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• *Migration – Natural hazards – Coping strategies – Risky environment*

Hermann Kreutzmann

After the Flood. Mobility as an Adaptation Strategy in High Mountain Oases. The Case of Pasu in Gojal, Hunza Valley, Karakoram

Nach der Flut. Räumliche Mobilität als Anpassungsstrategie in Hochgebirgsoasen. Die Fallstudie Pasu in Gojal, Hunza-Tal, Karakorum

With 8 Figures, 1 Table and 3 Photos

The high mountain environment of the Hunza Valley in the Karakoram is characterised by significant potential energy, extended glaciation and related events that tend to threaten habitations and settlements. The village oasis of Pasu is taken as a case in point to highlight adaptation and coping strategies over a longer period. The village lands of Pasu have been shrinking over time owing to glacier outburst floods in the upper valleys. The inhabitants of Pasu have developed a set of coping strategies that are linked to mobility. Shifting populations to newly created irrigated oases in previously barren lands, out-migration to urban areas within the Karakoram and to metropolises in down-country Pakistan in search of employment and education, international migration to overseas destinations, and the broadening of income generation by reducing the importance of agriculture in favour of services and tourism are measures of adaptation that are embedded into the socio-political and economic framework conditions. The shrinking village lands of Pasu have posed tremendous challenges to the mountain farmers, who have developed their own responses.

1. The Hunza Valley as a Risky Environment

On January 4, 2010 the Atabad rockfall blocked the Upper Hunza Valley and created a lake that extends for more than twenty kilometres northwards and interrupts access via the Karakoram Highway to the upper villages and to China. At the end of July, exceptional monsoonal rainfall coincided with the peak of glacier melt from the part of the Karakoram where more than one third is covered by ice. The flood was disastrous for the infrastructure of the mountain valleys and subsequently affected millions of people in the irrigated plains of Punjab and Sindh where

the water masses could not drain into the saturated soils of the most extensive and compact irrigation oasis on earth (*Kreutzmann* 2010, *Kreutzmann* and *Schütte* 2011). In this paper a longer historical view is taken in order to investigate the hazards that have been threatening the Karakoram oases and that have forced the inhabitants of the mountain settlements to become experts in coping with crises and designing strategies for adaptation and mitigation. The metaphor 'after the flood' incorporates the pending threat of a new hazard that is always expected in such a mountainous risky environment.

The village of Pasu is situated at the upper end of Atabad Lake and will be the case in point for our argument. Its inhabitants have a long experience with environmental threats and have developed a set of coping mechanisms in response to complex emergencies created by floods and glacial movements that were causing blockage of rivers and routes, subsequent dam breakages, flash floods and debris flows destroying water management systems and village lands.

In high mountain research, different strategies of adaptation to challenging habitats have been discussed over time. At present, a prominent discourse is linked to climate change and its social impact and subsequently to the potential for mitigation and adaptation. Among the numerous publications addressing climate change in mountain regions cf. *Eriksson* et al. 2009, *Kohler* and *Maselli* 2009, *Spratt* and *Lawson* 2009, *UNEP* 2009. From a different research perspective adaptation and coping are rooted in vulnerability research that takes into account the spatial dimensions of risk (*Bohle* 2007, *Müller-Mahn* 2012, *Wisner* et al. 2004). The vulnerability framework is embedded in "... the characteristics of a person or group and their situation that influence 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 someone's life, livelihood, property and other assets are put at risk ..." (*Wisner* et al. 2004: 11). *Bohle* (2007: 6) argues pointedly: "...social vulnerability will have to analyse the options open to the vulnerable for coping and adaptation, and the mechanisms and structures that promote or prevent successful livelihood activities. In risky environments it is necessary to know the existing capacities for sustaining livelihood security, before any political measures can strengthen or support them." While mitigation is out of the scope of local people in our village setting, their everyday life is a permanent adaptation to different challenges originating in ecology, economy and society. Adaptation is understood here in a broader sense as all activities and measures that are taken by vulnerable groups and individuals to cope with a changed situation that was triggered by events from the environmental, social and political spheres. When we address resilience in the context of Pasu the capacity of mobilising human resources needs to be highlighted and explained. The resilience of mountain dwellers in challenging environments draws on an expertise that should be used to cope with all sorts of crises demanding immediate action and relief. In earlier debates the academic emphasis was put on utilisation strategies combining resources accessible in different ecological zones. In the Andes *Robert Murra* identified vertical control as a highly sophisticated approach for establishing a strategy to merge assets in different niches and to disseminate risk (cf. *Brush* 1976a, 1976b, 1977; *Guillet* 1983; *Murra* 1985). The combination of marginal resources in their separate settings enables the survival of mountain households whose major asset is a high degree of mobility. In the tropical Andes, verticality is the prime factor facilitating regular altitudinal mobility if access to scattered resources is part of the control scheme. In the subtropical and temperate Inner Asian mountain areas, distance and altitude are linked in a seasonal regime. Mobility connects resource-rich areas such as the high summer pastures with permanent homesteads or,

Fig. 1 Pastoral mobility in the Hunza Valley. As an integral part of combined mountain agriculture the distance between irrigated oases in the valley bottoms and high-lying summer pastures is covered by herd migration. Some settlements claim pastures close-by while others manage distances between 5 and 75 km. Source: modified from *Kreutzmann* (2006b: 340) / *Viehwirtschaftliche Mobilität im Hunza-Tal. Als wichtiges Bindeglied der kombinierten Hochgebirgslandwirtschaft werden die Entfernungen zwischen den Bewässerungsoasen und den hochgelegenen Sommerweiden von den dörflichen Herden überwunden. Einige Dörfer verfügen über nahegelegene Weiden, andere legen Distanzen zwischen 5 und 75 km zurück. Quelle: verändert nach Kreutzmann (2006b: 340)*

in the case of nomadism, summer, winter, spring and autumn pastures (*Ehlers* and *Kreutzmann* 2000, *Guillet* 1983, *Uhlig* 1995). Mobility is the driving force enabling survival in marginal and remote locations. Studies of mobile people have focused on practices in the livestock sector. Consequently, *Erwin Grötzbach* (1980) hypothesised that utilisation strategies of high mountain

Photo 1 The oasis of Pasu (2400 m) at the edge of the Hunza River with its wide bed bordered in the northeast by steep scree slopes and rock formations culminating in Tupodan (6106 m). Photograph: *Hermann Kreutzmann,* August 24th, 2003 / *Die Pasu-Oase (2400 m) am Rande des weit ausgeräumten Hunza-Flussbettes. Am gegenüberliegenden Ufer finden sich steile Schutthänge und Felsformationen, die zum Tupodan-Massiv (6106 m) gehören. Aufnahme: Hermann Kreutzmann, 24. August 2003*

pastures were an essential classification tool for understanding cultural properties and societal differences. Classical interpretations tended to explain regional differences according to access to locally available and accessible resources and their consumption within the region. Socio-political embeddedness was grossly neglected and underrated. While mobility was associated with animal husbandry other forms of moving and migration escaped appropriate attention. Settlements, especially when they were regarded as permanent homesteads, counted as fixed and immobile structural parts of human dwellings in the mountains. Outward-oriented human mobility, encompassing migrant labourers, itinerant traders and students, was neglected in a similar manner (*Grötzbach* 1984). The assets of mountain households have been diversified over time; non-agrarian and non-place-based resources dominate in many cases (*Kreutzmann* 2006a). Food supply is managed on a monetary exchange basis with external producers etc. Mobility and exchange networks along modern lines of communication have added value to the households residing in mountain villages. Emphasising mobility as a central category and dynamic element of flexible and responsive mountain communities might be a useful approach to investigate vital features of mobility and to understand resilience in mountain contexts.

Tab. 1 Population change in Pasu / *Bevölkerungsentwicklung in Pasu*

Year	1790	1886	1921	1931	1972	1981	1989	1994	2008	2011
Households	10-12	40	22	22	45	61	70	80	120	125
Inhabitants	-	-	167	155	318	375	556	711	882	917

Source: Government of Pakistan 1975, 1984; Ismaili Council for Gulmit 1994, 2012; *Lockhart* and *Woodthorpe* 1889: 135-136; *Pal* 1928, 1934, *Qudratullah Beg* 1962: 154

The aspects to be discussed are:

- Seasonal mobility as part of combined mountain agriculture,
- Episodical mobility as a response to natural hazards,
- Out-migration for jobs and education as a strategy to diversify the income structure of mountain households,
- Tourism development as a means of reinterpreting local resources.

In the following, the case of Pasu village in the Karakoram Mountains is discussed from different mobility perspectives as they are reflected in the physical and social village setup. For the meaning of village in the context of the Hunza Valley cf. *Kreutzmann* (2006a: 259ff.; 2006b: 331ff.). The story to be told is a narrative of decline in which local land resources dwindle while multi-facetted external resources are tapped and integrated into the domestic strategy of income-generation.

2. The Setting

Pasu village is located at an altitude of about 2500 m in the Hunza Valley. In an arid valley-floor environment surrounded by towering glaciated peaks of up to 7500 m, about one third of the Hunza Basin is covered by glaciers (*Hewitt* 2005; 2006: 50; *Photo 1*) . Thermal conditions in the valley bottoms are ideal for combined mountain agriculture, while water from glacier melt is in ample supply for the settlement oases of this area with a population density of less than ten inhabitants per km^2 in the Karakoram.

In local oral tradition Pasu is regarded as one of the oldest Wakhi settlements in the Gojal area of the Upper Hunza Valley (*Fig. 1*). The Wakhi arrived here as migrants from the Wakhan Valley of Badakhshan in present-day Afghanistan (*Qudratullah Beg* 1962: 152). As permanent settlers, they replaced the Kirghiz nomads who had previously used the Gojal area as summer pastures. Wakhi immigration most probably took place at the end of the 18th and beginning of the 19th century. We have not been able to trace any earlier written evidence but the local oral tradition relates a much longer occupation of the oasis; the first settlers are said to have arrived up to 400 years ago. The recorded genealogies provide names for up to twelve generations. The early settlement history tells us that Pasu was an important village in Gojal I, which was one of the administrative sections (*maqsòo*) of the Hunza principality. Early reports mention that Pasu was a village of substantial size; some estimated as many as 300 houses. The first empirical colonial record originates from the 'Gilgit Mission' during the last quarter of the 19th century when Pasu was reported to consist of forty houses (*Lockhart* and *Woodthorpe* 1889: 135f.). A contemporary source gave a number of 25 houses, but its author *Leitner* (1891: 246) did not visit Pasu himself as did *Lockhart* and *Woodthorpe* (1889: 396ff.). This is nearly half

Fig. 2 Pasu and Hussaini between the glaciers – two villages and their shifting location. From the old settlement nuclei both villages have expanded towards neighbouring scree slopes where village lands have been

the size of present-day Pasu, while other neighbouring villages of Gojal, such as Gulmit and Hussaini, have experienced a six- to eightfold growth during the same period (*Kreutzmann* 1996: 282ff., 2006a). Here we find an early indication that despite its importance as a strategic settlement Pasu has fared quite differently, losing part of its population especially in the first half of the 20th century (*Tab. 1*). The village was initially established as a fortified and compact settlement (*khan*) which was augmented during the last century by scattered hamlets and individual farmsteads on the village lands (*Fig. 2*). These lands consist of an irrigated oasis where crops such as barley, wheat, potatoes, beans and peas are cultivated. Orchards of fruit trees such as apricot (*èowan, Prunus armeniaca*), mulberry (*tüt*, *Morus alba*), peach (*šaftolú*, *Prunus persiaca*) and apple (*mür*, *Malus sylvestris*) form the tree plantations; in addition, there are stands of poplar (*safidor, Populus*) and seabuckthorn (*zax̀, Hippophae rhamnoides*); the latter is an important fuel for preparing meals and provides an area where grass for winter fodder is cut and the village herds scavenge.

3. Seasonal Mobility as an Essential Feature of Combined Mountain Agriculture

In addition to crop cultivation in the irrigated mountain oasis, vast stretches at significant distances are incorporated into the combined mountain agriculture of Pasu. The Wakhi community of Pasu claims the pastoral rights for the northern bank of the Batura glacier (*Fig. 3*). Since the village of Pasu came into existence, these pastures have been an integral part of managing survival in this location. Between late September and May, the herds of sheep, goat and yaks are kept in the village and the outlying hamlet of Kharamabad on the left bank of the Hunza River (*Kreutzmann* 2004), from April onwards they are driven towards the Batura glacier (*Photo 2*). The sheep and goats cross the glacier from Yunzeben to Yashpirt already in April; yak cows and their calves follow by the end of May. Pasu village has distributed the higher-lying pastures between two groups. One uses Yashpirt and Kükhel; the other keeps its flocks in Fatma hel and Guchesm. The non-lactating yaks are kept more than 30 km away from the village in Lupdor throughout the year. The summer pastures along the Batura glacier are a valuable resource, providing the fodder basis for the herds; milk is processed there for butter and *qurut* (dehydrated whey). These two storable commodities are brought back to the village. Animal husbandry has always been an important basis of income generation, adding to the staples cultivated on the village lands. During the last three decades, orchards, pastures and forest resources have formed innovations in the cultivation at Kharamabad and Janabad Das. Agricultural mobility today includes seasonal pastoral migration to Batura; at the same time daily circulation between Pasu and Kharamabad is necessary when the animals are there and when crop cultivation and harvesting are required. Some households have built new houses in Janabad Das, but the majority of Pasu

cultivated and filial settlements established. To reach the seasonal pastures the river and glaciers have to be crossed. Source: topography based on Hunza-Karakoram, scale 1:100000; Quickbird data, May 11th, 2007; Generalny Stab map, scale 1:100000, sheet J_43_126; design and toponymic survey: *Hermann Kreutzmann*; cartography: *Bernd Hilberer* / *Die Lage der Siedlung Pasu zwischen den Gletschern – zwei Dörfer verlagern sich. Aus den alten Siedlungskernen heraus wurden Filialsiedlungen und junge Fluren auf benachbarten Schutthängen erschlossen. Die Wege zu den saisonal aufgesuchten Weideplätzen erfordern die Querung des Flusses und der Gletscher. Quelle: Topographie nach Hunza-Karakoram, Maßstab 1:100000; Quickbird-Daten, 11. Mai 2007; Generalny-Stab-Karte, Maßstab 1:100000, Blatt J_43_126; Entwurf und Toponym-Aufnahme: Hermann Kreutzmann; Kartographie: Bernd Hilberer*

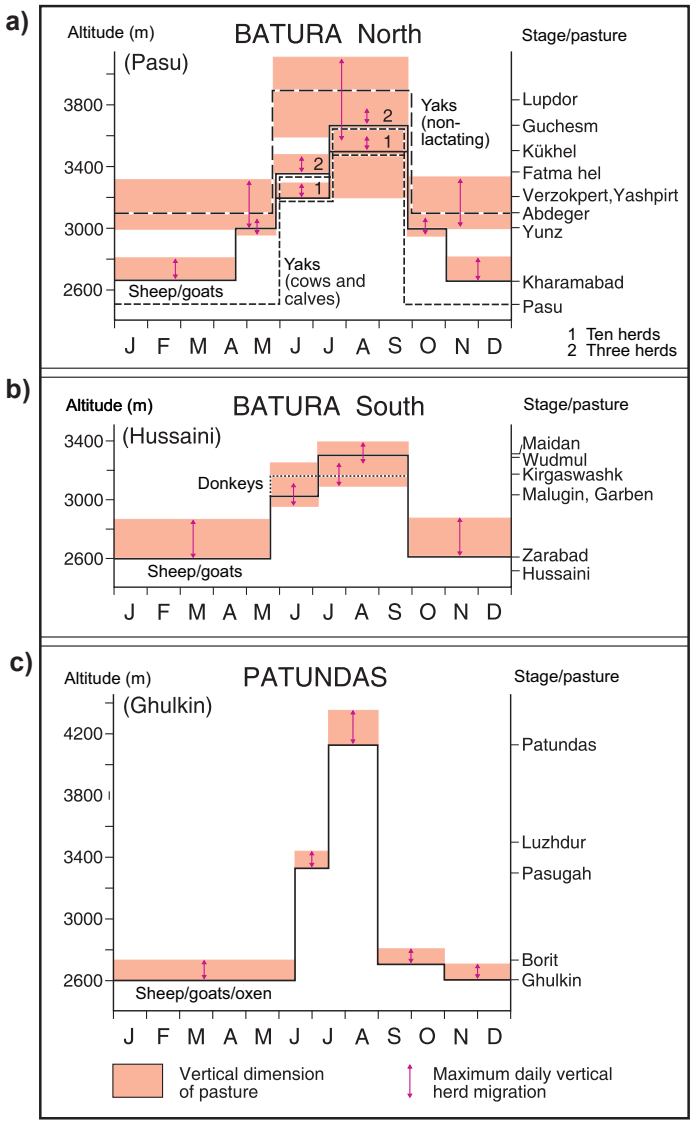

Fig. 3 Three stage diagrams representing the mobility patterns of three village communities that occupy pastures close to Batura and Pasu glaciers: a) Pasu on the northern side of Batura; b) Hussaini at the lower southern side of Batura; c) Ghulkin at the upper elevations between Pasu and Batura glaciers. The seasonal pattern of accesssing summer pastures in high-lying locations and winter pastures close to the nuclei settlements is similar, though modified by entitlements and access rights. Source: adapted from *Kreutzmann* (2006b: 349) / *Drei Staffeldiagramme aus drei Dörfern, die die Weiden im Batura- und Pasu-Gletschergebiet nutzen: a) Pasu am Nordufer des Batura; b) Hussaini mit den tiefer gelegenen Weiden am Südufer des Batura; c) Ghulkin mit den hoch gelegenen Weiden zwischen Batura- und Pasu-Gletscher. Das Mobilitätsmuster zwischen höheren Sommerweiden und tieferen Winterweiden ist ähnlich und wird durch Nutzungs- und Zugangsrechte modifiziert. Quelle: verändert nach Kreutzmann (2006b: 349)*

Photo 2
Pasu is connected with its filial settlement of Kharamabad by a lofty 140-m-long suspension bridge. Mainly women perform the daily duty of caring for the animal herds and irrigating the fields when in season. Photograph: *Hermann Kreutzmann,* June 30th, 1985 / *Pasu und die Sommerweidesiedlung Kharamabad sind durch eine 140 m lange Hängebrücke miteinander verbunden. Vorwiegend Frauen erledigen die saisonalen Arbeiten dort, wie Versorgung des Viehs und Feldbewässerung. Aufnahme: Hermann Kreutzmann, 30. Juni 1985*

people use the area for fodder cultivation and orchards and spend working time there whenever it is required. Utilisation of the meagre resources involves a high degree of mobility. The agricultural base seems to be quite archaic and stagnant. While the utilisation system might not have changed substantially, other challenges have significantly transformed the societal setup.

4. Episodical Mobility as a Response to Natural Hazards

Pasu's settlement history shows quite clearly that it is a village that was founded by migrants. At the same time Pasu is a nuclear settlement from which migrants moved to younger villages in the upper Hunza and Chupursan valleys. The

resettlement of Pasuik – the local Wakhi term for inhabitants of Pasu – households in Khaiber and Hussaini is attributed to the time of Shah *Silum Khan III* (1790-1824), who conquered Gojal. He was instrumental in incorporating Gojal villages into the Hunza principality and in promoting Wakhi immigration. This early phase of internal colonisation of neighbouring villages can be attributed to the need for cultivable land. Two major reasons are given for this. First, the demographic growth of the village and the admission of new settlers who arrived as refugees made it necessary to expand the food basis. Hussaini and Pasu commanded all pastures along the northern and southern sides of the Batura glacier, while Khaiber was a mixed settlement of Wakhi and Burusho from which the valleys of Shaujerav nearby and Gorhel (a side valley of Chupursan) were accessed for summer pastures. For the ethno-linguistic composition of Gojal villages cf. *Kreutzmann* (1996: 281); the individual village pastures and settlements are listed in *Figure 1*.

The second explanation for the expansion of settlements involves the loss of cultivated lands in Pasu itself due to natural hazards. Pasu is located between the two major glaciers of Batura and Pasu (for geomorphological and glaciological evidence cf. *Goudie* et al. 1984a; *Goudie* et al. 1984b; *Hewitt* 2001; 2005, 2010; *Hewitt* and *Liu* 2010; *Iturrizaga* 2005; 2007: 60ff., 176ff.). Nevertheless, the village frequently suffered from meagre water supplies for irrigation due to glacial dynamics that, by advancing, destroyed the headworks of the irrigation channels and, by retreating or shrinking, dried up the local water supply. In addition, the cultivated land has shrunk owing to lateral undercutting of the river bank. The collective memory of Pasu village strongly focuses on regular and episodical events which significantly reduced the village lands and space for built environment. *Qudratullah Beg* (1962: 350) is the only local source referring to a 'blockage of the Hunza River (possibly 1841 A.D.)' at a place called Buddung (*Badang*) which is just opposite Gamesar and close to the site of the latest event. According to the recorded tradition a "... lake was formed in the river course which extended upstream up to the bottom of settlement of Khyber in Gojal valley." There is still a place north of Batura glacier, halfway between Pasu and Khaiber called 'sare musk' which refers in Burushaski to a flooded forest. A religious scholar was asked to prepare an amulet (*taawíz*) "... to cause the natural dam on Hunza River recede and save them all from its destructive effects. It was feared that the rising water could completely inundate the villages of Fasso [Pasu] and Gulmit and there was a real danger of these villages getting submerged into this ever rising lake" (*Qudratullah Beg* 1962: 350). The *taawíz* worked and "By the grace of almighty Allah the river water started to overflow over the dam and started to rapidly erode and cut/wash away the natural dam. Soon the dam was busted and washed away and a huge flood was caused. This flood was so large that it completely washed away the lower portion of village Ganish ... It is narrated that the waters of this flood had completely washed away the entire village of Fasso and it had eroded the whole lands of this village. Prior to this flood, the village of Fasso was said to be a wide and large settlement. It was after this devastating flood that the remaining portions of Fasso village continued to be eroded and washed away by Shimshal floods every year. Hence the area of this whole village kept on reducing and decreasing with every succeeding year and then a time came when a very small portion of this village was left over. During the era of rule of Mir *Muhammad Nazim Khan* (1892-1938), the barren land located above the original Fasso village was resettled and made inhabitable with the new name of Fasso" (*Qudratullah Beg* 1962: 350f.). The story summarises the kind of risk, threat and loss that has been attributed to the village of Pasu in local historiography. The story related here is connected to a place near Sarat that was investigated by *Karlheinz Paffen* in 1954 (*Paffen* et

Photo 3
The site of the Atabad landslide (January 4th, 2010) seven months later. A nearly two kilometres wide dam is blocking the Hunza valley, allowing only a narrow spillover channel to release water. Rockfall and landslides have not stopped yet. Photograph: *Hermann Kreutzmann* July 31st, 2010 / *Der Ort des Atabad-Erdrutsches, der das Hunza-Tal mit einem fast zwei Kilometer weiten Damm versperrt. Nur ein kleiner Überlauf-Kanal führt Wasser des Sees in den Hunza-Unterlauf. Steinschlag und Rutschungen gehen weiter. Aufnahme: Hermann Kreutzmann, 31. Juli 2010*

al. 1956: 14) who attributed the event to the 1850s. *Frederic Drew* reports that in 1858 the Sarat rockfall created a lake that reached and flooded the upper Hunza Valley all the way to Pasu (*Drew* 1875: 419). According to *Qudratullah Beg* and oral tradition in Gojal the lake reached further up the valley and inundated lands significantly above Pasu and the Batura Glacier. The degree of damage in Pasu is not exactly known, but the village must have been abandoned for some time (*Derbyshire* et al. 2001; *Kreutzmann* 1994).

The advancing Batura glacier itself affected the habitations of Pasu in 1873 (*Hewitt* and *Liu* 2010: 534; *Mason* 1929: 20f.); in 1905 culti-

Fig. 4 Pasu in 1937. The earliest and only aerial photograph known to date was taken when a colonial flight mission was exploring potential airfields in the Karakoram. The picture is evidence for the extensive village lands and row of houses within orchards of Pasu prior to the floods and damage of the 1960s.

vated land in Pasu was lost owing to glacial advances in the Shimshal valley in general and by the Malungutti and Khurdopin glaciers in particular (IOR/2/1084/289: 153; IOL/P&S/7/180/1426; *Todd* 1930: 174). In the following year agricultural land, bridges and houses were destroyed in Pasu, Hussaini and other villages downstream (*Singh* 1917: 7; IOL/P&S/7/193/1654). Three entries in the colonial records at Gilgit document what had happened: "The bursting of the glacier dam in the Shingshal [Shimshal] valley caused a very high flood in Hunza river on the night of 11th August. … The flood was no doubt the most serious that has occurred since the Agency has been established … the water in the Hunza river rose 50 feet above summer level and 25 feet above last year's flood. At Bunji the Indus rose 30 feet, and the water was only 16 feet below the road way of the big suspension bridge known as the 'Partab-pul' (across the Indus 7 miles above Bunji). … The road between Nomal and Chalt has been literally wiped out …" (IOL/P&S/7/192/1618: Gilgit Diary 15/08/1906). "… flood of 11th August caused the following damage: seven cultivated fields and one house were washed away at Pásu, five cultivated fields were washed away at Suseni [Hussaini]. Two fields and rope bridge were washed away at Gilmit [Gulmit], six cultivated fields and some fruit trees were washed away at Ganish" (IOL/P&S/7/193/1654: Gilgit Diary 22/08/1906). "… recent Shingshal floods has carried away 35 fields with standing crops, 3 houses, 3 watermills and 1 orchard. A considerable quantity of wheat, grain, which was lying on the threshing-floors, and fodder has also been swept away" (IOL/P&S/7/193/1654: Gilgit Diary 29/08/1906).

Pasu has always been one of the villages hit hardest by these glacier dam bursts. The events described more than one hundred years ago resemble a key scenario discussed in the framework of today's climate change debate. Although the two glaciers bordering the village seem to be a visible threat to the settlement, the origin of risk and danger is located far away. Events occurring up-stream in a side valley were the main causes of the destruction in Pasu. Consequently, an understanding of Pasu's position in the riskscape of the Karakoram has to account for events in a wider arena (*Photo 3*).

In 1910 damage occurred to three houses, twenty agricultural terraced fields and many fruit trees in Pasu, as was documented in the colonial records (IOL/P&S/7/241/1118). In 1944 again, terraced fields in Pasu were affected by glacial advances and surges in the Shimshal valley (*Saunders* 1983: 107). Fortunately we discovered an aerial photograph (*Fig. 4*) depicting Pasu in 1937. Even then the scars from undercutting of the river terrace are perceivable, and the changing course of the Hunza River can be imagined. Nevertheless, Pasu appears to be a compact nuclear settlement with a distinct border between the irrigated village lands and the arid environment above the highest irrigation channel. The borderline on the edge of the terrace is similarly distinct. In between, the habitations are

Pasu represents a compact oasis bordered by the prominent terrace marking the edge of the Hunza river canyon in the East, Pasu glacier's outflow stream in the South, and the arid and steep slope in the North and West. Source: aerial photograph, taken September 20th, 1937 / *Pasu 1937. Das früheste und bislang einzige zeitgenössische Luftbild wurde während einer kolonialen Flugmission zur Erkundung potentieller Luftlandeplätze im Karakorum aufgenommen. Das Bild belegt die Existenz einer ausgepägten Flur und eines Siedlungsbandes gesäumt von Baumbeständen vor den Flutereignissen der 1960er Jahre. Pasu erscheint als kompakte Bewässerungsoase, die im Osten durch die Terrassenkante des Hunza-Canyon, im Süden durch den Ausfluss des Pasu-Gletschers sowie im Norden und Westen durch die steilen, trockenen Hänge begrenzt wird. Quelle: Luftbild, aufgenommen am 20. September 1937*

Fig. 5 Pasu in 1966. Nearly 30 years later a spy satellite image provides evidence of the change in the eastern section where substantial lands were lost in the aftermath of the early 1960s floods that undercut the river terrace. The bed of the Hunza river widened and the village lands shrunk. Source: Corona satellite image (September 22nd, 1966) / *Pasu 1966: Fast 30 Jahre später belegt die*

mainly located within the orchards – one hamlet of the Sakhi lineage is locally called '*boghik'* (the people of the orchards) – while sizeable terraces for crop cultivation are visible closer to the river bed. This state of affairs changed significantly in the years following the events described above.

In 1960 a bridge in Pasu was damaged (*Clark* 1960: 22), and this event was the beginning of a series of severe losses of land and property in Pasu during the following four years. In the collective memory of Pasu, the early 1960s are the "danger years" in which the village lost a substantial share of its lands. Records of early events are scanty, and we have listed only those events which explicitly refer to Pasu. The living memory of village elders is strong. Especially the events between 1960 and 1962 have shown dramatically that people could observe on a day-by-day basis how their fields, orchards and grasslands disappeared. *Hassan Khan's* garden (*bagh*) was the first to vanish, and then the process of destruction continued. In the 1960s the name of Virjerab glacier in the Shimshal valley became synonymous with destruction and loss. Terraced fields, orchards and houses were lost. The Mir of Hunza offered some sort of compensation and made initial attempts to cultivate Janabad Dasht, but efforts to bring water from Batura Glacier to irrigate the uncultivated steppe repeatedly failed. Some inhabitants were compensated with land in Nobod (new village) where 18 households found a refuge. This hamlet is located above the old nucleus (*yadiyor*) close to the Karakoram Highway. This information was gathered in interviews with *Ghulam-uddin* in Karachi, who provided a recollection and history of the 1960s events and a depiction of land losses, as well as from conversations with Pasu village elders and *Sanjar Beg* in Pasu in 2008. For this period we were also able to consult an early spy satellite image: The Corona satellite image of 1966 (*Fig. 5*) gives a blurred impression of the land losses inflicted on Pasu in the course of a few years; most people ascribe these losses to the years 1960-1962, when the village lands were substantially reduced.

To cope with the crisis, the settlement patterns of Pasu were modified and various outward-leading strategies were applied. The force of the natural events had been so strong that all efforts to control the undercutting of river banks by establishing protective bunds and other forms of stabilisation failed. The process of land loss could not be stopped. The most recent image in our multi-temporal comparison – a Quickbird image of 2007 (*Fig. 6*) – shows that the process of undercutting continued after the 1960s, with the river meandering and significantly widening the bed of the Hunza River. A comparison (*Fig. 7*) showing land losses of Pasu from 1937 to 2007 over the course of more than two generations highlights the shrinking village lands and the narrow corridor that is left for the course of the Karakoram Highway as the major artery of communication and trade.

In consequence, for some households the experience of the 1960s motivated them to develop an alternative strategy: to leave Pasu and establish new settlements in safer locations. During our initial enquiries in the 1990s we found that about 16 households in Khaiber (out of 30 Wakhi households) were originally Pasu migrants. In Hussaini

Aufnahme eines Spionagesatelliten den zwischenzeitlich erfolgten Verlust im östliche Abschnitt. Beträchtliche Flurstücke fielen den Uferunterschneidungen infolge der Fluten der frühen 1960er Jahre zum Opfer. Das Bett des Hunza-Flusses wurde geweitet, die Flur beschnitten. Quelle: Corona-Satellitenbild, aufgenommen am 22. September 1966

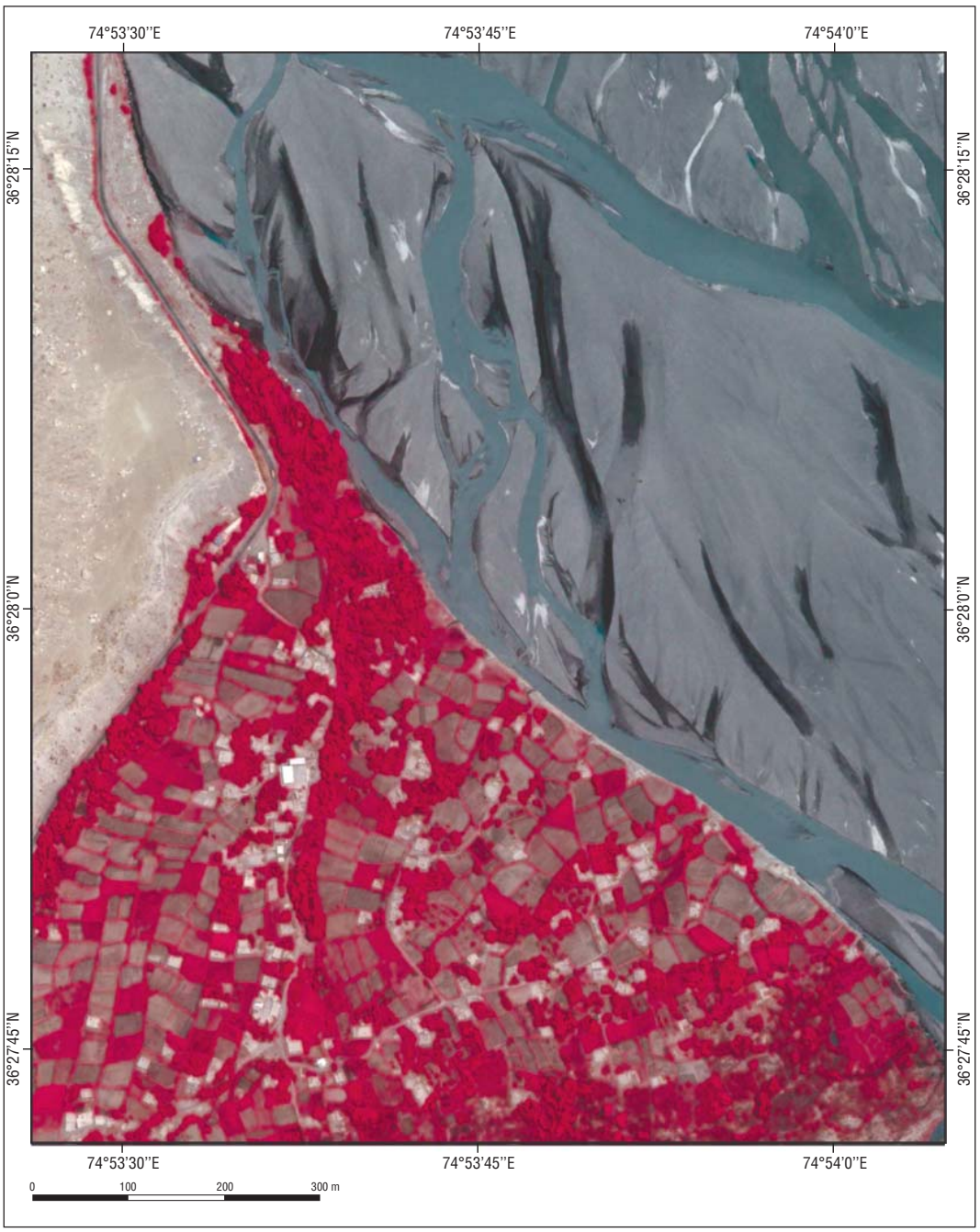

Fig. 6 Pasu in 2007. The Quickbird scene provides the greatest detail and underpins that land loss is continuing to date. The river bed has widened further and the village lands have continued to shrink. In the southern section the Pasu glacier's outflow stream bed has been planted with seabuckthorn

there were only three such households. A new opportunity arose when Mir *M. Nazim Khan* and his Wazir *Shukrullah Beg* started the resettlement of the Chupursan valley after a major mudflow had destroyed the settlements there in around 1830. Damage to all settlements in Chupursan was inflicted in 1830 by a mudflow following a glacier advance; cf. *Schomberg* (1935: 225, 1936). The resettlement in Chupursan was initiated in 1918, but gained pace after 1921 when Pasu settlers migrated to Shersabz (5 households), Reshit (2), Ispenj (10) and Zodkhon (8). The 25 households of Pasu origin made up two thirds of the 38 households recorded in the respective villages during the census of 1931 (*Pal* 1934). The period of relocation was initiated by the Hunza ruler as a form of internal colonisation by cultivating barren lands and transforming them into irrigated oases (*Kreutzmann* 1996). The settlers in the newly-founded oases were initially supported by their relatives in Pasu who inherited the remaining resources there. Later on bonds remained strong between Pasu and the new settlements only through marriage relations. The former summer camps of pastoralists were converted into permanent settlements in which the households received substantial land property. The new settlers had easy access to nearby pastures in the Chupursan side valleys.

5. Searching for New Opportunities

During these periods Gojal farmers were largely restricted to crop cultivation and animal husbandry. The Hunza rulers managed to make the Gojali contribute four fifths of the taxes although their share in the population was only one fifth. This statement holds true for the beginning of colonial rule in Hunza in 1891. By the mid-1930s taxation and forced labour pressure on the Wakhi farmers had substantially increased. Mir *M. Nazim Khan* exercised a strong regime with British backing there. Wakhi farmers not only fled from natural hazards and internal colonisation, but also began to search for new opportunities to escape the strict control of the local ruler. Already in 1921, two Wakhi had escaped across the northern passes towards Shughnan in present-day Tajikistan where they joined the Bolshevik army (India Office Library & Records: IOL/P&S/10/973: 238). Wakhi farmers and their sons were excluded from early job opportunities offered by the colonial administration which conscripted soldiers for the Gilgit Scouts. All posts allocated to Hunza were occupied by non-Wakhi applicants who were selected by the ruler (India Office Library & Records: IOL/P&S/12/3288: Administration Report for 1935). Consequently Wakhi, and among them the people of Pasu, failed to participate in the early phase of entrepreneurship which was based on military service and subsequently operating small enterprises in trade. Even today we find only five retired soldiers and three active military men among 467 male citizens in Pasu (data taken from the 2006 census by the Ismaili Council for Gulmit, provided by letter). Consequently, a general disharmony and exclusion was felt that articulated itself in a vigorous political debate. Today, supporters of the local ruler (Mir party) and their opponents (in the

(*Hippophae rhamnoides*) shrubs that provide fodder and fuel. Source: Quickbird data, May 11th, 2007, multispectral, pan-sharpened / *Pasu 2007. Die Quickbird-Aufnahme erlaubt detailliertere Einblicke und belegt, dass die Landverluste durch Uferunterschneidung anhalten. Das Flussbett weitet sich und die Flur schrumpft weiter. Im südlich angeschnittenen Ausflussbereich des Pasu-Gletschers wurde Sanddorn (Hippophae rhamnoides) für Futter- und Feuerungszwecke kultiviert. Quelle: Multispektrale Quickbird-Daten vom 11. Mai 2007*

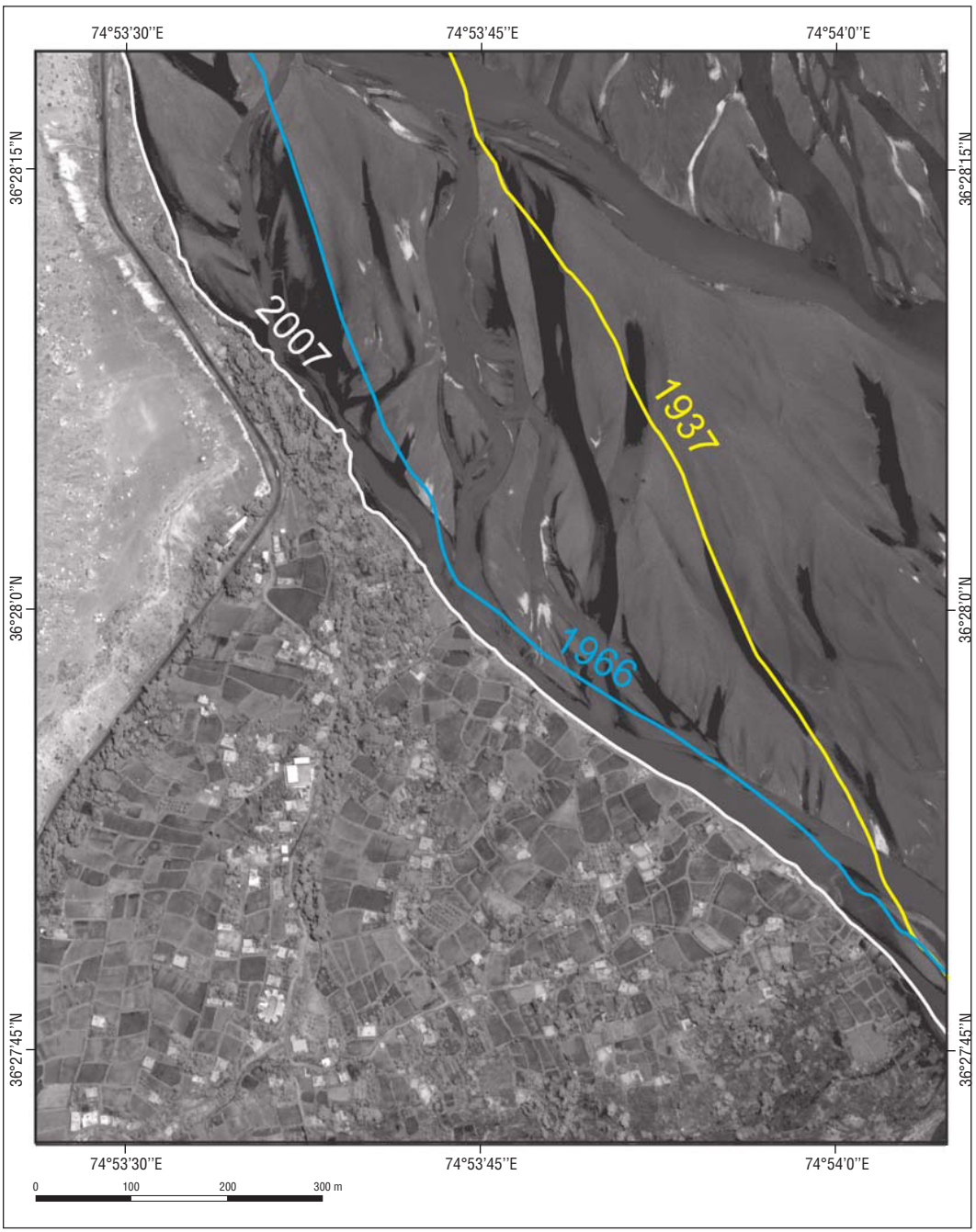

Fig. 7 Loss of land in Pasu over time: 1937, 1966, 2007. Taking the rectified spatial information from all three images, the process of loss of land becomes evident. Source: overlay from *Figures 4-6 Kulturlandverluste in Pasu im zeitlichen Vergleich: 1937, 1966, 2007. In der Überlagerung der*

case of present-day Pasu: followers of the Pakistan People's Party) are still striving to assert their contrasting positions. The judgement of the opposition was that escape from the valley would basically broaden the opportunities and the income basis of all households. Pasu has been a case in point to support this thesis.

6. Out-Migration for Jobs and Education as a Strategy to Diversify the Income Structure of Mountain Households

It took until long after Pakistan's independence for the Wakhi of Pasu to participate in physical infrastructure. By 1964 the first jeep had reached Pasu. Although not directly connected to this event, at about the same time people from Pasu out-migrated to the south of Pakistan, to the port of Karachi. From the beginning this out-migration was a twofold affair. Early migrants were in search of wage labour in unskilled employment. While classical out-migration from the mountain regions of Pakistan was for seasonal employment in road construction, service industries and menial tasks – the major construction projects of Mangla (1967) and Tarbela dams (1975) offered jobs for many –, Pasu people left their village for permanent employment, not just seasonal work. And Karachi remained their prime destination. Seeking education was another new opportunity that snowballed. After the first escapee managed to study and get a technical degree he volunteered to support others and so on. To cut a long story short: The educational pioneers profited from the introduction of basic education provided by government schools and private institutions supported by the Aga Khan Education Service. Wakhi children participated from an early stage in male and female education. In addition they found a supportive environment in Karachi where Ismaili entrepreneurs, followers of the Aga Khan, offered scholarships, material support and jobs in their enterprises to young students from their denominational community. Pasu is one of the Karakoram villages with the highest record of qualified people today. Out of 872 inhabitants 361 are 'out of station', of whom 17 are in government service, 90 in private service, and 16 in business (data taken from the 2006 census by the Ismaili Council for Gulmit). The majority of persons outside the village receive different forms of education in the Northern Areas (nowadays Gilgit-Baltistan), and in Islamabad, Lahore, Peshawar and – still ranking first – Karachi. Within the span of two generations, education-based jobs have become the prime resource for employment in a village where 79 % of the male and 75 % of the female population are termed educated. The prime position of Pasu is highlighted when compared with the neighbouring village of Hussaini where significantly lower percentages of professionals are to be found. The same statement holds true for the rest of Hunza. In a survey conducted in 1990, in 70 Pasu households there were seven engineers, two medical doctors, two chartered accountants, five social scientists and thirty bachelor degree holders. In addition there were three male and four female teachers from the village (*Kreutzmann* 1996: 313). The preference of Pasu inhabitants for non-agrarian positions and professions has made it complicated to find sufficient personnel to work on the fields and to care for the animal herds in the summer pastures. While the latter is mainly under female control, additional non-local labour has been hired in recent years for sowing and harvesting as well as for other domestic tasks in the homesteads.

So far we have discussed only migration within Pakistan. It is important to note that in this remote

rektifizierten räumlichen Informationen wird der anhaltende Landvelust belegt. Quelle: Überlagerung der Informationen aus den Abbildungen 4-6

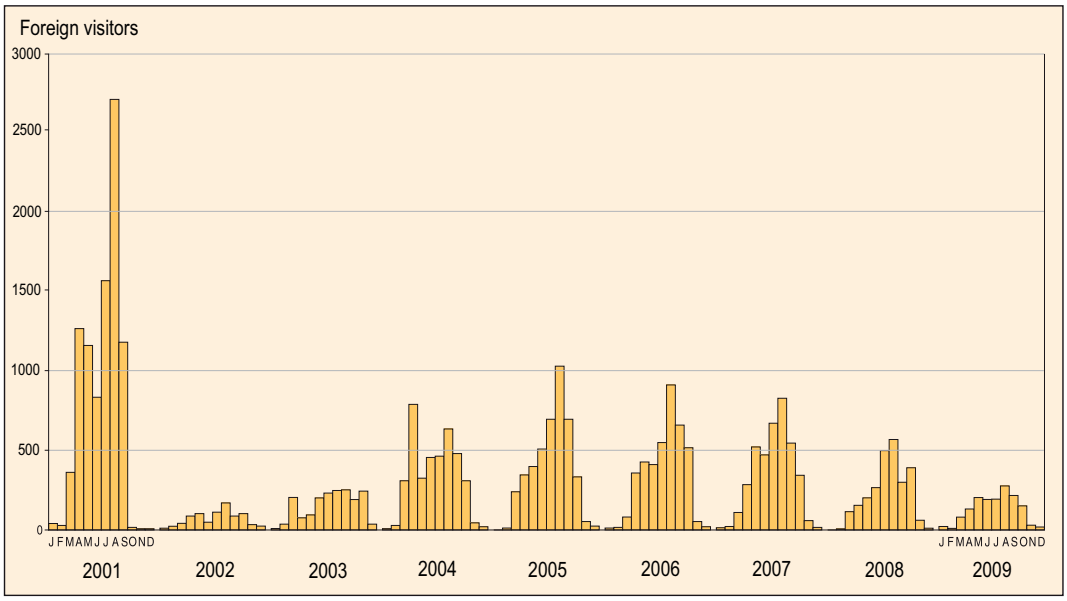

Fig. 8 Foreign visitors to Baltit Fort 2001-2009. The data on a monthly basis significantly show the seasonality of visitors' arrivals and how the events of 9/11 affected tourism in the Hunza valley. Since then tourism never recovered and failed to reach former levels. Source: Annual reports, Baltit Fort Office, Karimabad, Hunza / *Ausländische Besucher in Baltit Fort 2001-2009. Die Darstellung der Monatsdaten unterstreicht die Saisonalität des Fremdenverkehrs und den nachhaltigen Einbruch des Besucheraufkommens infolge der Ereignisse des 11. Septembers 2001. Seither hat sich der Fremdenverkehr nicht mehr erholt bzw. nicht mehr die früheren Besucherzahlen erreicht. Quelle: Jahresberichte des Baltit Fort Office, Karimabad, Hunza*

mountain village international migration is as common as in down-country Pakistan. During the late 1970s and early 1980s, when Pakistan derived a substantial share of foreign currency earnings through overseas Pakistanis in the Gulf States, five Pasuik were among those migrants who went to Saudi Arabia. In recent years their share has decreased. During our survey in 2003 four Pasuik were still working in Saudi Arabia, Kuwait and the United Arab Emirates. In addition three men managed to enter the United States of America, of whom two acquired legal residence status there, while one returned after five years to retire in Pasu. Three young men from Pasu spent educational stints in Canada, one migrated to the UK, one married a Japanese wife and one an Australian. Both couples have been active in tourism for the last decade. Thus, international migration is significant for one tenth of the households in Pasu. These migrants send substantial remittances to Pasu, a fact which is reflected in housing construction and other amenities.

7. Tourism Development as a Means of Re-Interpreting Local Resources

While all previously mentioned migration-related strategies for diversification of income resources have increased the exodus from Pasu village, there is one process that provides non-agrarian employment in the village. After the

opening of the Karakoram Highway for international travellers to Pasu in 1982, tourism activities were added to the income structure. For an assessment of the trading and tourism potential connected with the Karakoram Highway and its constraints cf. *Kreutzmann* (2009). Much earlier, porters and mountain guides from Pasu had been engaged to accompany mountaineering expeditions in Baltistan and to Nanga Parbat. Therefore the opening of the road meant that local expertise could be utilised locally. In the beginning three small guesthouses were established, which have meanwhile increased to eight. More importantly, the services of guides were offered for trekking and mountaineering tours in the Batura and Shimshal valleys. Before 9/11 a substantial income could be derived from tourism as some men found employment in travel agencies or founded their own travel businesses. Tourism being a difficult resource in politically unpredictable times, reliance on these undertakings has diminished in recent years (*Fig. 8*). Nevertheless, the skills revive as soon as new opportunities arise. A number of people have been engaged in assisting the Chinese engineers who started a project to widen the Karakoram Highway in 2008. Hotels have been transformed into rented-out accommodation, etc. Tourism completely collapsed in the aftermath of the events mentioned at the outset. Atabad Lake and the floods that damaged the Karakoram Highway as the major line of communication have terminated classical tourism for the time being. Nevertheless, tourism entrepreneurs provide local services to relief organisations and development projects.

8. Conclusions

Mobility as an adaptive strategy has played a major role in Pasu in helping the inhabitants to cope with the crises inflicted on them by environmental threats. During the 19th and early 20th century the securing of agricultural resources was of prime interest. Consequently, during this period out-migration aimed at establishing new settlements with a sound agricultural base and access to summer pastures. The settlements in the upper Hunza Valley and Chupursan are ample evidence of this strategy. The flood disasters of the early 1960s changed attitudes quite significantly. The severity of the losses and the concomitant opportunities provided by improved infrastructure and educational options motivated other strategies. Pasu developed into one of the 'model villages' of Hunza in terms of professional careers and female education (*Felmy* 2006). The investments in non-agrarian income opportunities were significant and greatly improved the well-being of its residents and their migrant relatives at other stations. In comparison with neighbouring villages of the same size and similar assets, Pasu has taken a leading role in diversifying its income structure and placing its people in a number of locations. Beyond the challenges posed by environmental threats, social cohesion within the Wakhi community of Pasu plays a major role in mutual support systems, in accepting female leadership and human capacity building. During the 19th century, Gojal was the grain chamber of Hunza and supplied the villages of Central Hunza with valuable resources. Nowadays Gojal is the brain chamber of Hunza with the highest number of professionals and highly educated people. Nevertheless, Pasu as a residential hub of the Pasuik remains in high esteem; migrants invest in new houses and improved facilities. The newly established filial settlement of Janabad functions as a land resource for further expansion of the settlement. Multi-locality and seasonal absence of household members is the price that has to be paid for a coping strategy based on the mobility of individual women and men. In times of severe political crisis the village itself is the last refuge for everybody to return to when enterprises in tourism or trade collapse, the KKH is blocked and communication is interrupted.

Despite numerous floods and high risk exposure that have regularly occurred in the course of cen-

turies, the people of Pasu have shown significant stamina and resilience to cope with substantial challenges. Their adaptation and experience could well be a major asset in coping with climate change challenges.

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Several persons supported the research in and on Pasu. First of all, my gratitude goes to my local supporter, consultant and friend for more than three decades, late *Ghulam-ud-din* to whom this paper is dedicated. *Sanjar Beg* in Janabad provided valuable evidence about the 1960s floods from his own experience. I am indebted to *Ahmed Jami Sakhi* and *Ali Qurban* in Gilgit for compiling valuable information about the oral traditions concerning Pasu memory and history. Office-bearers from the Ismaili Council for Lower Gojal in Gulmit took an interest in recording the employment and migration histories of Pasuik. I am especially indebted to *Sharif Uddin* and *Sherullah* as well as to *Fazal Amin Beg*. Technical support in rectifying multi-temporal aerial photographs and satellite images was kindly extended by *Marcus Nüsser* in Heidelberg.

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Summary: After the Flood. Mobility as an Adaptation Strategy in High Mountain Oases. The Case of Pasu in Gojal, Hunza Valley, Karakoram

The high mountain environment of the Hunza Valley in the Karakoram is characterised by significant potential energy, extended glaciation and related events that tend to threaten habitations and settlements. The village oasis of Pasu is taken as a case in point to highlight adaptation and coping strategies over a longer period of time. The village lands of Pasu have been shrinking over time due to glacier outburst floods in the upper valleys. The memory of these devastating events that have threatened the resource base for agricultural undertakings again and again is omnipresent, part of the oral traditions and local historiography. Evidence of disaster events and local responses is provided from diverse sources. The inhabitants of Pasu have developed a set of coping strategies and flexible responses that are mainly linked to mobility. Among these are the shifting of population to newly established irrigated oases on previously barren lands and out-migration to various destinations for employment and education. Nowadays we find Wakhi from Pasu in urban areas in the Karakoram and in metropolises in down-country Pakistan. Remittances from international migration to overseas destinations had a significant impact on broadening income-generation by reducing the importance of agriculture in favour of services and tourism. All strategies are measures of adaptation that are embedded into the socio-political and economic frame conditions. The shrinking village lands of Pasu have posed tremendous challenges to the mountain farmers who developed their own responses without abandoning their inherited settlement.

Zusammenfassung: Nach der Flut. Mobilität als Anpassungsstrategie in Hochgebirgsoasen. Die Fallstudie Pasu in Gojal, Hunza-Tal, Karakorum

Die Hochgebirgsumwelt des Hunza-Tales im Karakorum ist durch hohe Reliefenergie, ausgedehnte Vergletscherung und Schadensereignisse charakterisiert, die Wohngebäude und Siedlungen gefährden. Die Bewässerungsoase von Pasu hat über längere Zeiträume einen bedeutenden Anteil der Flur als Folge von Gletscherseeausbrüchen in höher gelegenen Talabschnitten verloren. Die Erinnerungen an die zerstörerischen Umweltereignisse sind allgegenwärtig, Teil der oralen Tradition und lokalen Geschichtsschreibung. Belege für derartige Ereignisse und lokale Reaktionen darauf werden aus verschiedenen Quellen herangezogen. Die Einwohner von Pasu haben auf diese Ereignisse mit einer Vielzahl von Anpassungsstrategien reagiert, die in vielfältiger Weise mit Mobilität verknüpft sind. Bevölkerungsgruppen siedelten sich in neu angelegten Bewässerungsoasen an; Abwanderung erfolgte zur Beschäftigungssuche und Ausbildung in urbane Marktzentren des Karakorum, aber auch in die pulsierenden Metropolen des Tieflandes. Remissen aus internationaler Migration nach Übersee hatten großen Einfluss auf die Erweiterung der Einkommensquellen wie auch die Verminderung des landwirtschaftlichen Beitrags zugunsten einer höheren Wertschöpfung aus Dienstleistungen und Fremdenverkehr. Die vorgestellten Maßnahmen belegen das hohe Maß der Anpassung und des Umgangs mit einschneidenden Ereignissen im Rahmen der gegebenen sozio-politischen und wirtschaftlichen Möglichkeiten. Die schrumpfende Flur von Pasu hat die Gebirgsbauern vor gewaltige Herausforderungen gestellt, denen sie eigene Kompensationsstrategien ohne Aufgabe des ererbten Siedlungsplatzes entgegengesetzt haben.

Résumé: Après la marée: Mobilité comme stratégie d'adaptation aux oases de haute montagne. Étude modèle de Pasu en Gojal, Vallée de Hunza, Karakoram

L'environnement de haute montagne de la Vallée de Hunza en Karakoram est caractérisé par un relief marquant, une vaste glaciation et des dégâts possibles qui s'ensuivent et mettent en danger les bâtiments d'habitation et les villages. L'oasis de Pasu est à juste titre un exemple pour mettre en relief les stratégies d'adaptation et pour faire face aux événements à long terme. Au cours du temps, les territoires du village de Pasu ont reculé à cause des inondations par les glaciers dans les vallées supérieures. Le souvenir de ces événements dévastateurs qui ont menacé la base de ressources pour les activités agricole est omniprésent et fait partie de la tradition orale et de l'historiographie locale. Preuves de l'occurrence de ces désastres et des réactions locales sont fournies par une variété de sources. Les habitants de Pasu ont développé une multitude de stratégies pour faire face aux événements et des réactions d'adaptation qui sont associées surtout à la mobilité. Entre autres on compte le déplacement de la population aux nouvelles oases irriguées qui se trouvent sur des territoires qui antérieurement ont été arides et la migration en quête d'emploi et éducation vers les centres urbains de Karakoram et aussi vers les autres métropoles animées du pays. Les versements de la migration internationale vers des destinations transatlantiques ont eu une conséquence significative pour l'augmentation des sources de revenue par la diminution de l'importance de l'agriculture en faveur de la prestation de services et du tourisme. Les mesures mentionnées prouvent un haut degré d'adaptation et la manière de traiter les événements décisifs en contexte de l'ensemble des conditions sociopolitiques et économiques. Le territoire en diminution des villages de Pasu a représenté une épreuve immense pour les paysans montagnards, à laquelle ils ont répondu avec leurs propres stratégies de compensation sans quitter leur habitat hérité.

Prof. Dr. Hermann Kreutzmann, Institut für Geographische Wissenschaften, Freie Universität Berlin, Malteserstr. 74-100, 12249 Berlin, Germany, h.kreutzmann@fu-berlin.de

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