' (cf Pierson 2005), and the shopkeeper expresses a lower-viscosity mixture (cf Costa 1988). In contrast, potential indicators of a debris flow include the Pradhan's observation of furious and fast flow conditions (cf Pierson 2005), and the shopkeeper's observation of an air blast, which may reflect a rapidly approaching debris flow front.

Channel yield and form dynamics

No hydrological monitoring of Phojal Nalla was performed in 1994, so interview accounts were used instead (Table 19.1b). The shopkeeper indicates a bankfull flood stage near the Phojal village road bridge (see Fig 19.2C). The Pradhan details elevated flow and sediment loads following the event for in excess of two days. The consequences were in-channel deposits (Runga farmer and Pradhan) and increased channel size (shopkeeper and Pradhan).

Physical impacts: Phojal Village, Phojal Nalla, Dawara

Interview data (Table 19.1b) reveal the breadth of physical and immediate economic impacts. In Phojal (see Fig 19.2A, location 7), respondents indicate: loss of multi-storey buildings (residential, commercial and flour mills); loss of vehicles including a truck; destruction of agricultural land and the loss of harvested apples; and severing of the local road. Downstream at Dawara, shopkeepers make reference to the loss of assets but do not confirm locations accurately.

Societal impacts in Phojal Village

Table 19.1c indicates how the community were both recipients and responders to the event, from health, long-term economic and socio-cultural perspectives.

1994

Human fatality accounts are inconsistent in Phojal, ranging from 7 (shopkeeper) to 20–30 (grandmother), and in Dawara, 5–6 people (shopkeeper). Victims came from both indigenous and migrant populations (Table 19.1c); among the latter many lived (illegally) along channel margins alike today at Dawara (see Fig 19.2D). Fatality accounts (eg grandmother) demonstrate the enduring trauma for those who survived but lost others.

During the response and initial recovery phases, the villagers helped each other (Table 19.1c), since there was limited government intervention (Pradhan) and no aid provided by the local bank (bank manager).

Post-1994

Economic impacts are also persistent, in respect of both housing and income generation. The permanent loss of some agricultural land in Phojal, and the temporary loss of road access for 12–16 months (Tables 19.1b and c) caused considerable anguish (eg Pradhan, shopkeeper). Berkes *et al* (2000) similarly found that Kullu Valley villagers give great weight to land areas producing cash crops, market access and roads in maintaining a sustainable lifestyle. The shopkeeper details his personal loss of property (Table 19.1b) and the subsequent construction of a temporary house (in which he still lives) (Table 19.1c). Twenty years on, people still perceive a lack of compensation from the government for their losses. For example, the shopkeeper asserts that his house, shop and stock were worth millions but he was offered 5000 Rupees (around £50 in 2014). He

Table 19.1c: Interview accounts from October 2013: societal impacts.

1994 Event Question Theme	Location of Interview	Interviewee (Generalised)	Responses (Via Interpretation of Mohan, October 2013)
Human fatality	Phojal Village	Grandmother	• *'…many people died…nobody survived from some of the families…and from here dead bodies were found more than 10km away from this area…around 20 or 30 people died in that'* [She confirmed she personally knew many of them] • *'Some people were from far away and they died. Now nobody lives here…this place is a hell for them, because they have lost their families and they do not want to stay…so they have shifted from this area to somewhere else'*
		Shepherdess	• *'never ever came any flood before 1994…is the saying by the old people, those who lived here … only in 1994 the flood came which has made a total destruction and many people have died in that…11 people died in that flash flood'*
		Pradhan	• *'Ten people died'* [He confirmed these were in Phojal village]
		Shopkeeper	• *'…Seven people died'*
	Dawara	Shopkeeper	• *'…inside the truck there were 2 conductors…they were also died…and 3-4 Nepalese died in that'* [Uncertainty where applies to?]
Emergency response & initial recovery	Phojal Village	Grandmother	• *'Many people came with the torch, some other things to see is there anybody survived in this flash flood or not...It was a horrible situation…'*
		Pradhan	• *'They had help for each other at that time. But how much can they do? Still, we have seen some people walking here and there in search of food…'* • *'…the Acting Chief Minister of the state came here… People ask from him the help but nobody has listen, and still people are waiting for the aid, waiting for the help…'*

Post-1994 Event Question Theme	Location of Interview	Interviewee (Generalised)	Responses (Via Interpretation of Mohan, October 2013)
Long-term economic impacts-compensation	Phojal Village	Grandmother	• *'…nothing is given by the government as compensation. So, some people have lost everything, only they survive themself'*
		Shopkeeper	• *'…has purchased a little piece of land here, which is not very costly and he has made this temporary residence over here because everything is [lost] and he is not having plenty of money left…waiting for the compensation from the government…not paid anything to him so far…owned everything, millions of property, but only offered 5000 Rupees'* • *'…big problem of repairing road, government has done nothing, even if money has come… not reached to the people'*
		Pradham	• *'…people are still waiting for the compensation…*[Losses were] *in millions, compensation in thousands'*
Socio-cultural issues	Phojal Village	Shopkeeper & wife	• *'…his daughter has grown up now…but there is a problem…he is not having anything left behind* [money], *the problem is facing the marriage of his elder daughter because he is not going to get a proper bride* [ie groom] *for his daughter'*
Psychological issues	Phojal Village	Shopkeeper & wife	• *'…very sad after that incident because everything has finished…temporary house is not in good condition - they don't have much money to repair it'* • *'they feel secure, but they still scared of, because what they saw…When there is a rainy season… there is terror in their mind'*
		Pradhan	• *'…we are all scared because at least how much land is left, that should not be washed away with that water now. And whenever there is rain…they have a kind of fear in their mind, in their heart…and they pray to God'*
		Grandmother	• *'If in future the flood will come they are scared of, because they have seen the destruction here, and they are still scared of and they pray to God that there should not be that kind of tragedy in the future…if the flood will come there is no chance for us to run…will leave everything in the hands of God'*

also implies that the compensation was top-sliced by the local government. Whereas it seems that the indigenous population rebuilt their lives in the local community, there has been out-migration of Nepalese, resulting in a cultural and economic loss to Phojal. Although migrant communities do exist nearby in Dawara and Dobhi, they remain vulnerable. For example, in Dawara one interviewee said they are aware of the risks, and in the event of a future flood would move away and expect to receive no government help.

The psychological and cultural impacts of the 1994 event continue (Table 19.1c). All interviewees expressed fear of future flooding, especially when heavy rains occur. Several people talked of helplessness in the face of future events and place themselves in the hands of God. Intergenerational impacts have also been reported – for example, the shopkeeper and his wife say that their loss of wealth, and therefore status in society, means that their well-educated daughter cannot marry a 'man of consequence' because of her impoverished background; she is also now unwilling, or unable, to bring her town friends to her home village, and this is a cause of sorrow to her parents.

Heritage and Resilience in the Phojal Nalla Catchment

The 1994 heritage–resilience condition

Building community resilience is predicated on the ability to learn, in part by recognising and exchanging collective indigenous knowledge (McEwen *et al* 2012). The foregoing data report this theme and are used to interpret the community heritage–resilience condition. Oral histories of former events (1994, 1894) are numerous in the community, providing confirmation of intangible heritage. However, written accounts (other than the village record, see Fig 19.3) and photographs are not apparently in the public domain, so these aspects of heritage are possibly underutilised.

More positively, Table 19.1 indicates good collective awareness of event temporal sequence, spatial patterns, hydro-geomorphological attributes and impacts. Appreciations include: (1) seasonality and event timings; (2) connections between hillslope and channel settings (downslope transfer of material and livestock); (3) approaching flow indicators (ground-shaking, noise, wind blast and sparks); and (4) physical impacts on the channel system and adjacent socio-economic assets.

Measures for coping and adaptation are also evident in Table 19.1. Coping strategies included: responses (evacuation of houses, search by torchlight and inspection of bank assets) and recovery (food sharing, community financial self-help, compensation claims and rebuilding of lives among the indigenous population). Adaptations included: (1) limited rebuilding and non-residential use of remaining structures along the Un-named Nalla in Phojal by the indigenous population; (2) new land ownership maps (2006-2007) clearly delimit the Un-named Nalla channel corridor, which may suggest *ad hoc* land-use planning; and (3) localised re-vegetation of 1994 event deposits near Runga by farmers to modify sediment source erodibility. The fate of the migrant population, however, seems less fortunate, with no apparent recovery in Phojal.

Developing capital for resilience in the Phojal Nalla catchment

Opportunities to develop capital to enhance resilience exist and are offered for consideration, recognising that further investigation is required to evaluate their necessity and feasibility. This is timely given the development pressures in the Kullu Valley.

Economic capital

Communities with diversified income and credit sources generally exhibit more resilience (Gardner and Dekens 2007). In the Phojal Nalla catchment, horticultural and agricultural activities dominate, supplemented by smaller-scale retail and taxi businesses. Financial hardship following 1994 (Table 19.1c) questions the extent of diversification. Further, the bank did not offer any aid and available credit was poorly utilised in 1994. This may present an opportunity for the creation of a community disaster aid fund, being a partnership between the local bank, local authorities and villagers. This would empower the community to be proactive rather than responsive, addressing the perceived lack of government compensation (Table 19.1c).

Reliable communication networks support emergency response and recovery (Pfefferbaum *et al* 2007). Phojal village currently has landline and mobile telephone coverage, but these may be at risk from natural hazards. In this regard, the Phojal Secondary School headmaster stated they did not have access to two-way radios, and more so did not perceive the need for this communication redundancy.

Roads enhance access to markets, health services, food, water and emergency response (Berkes *et al* 2000). Villages in the Phojal Nalla catchment are served by a single road (see Figs 19.1 and 19.2). The hydro-power development in the catchment (HPSEB 1998; BEHEPD 2009) may present an opportunity for road construction and upgrading. Villages could also stockpile materials and equipment to facilitate emergency repair of roads and bridges, reducing dependence and impacts of road loss as reported in 1994 (Table 19.1b and 19.1c).

Social capital

Education is key to building resilience (Frankenberg *et al* 2013). In Phojal village, discussions with the Pradhan and school headmaster reveal that there is no formal syllabus regarding hazards, although awareness is raised during morning assemblies when pupils are advised on behaviour during earthquakes. Emergency telephone numbers and evacuation route signs are displayed in the playground, although it was not clear whether emergency response training and rehearsals take place. There is also an absence of IT facilities and specific textbooks; having these would provide a means to better incorporate hazard and risk awareness into the curriculum.

Muttarak and Pothisiri (2013) suggest that improved education has wider intergenerational benefits, as information is exchanged among the community. However, knowledge is not unidirectional, as memories passed between generations create a sense of place, and this helps to reproduce heritage and maintain readiness (Norris *et al* 2008; McEwen *et al* 2012); such accounts exist in respect of the 1894 flood.

To expand social capital, opportunities may include: (1) citizen participation in community organisations (Pfefferbaum *et al* 2007; Norris *et al* 2008), which in Phojal would benefit from a new village hall (lost in 1994); (2) information boards and places of disaster memory; and (3) establishment of a community hazard warden team to record events, operate early warning sensors and liaise between stakeholders (McEwen *et al* 2012).

Environmental capital

Gardner and Dekens (2007) suggest indigenous knowledge has long influenced settlement locations in the Kullu Valley, and this hazard avoidance affords permanent populations some resilience. Exposure to natural hazards does remain in tributary valleys, and on river terraces and

fans, and particularly afflicts vulnerable migrant populations, eg Dawara (see Fig 19.2D). In such locations, Gardner (2002) contends that detailed land-use zonation and management is limited; it follows that developing such measures may assist. However, more achievable in the short-term would be the assisted relocation of migrant populations away from Phojal Nalla, and measures to deter resettlement such as rewilding the channel corridor. While reducing exposure these measures do not eradicate hazard occurrence, so pre-event planning is also needed. Although a Kullu District Disaster Management Plan exists (Nanta 2011), integrated emergency response planning seems absent at village level; in Phojal the Pradhan indicated it was beyond their financial means. The Phojal School headmaster also indicated an absence of emergency kits; hence opportunities to improve self-sufficiency in the aftermath of disasters remain.

Conclusions

The loss of heritage may impact negatively on people, due to cultural significance, loss of learning, identity and connection to place, as well as more specific socio-environmental factors such as memory and materials connected to flood events. This chapter has examined the heritage–resilience condition of communities in the Phojal Nalla catchment in the context of a 1994 flood, using physical and social science methods. The objective is to contribute to understanding of the benefits of intangible heritage in helping people enhance resilience in the context of hazard and risk. Three keys points emerge:

(1) The 9–10 August 1994 flood was triggered by convective rainfall, resulting in slope instability and channelised flows over c. 8km. This inflicted health, physical, economic and socio-cultural losses both at the time and in the aftermath; these span tangible (physical objects impacted) and intangible (people centric) heritages;
(2) Oral accounts and village records demonstrate a heritage of learning from the 1994 and 1894 events. Some resilience is demonstrated in 1994 in terms of coping during the event, and in subsequent adaptations;
(3) Opportunities to enhance heritage–resilience are offered in respect to economic, social, and environmental capital.

Research findings demonstrate the complexity and sensitivity of the social–physical environment in the Kullu Valley; many opportunities to extend knowledge and promote heritage–resilience remain, and these have added urgency in a region prone to a number of hazardous processes that is undergoing rapid socio-economic development.

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