Ganga Ram Regmi
Falk Huettmann *Editors*

Hindu Kush-Himalaya Watersheds Downhill: Landscape Ecology and Conservation Perspectives

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Foreword by the Editors

Writing a book on the Hindu Kush Himalaya (HKH) region remains a global task. It means so many things to so many people. For me, FH, the HKH regions comes loaded with exotic concepts; it's a vast and deep landscape of global relevance reaching far beyond 'just' Asia. It features over two billion people, and already the spiritual aspects are too vast to catch and to understand for us westerners. As a child, I heard about this region and subsequently read about it, but details remained 'foggy' to me, and neither our education system would virtually present it to us nor our media! We got left in the dark. Turning later into a professional landscape ecologist, I was intrigued for years by this landscape, its mountains and people, and finally – but way too late one may submit – I was able to learn more through its wildlife and biodiversity about this region, its mountains, its water systems and the world and the universe we live in!

But the HKH region is more than just that. For GR, it's home, where he lived and grew up and makes a living. HKH is not 'a museum for western people'; instead, it's part of the real life and reflects all global processes. As a Nepali scholar gone abroad, GR can present on such experiences first hand.

Considering the Anthropocene of seven billion people and with many more to come soon, one simply cannot express all aspects of HKH well. HKH means many things to many people. Books – or science – are not good platforms to present that, and so we still can only start to grasp the complexities and to remain in awe. Instead of the western world describing such a vast reality in its narrow and limited, experiment-driven mind, we find the HKH region can instead inform, and improve, aspects how the world overall acts and describes things. The HKH region has much to offer on those grounds still, but many of its pristine and diverse elements are put in decay by ruthless global trends and efforts!

Here, we tried to start this process of deep appreciation, and – while incomplete – we express and document what we know and saw, thus far, in the HKH region. This book is for people who move and who look beyond the horizon at the mountain peaks and in the remote valleys to capture what Mother Earth – our

universe – really is about! We kindly invite the reader to engage into our chapters and in a good debate to forward the subject of sustainability and for all what the HKH region has to offer, which will easily reach beyond a lifetime and have global repercussions!

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1 July 2019

Preface: The Third Pole – Lessons for 'Barbarians' Everywhere?

I try to live a low-carbon life. I travel little, bike much. I invest in photovoltaic and wind power. I use a plug-in electric hybrid automobile. To some extent, I attempt to compensate for a long career of mandated and invited air travel, although my partner can confirm that we lived nearly 10 years in the UK and Switzerland without a car. Co-workers will attest to my persistent (often inconvenient) preference, as resident of Europe, for train travel. The appellation "armchair traveller" suits me. I welcome opportunities to read books about distant regions.

During the International Polar Year 2007–2008, we gave lip service to the ice and snow region addressed in this book – the Hindu Kush-Himalaya (HKH) – while research and media attention focused instead on the Arctic and on Antarctica. I traveled to "gateway" cities both north and south, often to events organized by local promoters hoping to enhance commercial success of their particular access services. I traveled to central India and south-central China but never close to this HKH region. I unknowingly joined downstream users of HKH-derived water. Now, Drs. Ganga Regmi and Falk Huettmann and colleagues have compiled an interesting guide to this "third pole" location.

I start this exploration with curiosity and caution – curiosity about mountain regions, particularly about difficult, challenging, remote mountain regions. I resonate with James Scott's depiction, in his recent book *Against the Grain*, of "barbarians." Although defamed by central authorities (who, not incidentally, also introduced the earliest written histories), Scott's barbarians lived outside of tax and legal systems. Those barbarians sustained diverse food sources and habits; stimulated exchanges of material, ideas, and genes; and very likely recognized the need for constant innovation. Scott argues that, for much of its early development, civilization depended as much or more on barbarians than on cities. Excluded by force or choice from deltaic wetland grain-producing regions, those so-called 'barbarians' often occupied remote mountainous regions. My curiosity follows that spirit: challenging the status quo, looking for innovation, finding solace and inspiration in high mountains, and preserving the wild against the commercial demands of civilization. What might I discover about modern mountain barbarians in this book focused on the HKH?

My caution arises because I suspect (phrases like "serious problems" and "business as usual" in the book's section headings tend to heighten suspicion) that – expecting Shangri-La – I might instead confront exploitation, commercial excess, and, as a consequence of the very remoteness I admire, grotesque carbon footprints. When, as director of the World Climate Research Programme, I suggested that we consider carbon expenditures in planning administrative and advisory meetings, participants – confident of global importance of their activities – would not hear such caution. If we fail to set good examples in prominent endeavors, what might we discover in out-of-the-way locations?

The book offers geophysical and ecological landscape descriptions to get us oriented (strange word "oriented" in this context). It introduces us to cultures, languages, and religions because those have played and continue to play surprisingly strong – often but not exclusively positive – roles in environmental protection and conservation. The book devotes the majority of its chapters, text, and figures to biodiversity and conservation ecology – the essential inseparable essence of the HKH region from local as well as global perspective. A theme of water, from high-altitude snow and ice to literally millions of downstream users, pervades the text. Two final sections, one focused on challenges and problems followed by a second describing current good examples and practices, tend to leave the reader in a cautious and concerned mode.

The book assembles contributions from ten countries, with more than 50% of chapter authors from Nepal; more than 30% from the USA; a few each from China, Pakistan, and the UK; and one each from Australia, Germany, Norway, and Switzerland. Readers will encounter influence of Drs. Regmi and Huettmann in many of these chapters: Falk wrote 15 of 45 chapters himself, and he and Ganga serve as coauthor on many others. But why not? Their work and the book itself promote Nepalese authors and research. I, for one, always enjoy reading their activities, ideas, and viewpoints. Falk and I share a very strong commitment to full open access of all information and tools, a persistent theme in this book with many good examples.

I recommend the book to conservation ecologists, water managers, and curious armchair tourists. Yes, it conveys primarily a Nepalese viewpoint, but those Nepalese researchers know their region and its issues. Their curiosity and energy stimulate our own. They also address larger issues with undoubted global impact. As the reader explores these narratives, I call her or his attention to three issues.

The HKH region has sustained and continues to sustain *remarkable biodiversity*. Nepal alone has warm wet lowlands, moist (often forested) midlands, and cold dry highlands home to everything from elephants to snow leopards. Large migration pathways and flyways cross the region. The book often describes flora and fauna reflecting Palearctic (northern) or oriental (southern) regimes. Readers will join me in recognizing that the intersection of those source influences combined with awesome elevation ranges and historically limited access has stimulated and supported

remarkable biodiversity. Here, one will discover (for themselves, no disclosures from me) the gharial, the langur, the Pallas cat, and the Sarus crane. In cases itemized here, natural area reserves associated with religious compounds and cultural/religious veneration of specific animals often play a positive role in conservation. HKH biodiversity faces extreme threats, with many facets of those threats itemized here in chapter after chapter. But, without question, one started with, and many of these authors work to preserve, a valuable globally distinct ecological resource.

The HKH region undergoes severe disruptive destructive change. It appears that we subject this remarkable region to even more remarkable exploitation. One senses a "Wild West" mentality? Mining, "rampant" dams, commercial forestry and agriculture, heavy-handed tourism – one detects the worst of humanity's excessive consumption and construction habits rapidly at work here. Without diminishing the collective negative impact of all these forces, *climate change*, particularly through its very disruptive impact on water in the form of snow and ice, already disrupts even the disruptions? Readers will confirm that most of these 45 chapters call out climate change as the largest, often most difficult to quantify, forcing function for the present and future. Even admitting known global-scale climate impacts on sea level, storm tracks (including monsoons), diseases, etc., one gets a clear sense of a seriously negative climate future for a region already facing its own peculiar challenges.

In one of Falk's personal chapters, he raises this interesting question: Do the mountainous regions of HKH represent a *source* of remarkable animals *or* a *refuge* to which animals from a wider region have now retreated? This question echoes my thoughts above, stimulated by James Scott, of mountains as homes but also refuges for barbarians – refuges, in other words, for diversity, innovation, fresh ideas, and new approaches. I do not anticipate an "either/or" answer to the source versus refuge question. One can find, especially in this book, examples of both. In some ways, however, a mixed answer, part source part refuge, implies even greater impact and importance of such regions. In native prairies (where we can find them) and in tropical rainforests, we find (and hopefully preserve) a wealth of biodiversity, stimulated and supported in those cases by relatively constant environmental conditions. In contrast, perhaps uniquely in HKH, an authentically cold snow and ice environment far from the geographic polar regions, we find a biodiversity hot spot stimulated not by constancy but by interfaces and gradients. Does HKH represent a highly stressed but perhaps hopeful example for conservationists? Can modern barbarians find cause for optimism?

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International Programme Office;
Chief Editor (nearly retired), *Earth System Science Data* ESSD open data journal

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About the Editors

Ganga Ram Regmi Ganga has 15 years' experiences in wildlife survey, monitoring and conservation in one of the most difficult terrains of the world, the Hindu Kush-Himalaya region. He is the founder and long-term director of 'Global Primate Network' (now 'Third Pole Conservancy'), a small NGO actively engaged in wildlife research and conservation activities in Nepal. He graduated in Zoology and Primate Conservation from Nepal and Oxford Brookes University, UK. He is also a manager for the Nepal Snow Leopard Project funded by the Snow Leopard Conservancy, USA. Over the years, he has received many grants and prestigious awards from the international community for his work on wildlife and biodiversity conservation in Nepal.

Falk Huettmann Falk spent over 10 years doing field work and research analysis – including a sabbatical – at the Third Pole: the Hindu Kush Himalaya region. He is a 'digital naturalist' linking computing, open-access data and the Internet with natural history research for global conservation and sustainability. Working as a professor for Wildlife Ecology with the University of Alaska Fairbanks (UAF), he and many international students run the EWHALE lab, where he pursues biodiversity, land- and seascape approaches, the atmosphere, global governance, ecological economics, diseases and new approaches to global sustainability on a pixel scale in a transparent and repeatable way. Most of his over

220 publications and 8 books are centred on open access and open source, geographic information systems (GIS) software, metadata and data mining/machine learning, pushing real-world conservation questions forward.

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Chapter 9
Showing True Change of the Hindu Kush Himalaya Region Through the Power of Photo Monitoring as a Visual Memory of Change

Fritz Berger

9.1 Introduction

The visual memory of most modern humans is rather weak and short-minded, specifically when it comes to details of our surroundings, nature and in vast landscapes: we usually don't remember well how it looked months back or in the past decades; we cannot relate well. To tackle this problem Photomonitoring (FM) in short; as taken from the German language where the author developed it) makes for an ideal tool. Photomonitoring is among the best means to document changes in landscapes over time. The series of two or more pictures helps in planning but also to evaluate and discuss already executed programmes in hindsight for impacts. Further, taking more photos can support oral and written analysis and statements even further.

Whereas words tend to stimulate our intellect first, photos actually touch immediately our emotions. To illustrate this: For a women collecting firewood, a road worker, or a farmer it will be quite difficult to read and understand a quantitative written analyses on erosion and regeneration; but if you show them a photo they will immediately start telling stories coming from their own experiences. As one visitor of my Photomonitoring exhibition titled "*A new tree in Charikot*" wrote in the guestbook: "*Changes are inevitable, but the photographer has presented a vivid picture of the changes that have taken place in our surroundings. This we could have noticed only through photo monitoring.*"

All the photo are by Fritz Berger, when not otherwise mentioned

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Here we can only show the value and concepts. To introduce this unique technique as a general tool – a science – on a larger scale, and with sound methods, the creation of a Centre/Institute for Photomonitoring is necessary (Suggestions are welcome, please contact the author).

9.2 Background, Context and Bio Data of the Photographer

Fritz Berger was born into a farming family south of Bern, Switzerland in 1938, as the third of eight children. After primary school, he earned an apprenticeship in horticulture, starting a life-long fascination with plants and agriculture. At 24, he started working as an adviser to development projects abroad, initially in Greece, but later in Nepal and Pakistan. Berger took a camera with him on every field excursion, developing this initial hobby into a passion for photography with a professional outcome.

In 1987, Fritz returned to Bern and began working as a freelance photographer. His assignments took him far afield once again, documenting activities in Nepal, Pakistan, Palestine, and ex-Yugoslavia (today knows as the Balkan region). He particularly enjoys documenting people, their work, and their struggles to make it through life.

Fritz speciality is Photomonitoring. He conducted trainings on this subject, wrote articles and conducted exhibitions. In 2010, Berger performed some of this work for ICIMOD, SDC and HELVETAS travelling to many sites in remote Nepal to record the impacts of natural forces and human activities.

The following photo series come from this work and present a unique combination of luck and determination allowing to determine landscape changes in the HKH region and with full background stories. That's what these following series allow for; these are now documented stories and landscape tales not to be forgotten:

FM Series for the Hindu Kush-Himalaya region

1. Observe Landscapes for Changes

a

Photo 9.1a Buju 2100 m, Swat, Pakistan August 1985 and August 2005
There are two details that are interesting in these FM pictures from Buju: the field crops and the forest opening in the background. As the photo from 1985 shows corn dominates (yellow green) next to it there are dark green fields with potatoes. Whereas in 2005 only potato fields can be seen later and corn has completely disappeared. Cabbage grows in the bright green field behind the mosque. After a road was built to Buju, the farmers have switched to cash crop

Avalanches are the cause of the broad forest opening. In 1985, young firs grow in the lower part of the opening. In the snowy winter of 2014 another avalanche broke down, which destroyed the young trees and penetrated the area almost to the mosque, as people told me. The avalanche destroyed two houses, and more than ten people died

b

Photo 9.1b Gayal a village in Manang valley, Nepal July 1978 and July 2010
At first glance, it seems like nothing has changed in the 32 years between those photos. But let's first look at the farming village of Gyal: Noticeable are the Gumpa in the center and the new building with a blue roof on the right edge of the village. By building new houses, the village has actually expanded. When we look at the white prayer flags, we find that there are fewer of them in 2010, suggesting that many houses are empty by then. People either died or emigrated. Also, looking closely at the 2010 photo, we notice that only about one half of the fields are cultivated (=only on those who have a uniform green) On my first visit in 1978, buckwheat, peas and barley were grown, in 2010 it was only peas. Has diversity changed to monocultures?

2. **Deforestation**

Photo 9.2a Urbanization of Gula Bad, in Kalam valley, Pakistan, 1983 and 2014
The photo from 1983 shows the thinly wooded pastures of Gula Bad. A year later, a road was built there and the valley on both side of the river slowly converted into fields to grow potatoes as cash crop. Farmer huts were built and for their construction most of the trees were cut down. The little river on the left side, has changed its course slightly (Photo taken 2010) (Photo 2014 by M. Zaman Sagar)

Photo 9.2b Hill over Simikot in Humla, Nepal 1999 and 2010
In just ten years, all the pine trees were felled on this stony hill. Buckwheat, initially just grown behind the stone wall in 1999, is planted on the steep slope in 2010

3. **Landscape healing**

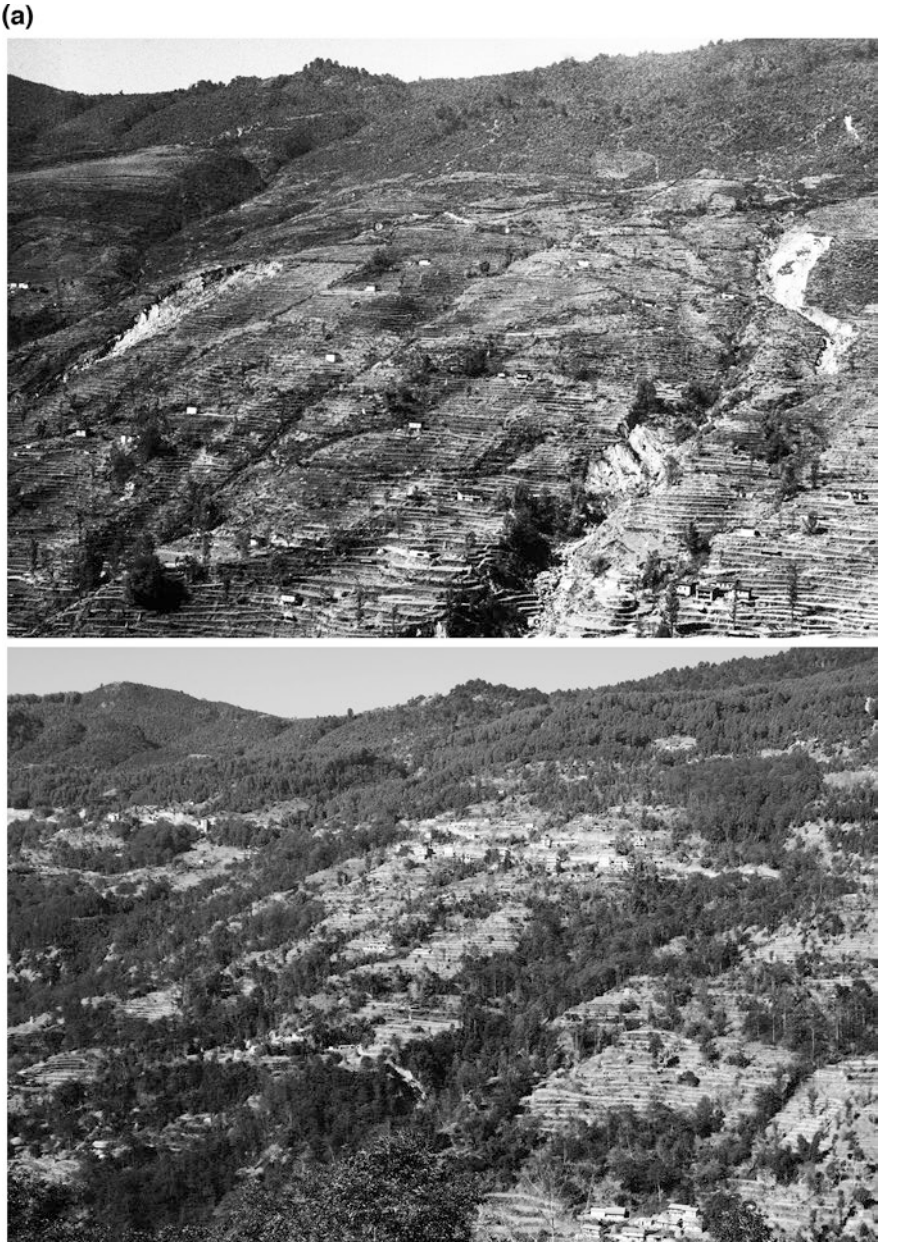

Photo 9.3a Boch in Nepal 1977 and 2018
In 1977 the slope has deeply eroded gullies and the hill looks barren without trees. For the construction of new road the water was drained through a safe runoff, and Utis were planted in an eroded gullies. In the nineties the community of Boch started some larger replanting activities on the hill above; protecting them from grazing helped to reduce the surface water and the deep gully healed slowly. In 2018 the slope looks stable and is covered with a lot of trees and new houses with a new road to reach their homes

Photo 9.3b Charnavati valley in Nepal, 1974 and 2010
Unstable terrain in the valley below the ridge of Seilung 1974. Back then, the new forest law asked villagers to engage in taking care of their forests. This measure helped to regenerate big parts of the hills in Nepal as seen here in the photo of 2010; the eroded surfaces on the hills are now covered with forest and the riverbed is stabilised

4. **Forest planting**

Photo 9.4a Dandapakhar, Nepal, 1975 and 2010
The 1975 photo shows villagers planting pines trees in a barren slope. In 2010, the entire slope is well covered with a dense forest, from which lumber can now be harvested for local demand and sale (Photo 1975 by Samuel Mauch)

Photo 9.4b Tree planting after the old road-widening construction, Dolalgath, Nepal, 1998 and 2010
When the old road was widening into the steep slopes of the narrow river valleys, there are always new landslides occurring as the photo from 1998 shows. Professionally executed measures with the help of plants (bio engineering) can ensure though a permanent stabilization of the slopes, photo 2010

5. **Damages by river floods**

Photo 9.5a Kalam bazaar in 1997 and 2014, 4 years after the flood disaster
As one can see on the first photo, the old river bed was initially located in front of the mosque (blue roof) which was used for tourists to enjoy the cold water from the canals. At the footpath over the bridge shops were erected
The actual flood that devasted large parts of Pakistan in the summer of 2010 had its origins in the foothills of the Hindukush. It was caused by extreme thunderstorms and precipitation, which then caused great damage, as shown here in Kalam. (Photo 2014 by M. Zaman Sagar)

Photo 9.5b Kali Gandaki at Kagbeni, Mustang in Nepal, 1978 and 2010
The photos of 1978 and 2010 show how the river slowly erodes away the irrigated fields and soils below the village. Even walls built by farmers to keep back the river cannot prevent that

6. **Urban growth**

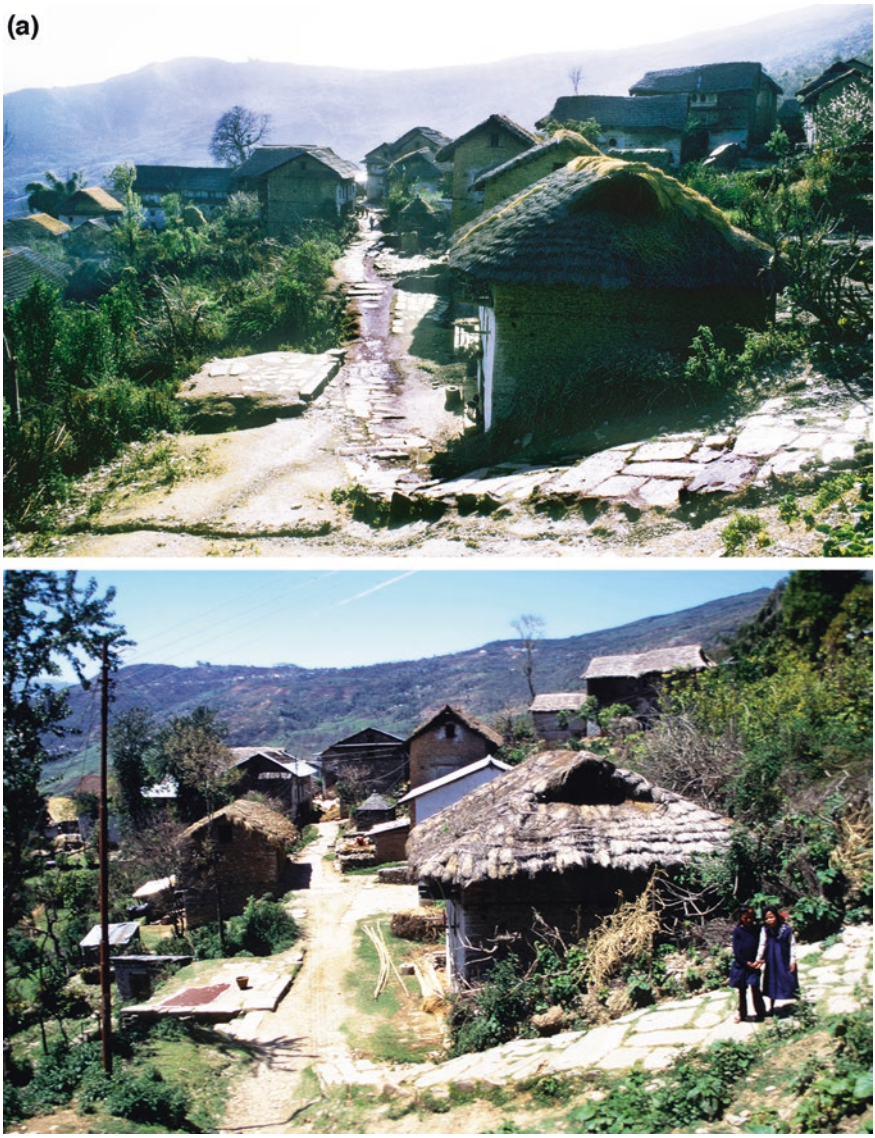

Photo 9.6a A street in old Dolakha, Nepal, 1974, 1998, 2005 and 2016
This series of 4 photos shows the changes in the old Newar town of Dolakha during 42 years. Thatched roofs could still be seen until the turn of the century, but after that all the houses were covered instead with corrugated sheet. In 2016 the damages of the earthquake 2 years earlier, is still evident. This street is not passable by cars and therefore it has not changed much. The village centre moved to upper Dolakha where now a new road connects from Charikot

Fig. 9.6a (continued)

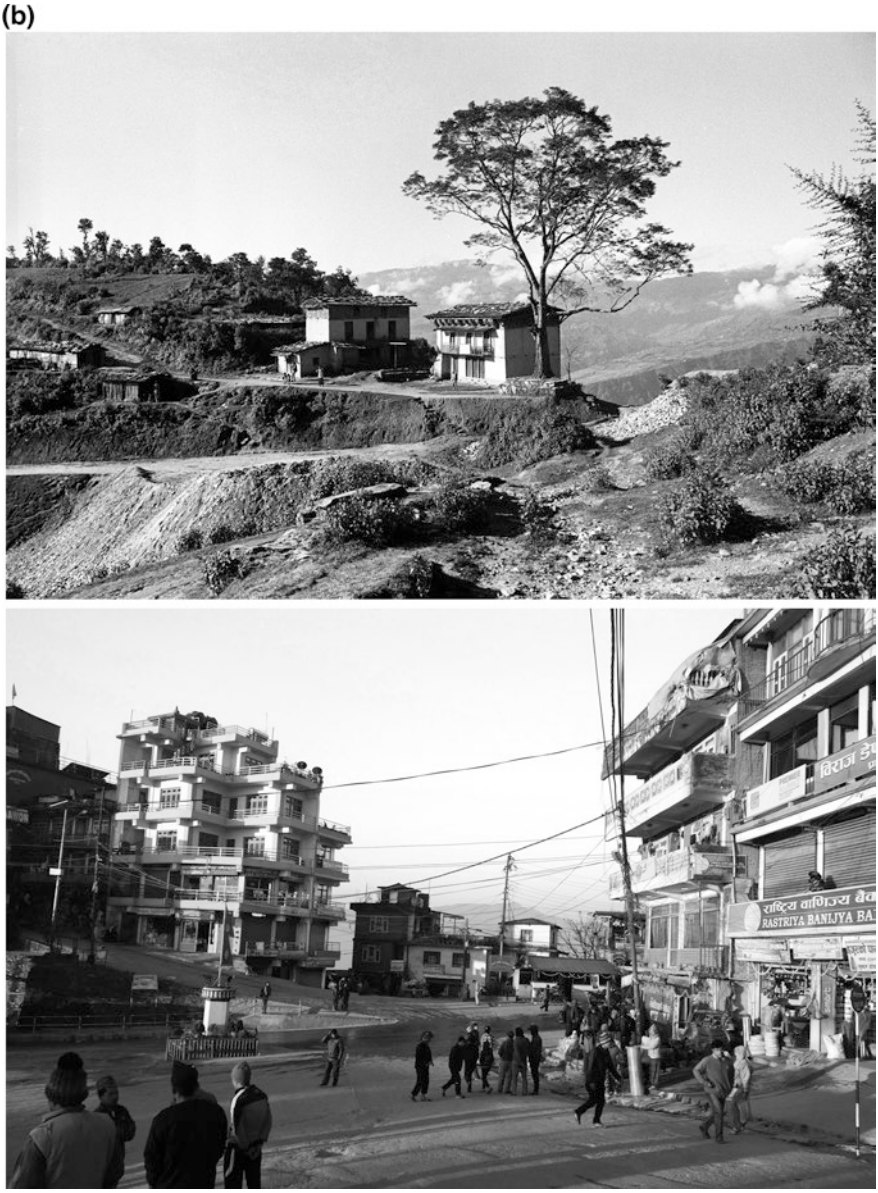

Photo 9.6b The centre of new Charikot, 1978 and 2018
The first photo from 1978 was made a few months after the excavation for the Jiri Road to reach Charikot. The place had been named the capital of the Dolakha district several years earlier and it consisted of a small bazaar and just a dozen of office buildings. With the new connection to Kathmandu, Charikot grew during the following decades to a small town with modern buildings and facilities, as the photo of 2018 shows

7. **The power of roads**

(a)

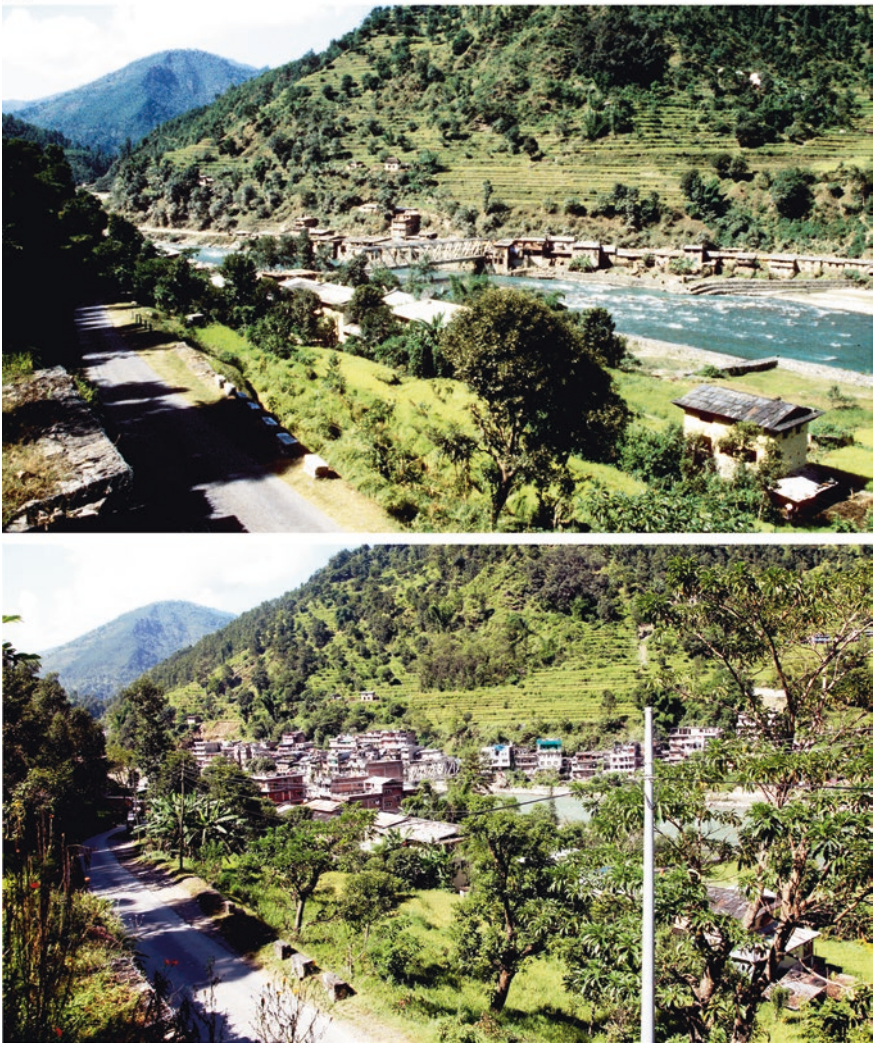

Photo 9.7a (a) Kalichor, Sunkosi, Nepal 1996 and 2010
These photos impressively show the dynamics that result from the construction of a new road and highway. In Kalichor, near Lamosangu, the road to Chrikot and Jiri leaves the Arniko Highway. When the picture was taken in 1996, the bridge existed for 15 years. On the narrow ground between the road and the river are already a number of houses
But in the photo from 2010 we see a lot of new multi-storey buildings on both sides of the Sunkosi. On the other side of the street, construction sites were carved into the steep slope to build new houses. In Kalichor today thousands of bus passengers eat-in, and they shop in the many new shops the cheap goods imported from China

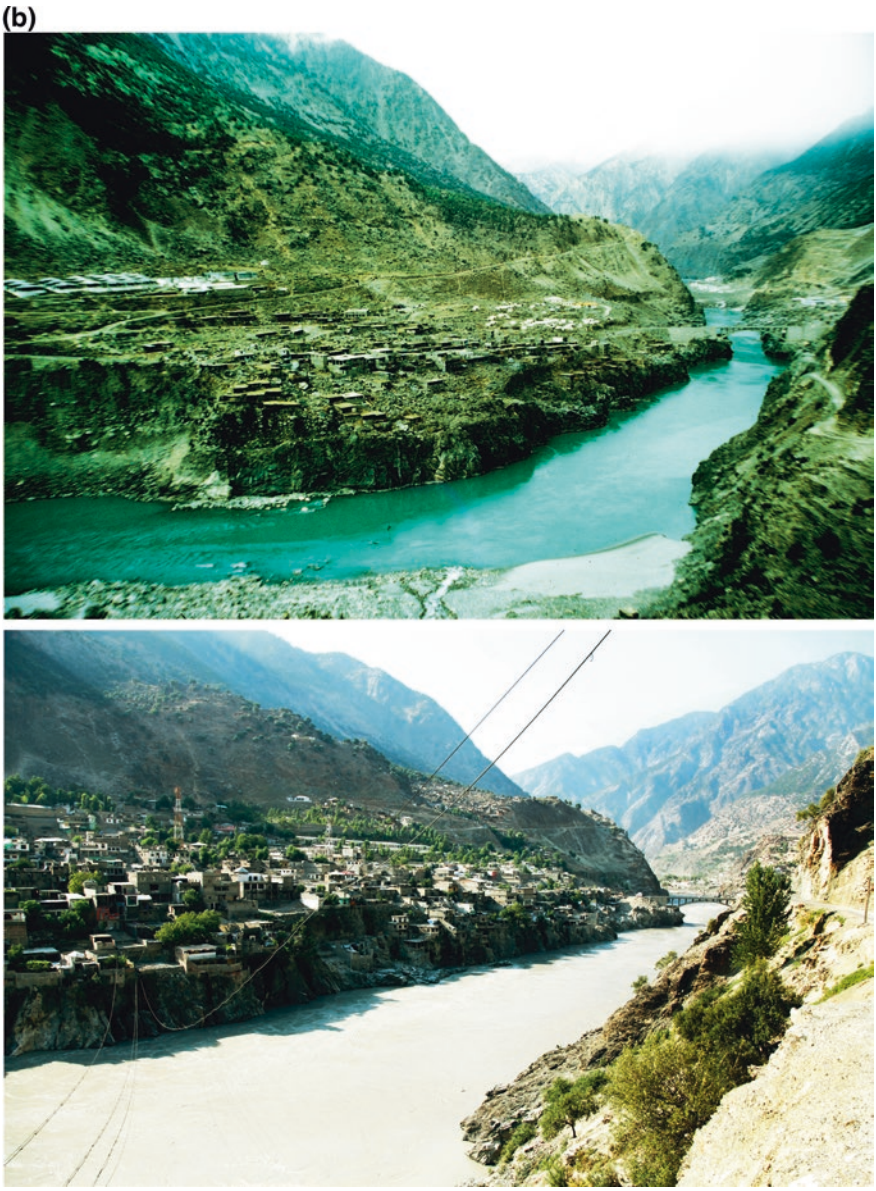

Photo 9.7b Kamila in Indus Kohistan, Pakistan 1984 and 2011
Until the construction of the Karakorum Highway after 1960, there were virtually no traffic routes and settlements in the Indus Gorge. But in 1984, Kamila became the administrative capital of the district of Kohistan. There are many barracks and simple houses. On the right side of the picture, the bridge over the Indus River is visible
In 2011 then, the settlements between the river and mountain slope has become a small town. Kamila is now an important trading centre for the surrounding valleys, which are already electrified as the high voltage power line shows

8. **Divers infrastructure**

Photo 9.8a A dam is being built at Lamabagar, Nepal 2010 and 2016
The photo from 2010 was taken shortly before the new road Lamabager arrived. In 2016, during the work on the dam (visible in the back of the valley) was interrupted due to the heavy earthquake of 2015. There are new houses in the village (some of the old ones are damaged) and a road is passing in the riverbed. It will be interesting to see how Lamabagar develops in the future. It is now planned to expand this place as a tourist destination

(b)

Photo 9.8b The airfield expansion of Simikot, Humla, in Nepal 1999 and 2010
The photo of 1999 shows the narrow unpaved runway. It is surrounded by new buildings in a fertile plateau. At the end of the runway, the old village of Simikot is visible
2010 shows a now-paved runway under construction. Simikot has greatly increased on both sides of the runway. The place now has electricity, which is visible through the line that leads across the fields

Photo 9.8c The magnetite mines of Karidungha 1973 and 2018
In the years when the first picture was taken, Nepal awarded a license to remove magnesite to one Indian company. Eight years later, the road to Jiri was built right through the mine grounds. Soon, however, the exploitation was unprofitable and it was all given upp. The remaining deep wounds on the mountain can be seen in the photo of 2018

Photo 9.8d Hotel in Kalam, Pakistan 1986, 2005 and 2014
The mass tourism of the past decades has visibly changed the valley of Kalam, as clearly shown in the photos of 1986, 2005 and 2014. Whereas in 1986 it is located next to the road, some of the remaining farmland, a cemetery and some houses and the first hotel can be seen; a new tourist destination starts to emerge. As the photo from 2005 documents many new hotels and shops got built along the road and near the river. As the photo from 2014 shows, the flood of 2010 washed away several hotels that were build too close to the river. (Photo 2014 by M. Zaman Sagar)

Fig. 9.8d (continued)

9. **Air and river pollution at Kathmandu**

Photo 9.9a Baharatar 1998 and 2016
The two photos clearly show two main problems of Katmandu: the wild, unplanned expansion of the city as well its enormous air pollution! The traditional small town has expanded into a city in just 20 years, with huge areas of valuable cultural land being simply built over

Photo 9.9b Bagmati at Pashupatinath 1974 and 2016
The Bagmati is a sacred river in which people – at least until two decades ago – bathed in Pashupatinath (a World Heritage Site), one of the most venerable sanctuaries on its shores. Because of the poor water quality and the contented waste, it is currently not only repulsive but also a health risk to bathe in Bagmati