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Constructing Roads—Constructing Risks? Settlement Decisions in View of Landslide Risk and Economic Opportunities in Western Nepal

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Government authorities and development agencies use road construction as a tool to support socioeconomic development in remote areas worldwide. In mountain regions, roads are closely connected with landslide risk. They destabilize slopes and often lead to the expansion of settlements into hazard zones. Weighing increased landslide risk against economic opportunities, inhabitants of adjacent areas acquire land along road corridors and build shops and houses. This article presents a case study from western Nepal, where an internationally supported road construction project triggered the establishment of a new bazaar in a landslide-prone area. Based on data gathered from qualitative interviews and a quantitative household survey, it discusses people's rationales for moving to the hazard zone, placing special emphasis on risk perception and economic reasoning from a livelihood perspective. The article also considers the extent to which the approach to rural road construction presently used in Nepal influences such developments. The study provides insights into the links between risk perceptions, livelihood strategies, and road-related development interventions and provides suggestions for a risk-sensitive adaptation of current approaches.

Keywords: *Landslide risk; risk perception; road construction; decision-making; Nepal.*

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Introduction

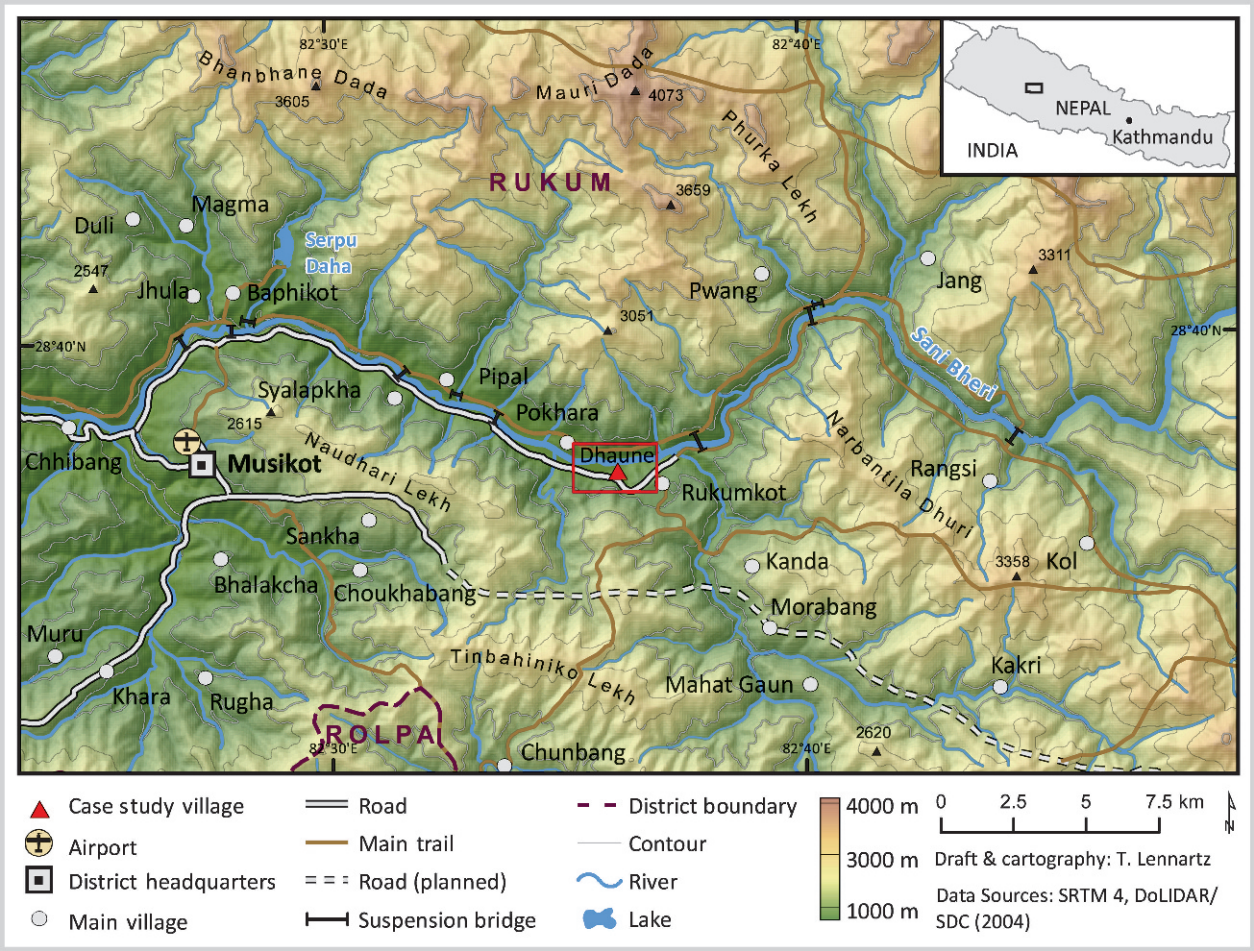
The influence of road access on mountain development has been intensely discussed for several decades (Allan 1986; Uhlig and Kreutzmann 1995). Some authors caution against overemphasizing the development impact of roads and point out that development can occur whether or not roads are built (eg Kreutzmann 2000). However, donors like the World Bank see transportation as "a crucial driver of development, bringing socioeconomic opportunities within the reach of the poor and enabling economies to be competitive and thrive in a globalized world" (World Bank 2013: n.p.).

At the beginning of international development cooperation with Nepal in the 1950s, a lack of transport facilities was identified as "the bottleneck of any progress" (Hagen 1959: 73). Although a review of the economic effects of mountain roads in Nepal showed rather meager results (Blaikie et al 1977), over the past decades the Government of Nepal has devoted on average 15% of capital expenditure to the transportation sector (CBS 2009). It has also emphasized the importance of road access for rural communities in recent development plans (NPC 2007, 2010). However, by 2007 more than 18.6 million people (about 70% of the total population) still had no access to rural transport (World Bank 2007: n.p.). Hence, Nepal is considered one of the least accessible countries worldwide.

Since the end of the civil war in 2006, road-building activities in the hill districts have increased significantly. Due to a range of environmental factors, this region is highly susceptible to landslides, which are causing increasing numbers of fatalities (Petley et al 2007). Roads influence landslide risk in 2 ways. First, construction has destabilizing effects. It undercuts slopes, while inadequate spoil disposal increases weight and alters the natural drainage system (Sidle et al 2006). This impact on the hazard component of landslide risk is described in a great number of studies (eg Hearn 2002; Nüsser et al 2010). Second, they affect settlement patterns, which usually change after a valley is connected to the regional transportation network (Sarkar 2010). Studies have shown that the main explanation for the increase in landslide fatalities is population growth connected with the establishment of new settlements, or the expansion of existing settlements, on sites that are susceptible to slope failure (Petley 2010). Despite the evidence, the link between road construction, livelihood-related settlement decisions, and landslide risk has received little attention.

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FIGURE 1 Location of the study area and the case study village of Dhaune. (Map by T. Lennartz)



This article presents a case study from western Nepal, where an internationally supported road construction project led to the establishment of a new bazaar in a landslide hazard zone. After a short description of the geographical setting and the methods and data used, it briefly outlines the road construction project, the development of the settlement, and its hazard profile. Then it discusses people's rationales for moving to locations near the road and considers the extent to which the project approach provided additional incentives for settling in the landslide zone. The article concludes with some suggestions for more risk-sensitive rural road construction.

Geographical setting, methods, and data

The case study village of Dhaune Bazaar, is located in the valley of the Sani Bheri River (Figure 1). It lies in Rukum District, about 350 km northwest of Kathmandu (28°27′30″N, 82°36′05″E). The first road to Rukum was completed in 2003, and Rukum is still one of the least accessible midland districts (Gersony 2003). The area comprises rather modest elevations (750–4000 m). It is mainly underlain by meta-sedimentary rocks like slates, shales, and phyllites (Fuchs and Frank 1970), which are considered highly susceptible to landslides (Petley et al 2005). The area has a subtropical to temperate climate with usually frost-free winters (Sharma and Joshi 2008). It receives an average annual rainfall of 2131 mm. More than 80% of the total annual precipitation falls between June and September (DHM 2008). This concentration of rainfall makes the monsoon season the period of highest landslide hazard. During the monsoon of 2011 alone, landslides caused at least 25 fatalities and displaced more than 200 families in Rukum (UN RHCO Nepal 2011). Many of the district's 210,878 inhabitants live in scattered settlements within the Sani Bheri Valley, where population density is about 106 people per km^2 (CBS 2012). High-caste hill Hindu groups (*parbatiyas*) like Chhetris (58.2%), Brahmans (3.4%), and Thakuris (5.1%) form the majority of the population. Magars (23.2%) are the largest indigenous hill group (*janajati*). The percentage

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of people belonging to occupational castes (*dalits*) is approximately 6.7% (Sharma and Joshi 2008). The remaining 3.4% of the population belong to several smaller indigenous groups.

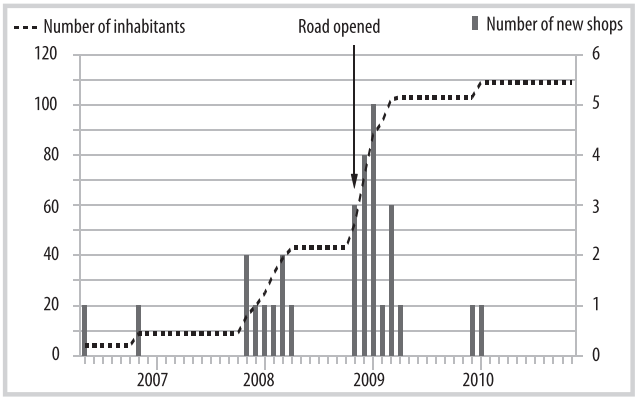
Local livelihoods are mainly based on subsistence farming. The valley bottom and lower slope sections are intensively cultivated. Paddy rice, wheat, and maize are grown on irrigated (*khet*) and dry terraces (*bari*). Small fruit plantations and house gardens complement these staple crops. A mixture of grasslands, used for grazing livestock, and forest patches composed of chir pines (*Pinus roxburghii*) and oaks (*Quercus* spp) cover the ridge tops. Marketing options for agricultural surplus produce, if there is any, are rather limited. In recent history, the armed conflict between Maoist insurgents and royal security forces (1996–2006) severely affected the local people and their livelihoods (cf Ogura 2007; Thapa 2012). Being part of the "Maoist heartland," Rukum was hard fought over. The district accounted for more than 900 fatalities (INSEC n.d.)—more than any other district in Nepal.

Research in Dhaune was carried out in 2009 and 2010 and comprised qualitative interviews, a quantitative household survey, and field mapping. In 2009 interviews were carried out with shopkeepers, district authorities, and project staff of an international development agency involved in road construction. The interviews covered core topics including the impact of road construction on settlement patterns, livelihood strategies, and the perception of landslide risk. Based on these qualitative data, a household questionnaire survey was conducted in late 2010. In Dhaune, 29 out of 32 shopkeepers were surveyed. In addition, the settlement was mapped in the field and on the basis of high-resolution satellite imagery (GeoEye®, 17 November 2008 and 23 February 2012). Complementary information on road construction policies was drawn from legal documents, published construction guidelines, and unpublished project strategies.

Emergence of a new marketplace in a landslide zone

The armed conflict between the Maoists and the national security forces severely hampered livelihood activities in Rukum for several years. Therefore, the district became the focus of several internationally supported development interventions. In order to assist rural households during the conflict and support their rehabilitation after the war, the German development agency (Deutsche Gesellschaft für Technische Zusammenarbeit or GTZ, since 2011 part of a new agency called Deutsche Gesellschaft für Internationale Zusammenarbeit or GIZ) and its Nepali counterparts jointly implemented 2 successive projects. A central component of these projects was the construction of a 34-km-long road along Sani Bheri River (Figure 1)

FIGURE 2 Population growth and increase in number of shops. (Source: Author's survey)



according to the principles of the so-called Green Road Approach, which aims at constructing low-cost but technically appropriate rural roads, using participatory, labor-intensive methods. This approach has been developed in Nepal by Swiss and German development agencies since the 1970s (cf Schaffner 1987; Acharya et al 1999; GTZ 2008a, 2008b), and served as a blueprint for the official construction policy for rural roads in Nepal (DoLIDAR 1999). Integrated into food/cash-for-work schemes, road construction provided short-term employment opportunities. In the long run, the road is expected to facilitate the exploitation of agricultural opportunities, reduce the duration of food shortages, and accelerate the expansion of social and health services.

The new road influenced settlement development throughout the valley. Particularly interesting is the case of Dhaune, a completely new roadside settlement. Before the road was constructed, the bazaar did not exist at all. The outer margins of the area were used for paddy cultivation on *khet* fields, and only a handful of houses had been constructed between the fields. These were only temporarily inhabited in times of high agricultural workload by peasants from the neighboring village of Rukumkot, located a 20-minute walk uphill. Within 3 years, the formerly unsettled land was converted into a new bazaar. The first shop opened in May 2006, when the road was still under construction. Migration to Dhaune increased substantially after the official inauguration of the road in November 2008 (Figure 2). Thereafter, building materials could easily be transported along the valley, which allowed quick construction of additional huts. Consequently, the number of shops and people more than doubled within the following year. The shopkeepers are usually accompanied by 2 to 3 household members and stay in the shops overnight to watch over their belongings. In December 2010, 109 permanent settlers lived in Dhaune, working and living in 32 small tea and food stalls, hotels, and shops that sell clothes, household goods, and food (Figure 3).

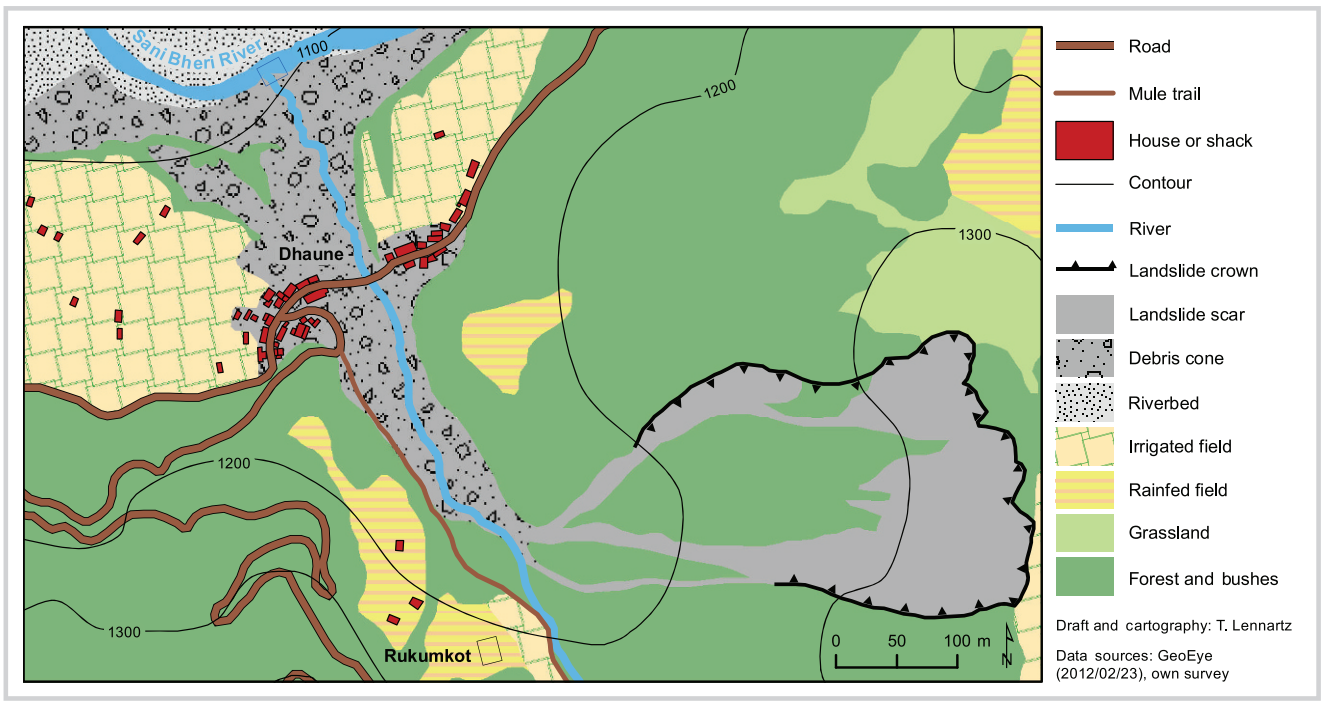
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FIGURE 3 Dhaune has turned into a trading post of regional importance. (Photo by T. Lennartz, April 2010)



From a natural hazard point of view, the location of the bazaar is very problematic (Figures 4 and 5). It is situated on a fan-shaped area that consists of both alluvial sediments and debris. The alluvial material was deposited by a small creek whose discharge increases significantly during the monsoon. The debris stems from a more than 200-m-wide active landslide zone only 100 m away from the first shacks. The slope failure has been active for decades, beginning long before the road was constructed. The lower parts of the debris cone and the landslide scar are partially vegetated, indicating that the last big landslide took place several years ago. However, the slope

FIGURE 4 Map of the settlement and the adjacent landslide area. (Map by T. Lennartz)



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FIGURE 5 View of the landslide scar and the bazaar from the opposite slope. (Photo by T. Lennartz, October 2012)



failure is far from inactive. Residents confirmed that every monsoon season parts of the landslide scar are reactivated, which causes great concern among the settlers. For the time being, the run-out zone of these events is too short to reach Dhaune, and the shops have not been damaged. However, there remains a permanent risk of larger rock falls and debris flows, which might damage at least those shops that are located next to the center of the fan. Even in the absence of concrete damage or casualties, the risk situation in Dhaune has reached the attention of the national media (Anonymous 2012).

Rationales and incentives for settling in a hazard zone

In view of the hazard potential, the question arises why people settle in such a hazard-prone area. What were the motivations to move to the landslide zone? To what extent were these settlement decisions influenced by the specific approach of the development project?

Lack of hazard awareness

One reason for settling in hazard-prone areas that is often mentioned is a lack of awareness and hazard-related knowledge among immigrants. For instance, Oven (2009) reports that some migrant households in Larcha, central Nepal, were surprised by a debris flow in 1996 (cf Adhikari and Koshimizu 2005). This type of hazard was hardly known in their place of origin, so they lacked specific knowledge on warning signs and possible run-out zones. However, in Dhaune, this explanation does not hold true. All but 2 settlers come from surrounding villages. Two thirds of the interviewees reported having visited the area at least once a month before they moved there. Therefore, a high degree of familiarity with the area and the local hazard can be assumed. Interviewees also mentioned a number of warning signs that immediately precede landslide events (such as a specific noise and changing color of the stream). Hence, they do possess local knowledge of landslides; comparable knowledge was also verified by studies in other Himalayan regions (eg Johnson et al 1982; Hewitt 2010).

External constraints

Other authors associate the expansion of settlements into hazard zones with social constraints. It has repeatedly been pointed out that marginalization and discrimination based on caste or ethnicity push certain sections of the population to occupy hazardous areas (Wisner et al 2004; Bolin 2006). In case of a disaster, this often leads to disproportionally high losses among socially marginalized sections of society, which Hewitt (2013) calls “discriminatory losses.” Discrimination based on caste and ethnicity plays an important role in Nepal (cf UNDP 2009). However, this case study found no indication that marginalized people like low-caste Hindus or ethnic minorities are forced to live in this hazard-prone location. These groups do not form the majority of the inhabitants. Instead, the social composition is comparable to other settlements in central Rukum. About three quarters of the shopkeepers belong to high-caste Hindu groups (2 Thakuris, 19 Chhetris). There are only 3 *dalit* families and 5 households belonging to ethnic minorities (4 Magars, 1 Gurung).

Settlement decisions are also influenced by economic constraints (cf Santi et al 2011). Because hazard zones have a relatively low value and can be acquired or rented more easily, they are often taken as settlement opportunities by the poor. In Dhaune, many of the new businesses are indeed run by poor families. This is demonstrated by survey data on landownership. In view of the significance of agricultural livelihood activities in the region, this is an appropriate indicator for measuring the relative wealth of a household. Half of the households in Dhaune own less than 0.04 ha of agricultural land per capita. In light of the district’s average of 0.13 ha of agricultural land per capita (CBS 2009), these people are poor even by Rukum standards. However, there are also households that possess comparatively large landholdings.

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At least every fourth family owns plots that are 2 to 6 times larger than the district's average. This indicates that it is not only the poorest households who occupy the hazard zone.

In summary, data from Dhaune show that simple taxonomies or checklists of vulnerable groups based on caste, ethnicity, or poverty level do not necessarily explain complex realities on the ground. It rather supports findings from other areas in Nepal that suggest that it would be misleading to perceive roadside settlements merely as "high-risk areas filled with marginalized poor people living on the brink of disaster" (Oven 2009: 154). Instead, many people moved to the new bazaar location because they actively seek to seize economic opportunities and diversify their livelihoods.

Economic opportunities and livelihood diversification

The increasing need for a cash income contributes to the attractiveness of roadside settlements. Nowadays, people in rural Nepal increasingly need cash to pay for education, health services, supplementary food items, and farm inputs. In general, the opportunities for generating cash income in the region are rare. Very few families are able to produce an agricultural surplus for sale, wage labor opportunities are limited, and the only regular cash income comes from remittances. In contrast to other villages in the valley, the proportion of households in Dhaune that receive remittances is very low. Only 3 shopkeepers reported benefiting from this source of income. Opening a shop is thus an alternative for households that cannot rely on money transfers from abroad.

Survey data show that running a business in the bazaar is indeed a promising alternative. In 2010 the average business yielded an annual profit of about 130,000 Nepalese rupees (NPR; in 2010, NPR 100 ≈ US$ 1.35). Depending on the type of business, the ability to invest, and the personal skills of the entrepreneur, profits varied from a modest NPR 10,000 to a staggering NPR 700,000. Hence, many shopkeepers do earn a significant amount of cash compared to the mean household income of approximately NPR 120,000 typically found in rural areas of the midlands of far- and midwestern Nepal (CBS 2011).

Livelihood diversification in order to spread risk and improve one's standard of living is common to those living in rural areas of developing countries (Rigg 2006). In Dhaune, only 3 shopkeepers reported that the bazaar business was their only source of income. Households usually combine up to 5 different income sources; many of them engage in agriculture and livestock rearing. Few families receive additional income through government employment or remittances. The business takes a central position within the livelihood portfolio of most households: 23 interviewees ranked their shop or hotel as the most important activity.

Two different types of diversification strategies can be identified. The wealthier households diversify their livelihoods to pursue a "consolidation strategy" (De Haan and Zoomers 2005). Within this strategy, starting a business is an investment to stabilize the well-being of the household. The majority of the poorer households apply "security strategies" (ibid): households diversify their livelihoods by exploring nonagricultural income opportunities in order to reduce the risk of a total collapse of a household's livelihood. Additional income enables households to cope better with adverse events such as crop failure or the loss of a breadwinner. Hence, people place the landslide hazard in the context of wider socioeconomic concerns and take a broader perspective on risk. From this point of view, opening a shop in a landslide zone actually constitutes a risk reduction strategy. The settlement is thus the result of a trade-off between increased landslide risk and the reduction of other everyday risks (cf Nathan 2008; Oven 2009).

Incentives provided by the Green Road Approach

As was shown in the previous section, the establishment of a new bazaar in a landslide-prone area is closely linked to livelihood decisions taken by households. People moved to locations near the road to seek economic opportunities. But why did they settle in this specific location? What made land encroachment more attractive in this area than at other sites along the road corridor? Answering these questions requires a closer look at the specific project approach.

Green Road Approach guidelines provide a detailed description of measures to reduce the destabilizing effects of roads (eg mass balancing, controlled tipping of excess material, and bioengineering). However, they do not include any recommendations on the recognition and prevention of unwanted road-related settlement development. On the contrary, new shops and houses along the road are seen as a proof of the positive economic impact of the road, and the approach itself provides incentives for this. To limit construction costs, the Green Road Approach anticipates that land needed for road construction will not be acquired with project funds. Landowners along the road are expected to contribute land voluntarily, without receiving any direct compensation. In cases where hesitating landowners oppose the road project, the guidelines suggest to persuade them by alluding to the increasing value of their remaining plots along the road (GTZ 2008a, 2008b). The approach encourages landowners to sell or rent out a plot adjacent to the road. This actually conflicts with existing, but rarely enforced, legislation on road construction in Nepal, which prohibits construction along road corridors (eg DoLIDAR 1999; GoN 1974). Only 3 families from the neighboring village of Rukumkot own all plots in Dhaune. These owners lease the land to the shopkeepers, who pay monthly rents of NPR 200–3,500. While compensation for the loss of land might have been the first motivation for renting out plots, it has become a good business in its own right. Every year, the landowners together earn about NRP 300,000, which certainly makes them the major beneficiaries of the new marketplace.

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In addition to this general problem related to the construction approach, specific decisions taken during project implementation encouraged settlement development in the hazard zone. The road follows the alignment of a major mule trail, which traditionally provided the most important means of transportation in the valley. At the location of the new bazaar, this trail bifurcates. One of the branches climbs up the side valley and passes through the neighboring village of Rukumkot. Junctions exert a strong pull on settlers who want to engage in trading. The attraction was further strengthened by the fact that road construction was stopped shortly behind Dhaune. The site became the end point and transfer station for all road transportation. Every vehicle had to stop there so that goods could be repacked for further transportation by mule. This made it an especially profitable place for trading and consequently attracted more and more people. This situation lasted for about a year; by the end of 2009, the district authorities built a feeder road, which now connects the valley road to Rukumkot (see Figure 4). Nowadays, small motor vehicles are able to reach the larger village directly, without having to stop in Dhaune. This has slowed down the expansion of the settlement. The decision to have the road end right after a juncture of traditional mule trails had an important impact on where the establishment of a new settlement would appear particularly attractive.

Conclusions: toward risk-sensitive road construction

The case study has shown that a combination of economic considerations, local livelihood strategies, and the specific implementation approach of a development project led to the establishment of a settlement in a landslide-prone area. The findings support Cannon's statement that "there is evidence of a significant degree of choice involved in living in dangerous places" (2008: 351). This is true not only in the case of Nepal. Economic incentives and better livelihood opportunities induce people to settle in hazardous areas in mountain regions worldwide. Examples can be found from Switzerland, where tourism resorts are constructed on old debris-flow deposits (Zimmermann 2004), to the upper Indus Valley in Pakistan, where scarce arable land is mostly restricted to debris fans and landslide deposits (Santi et al 2011; Hewitt 2010). Nonetheless, the impact of road construction projects on the expansion of settlements into hazard zones is presently especially high in the Himalayan region (Sarkar 2010). The case study findings suggest a risk-sensitive revision of the Green Road Approach and comparable approaches in other countries.

A first step in order to prevent the development of unwanted settlements would be to sensitize project staff and participants in future projects to the impact that roads have on settlement development and landslide risk. Second, project guidelines should be complemented with tools and recommendations that help to anticipate adverse developments and support proactive settlement development. For the latter, it is crucial to integrate road construction projects into existing regional planning processes and support a systematic planning approach. During the planning process, it is essential to identify hazardous but economically attractive areas along favored road corridors by means of hazard and risk mapping. Local people should be invited to participate in these activities and to contribute valuable local knowledge and context-specific information.

In view of the pressing needs to diversify livelihood strategies and to generate monetary income, opening a roadside shop in a hazard zone might actually be a reasonable decision. Therefore, it is questionable whether stronger enforcement of existing laws could prevent roadside developments. Instead, one should consider measures to indirectly prevent land acquisition and settlement development in hazardous locations. For instance, the provision of cheap land, clean drinking water, and sanitary facilities could provide incentives for settling in safer areas along the road.

The case study findings generally support the position of the World Bank that roads bring "socio-economic opportunities within the reach of the poor" (World Bank 2013: n.p.). However, in order to achieve sustainable mountain development, it is imperative that future projects be implemented in a risk-sensitive manner. Only then is it possible to take advantage of the development benefits provided by transportation infrastructure without further increasing landslide risk.

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