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Development Indicators for Mountain Regions

The human dimension of development processes in high mountain regions regularly escapes appropriate assessment due to a lack of applicable methods. Comparative data are lacking, and it is difficult to substantiate the position of mountain societies within nation-states. In view of the International Year of Mountains, consideration should be given to the focus of research and the need for comparative approaches. Using examples from case studies in South Asian high mountain regions, this article introduces an approach that applies widely known human development indicators to different regional levels. Evaluating the results and interpreting the dimensions of these indicators reveal pressing problems in mountain research as well as fields for further investigation.

Keywords: *Human development; indicators; disaggregation; comparative approach; South Asia; India; Nepal; Pakistan; Afghanistan; Tajikistan.*

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Introduction

The inadequacy of scientific tools for describing and analyzing development problems in high mountain regions has been the subject of increasing scholarly debate in recent years. A number of efforts have been made to resolve this problem (Thompson et al 1986; Messerli and Ives 1997; Rhoades 1997; Thompson 1997). Stimulated by growing demand in local communities and by policymakers and development planners, multi- and interdisciplinary approaches have been put forward to address perceived research deficits. At the same time, loss of common ground for methodological understanding and the application of certain research methods have made it more difficult to cross the traditional boundaries between scientific disciplines.

Geography is no exception in this regard. Mountain geographers in particular have been confronted with this debate for a long time, but a new dimension was added in recent years when the methodological divide between the natural and social sciences, that is, physical and human geography, became more obvious. At the same time, development practitioners are increasingly demanding holistic approaches (Figure 1). Their demands are supported by the modern social sciences, which have discovered time, space, and environment as relevant categories. Fruitful debates have occurred, especially in the field of global change and in the search for adequate development concepts (Stern et al 1997; D'Antonio et al 1994; Goudie 1994; Wilbanks 1994; Kasperson et al 1995; Petschel-Held et al 1995; Schellnhuber 1997; Turner 1997; Vitousek 1997; Liverman 1998; Reusswig and Schellnhuber 1998; Meyer and Turner 1999; Price 1999). Today, interdisciplinary approaches are used to gain insight into complex phenomena and transdisciplinary solutions are advocated where different professional experiences and backgrounds are involved.

Inter- and transdisciplinarity are particularly sought when addressing human-induced environmental transformation in mountains, which has become the focus of much research leading up to the International Year of Mountains 2002. When the deteriorating living conditions of mountain people become the object of research, interrelationships among all natural and human factors involved must be taken into account. Combining knowledge of environmental conditions with the survival strategies of individuals and local communities that aim at a better, sustainable future presents a challenge to everyone involved in research, policymaking, and development practice.

The present article aims to stimulate debate by exploring a comparative approach involving selected indicators, as these are widely applied in development reports and practice. The discussion of indicators will shed light on how they are applied and reveal their conceptual limitations. This could provide us with a clearer vision of appropriate strategies for security enhancement (Thompson 1997) in mountain societies.

The challenge for geography

Looking back at the geoecological research tradition, we can see that the problems of analyzing mountain conditions are ubiquitous. Hopes for a solution to the "Himalayan Dilemma" (Ives and Messerli 1989) were projected onto mountain inhabitants although, surprisingly, comparatively little attention was paid to the complex living conditions of mountain people. The assumption that living conditions are homogeneous and the fact that human responses within biotic systems are assessed with reference to carrying capacity, treating human beings as equal members of the biological world without taking account of human decision-making power and culture, are 2 major problems arising from such generalizing approaches. At the least, perception of common practices and problems among mountain dwellers in developing countries lacked sufficient appreciation of the great variation between regions, groups, and households and their members (Kreutzmann 1995a, 2000; Messerli and Ives 1997; Ehlers and Kreutzmann 2000).

Generalizations disguise one of the most obvious facts about mountain societies: extreme forms of socioeconomic, political, and cultural heterogeneity (Kreutzmann 1995b; Thompson 1997). Generalizations also show a lack of understanding of the complexities of human activities and economic penetration within a given mountain habitat. Territorial usurpation and the

FIGURE 1 International development agents provide humanitarian aid to the Kyrgyz of the Little Pamir in Afghanistan. Humanitarian aid is loaded onto yaks and brought to remote grazing grounds. To support such development activities and contribute to sustainable living conditions, research must develop the means to assess complex political, social, environmental, and cultural realities. (Photo by H. Kreutzmann, June 2000)

exploitation of natural resources are underestimated as the driving forces of human habitat systems in high mountain regions. This also applies to socioeconomic relations between highlands and lowlands.

One could argue that classical regional geography inevitably leads to this approach because it is inadequate to cover the human sphere. But there is a more general difficulty separating a natural science approach from social theories and related models, well known to all participants in transdisciplinary research programs. Natural scientists try to understand each other by defining standards of measurement and by incorporating their results into a dominant model on which to base comparative high mountain geography. In the absence of a universal theory, standardization of methods seems to be extremely unpromising in the social sciences. A variety of theories and methods are applied on a metalevel to solve particular research problems. Trying to understand human behavior in social environments through general theories about societies and groups has been criticized as an approach that underestimates the importance of personal actions and individual decision making (Giddens 1984). As a result, theoretical approaches are chosen that do not necessarily fit into a natural science model. This could be pictured as the difference between geoecological analysis of more obvious or visible factors in space and time on the one hand and analysis of less visible elements in the space created by human action on the other hand.

Common fields of research

Despite the dichotomy in methodological foundations, certain topics in the interaction of space, environment, and human activities are important areas of cooperation across disciplinary boundaries. Consensus has been reached by identifying land use in a broad sense, forest exploitation, and utilization of natural grazing grounds. The UNESCO-sponsored Man and Biosphere projects (MAB-6) adopted such an approach. This set of 3 topics might be augmented by attributing equal importance to other areas, such as the construction and protection of settlements and traffic infrastructure. Furthermore, transdisciplinary cooperation is required if the environment is at risk to such a degree that human activity and habitations are endangered. Investigations into settlement processes and natural hazards have become well established in transdisciplinary research and are important in understanding of survival conditions in high mountain regions (Kreutzmann 1994; Hewitt 1997; Messerli and Ives 1997).

Chapter 13 of Agenda 21 posed a challenge to mountain researchers, and the scientific community is expected to provide adequate responses (Sène and McGuire 1997). In this context, one of the most important fields of research is development processes in mountain environments in developing countries, where ecological, sociopolitical, and economic pressures come to a head to a substantially higher degree than anywhere else. If we are interested in treating mountain regions within the developing world as part of this world, then it seems more than appropriate to apply well-established development indicators to mountain research. This could enable us to do comparative mountain research in order to define development deficits and identify deprived groups within mountain regions.

Tentative approach for high mountain studies in developing countries

In considering pressing development problems from the perspective of development research, arguments can be made for a general and comparative view of

TABLE 1 Human development indices for selected mountainous countries (PPP in US$, purchasing power parity; HDI, Human Development Index; GDI, Gender Development Index; HPI-1, Human Poverty Indicator for developing countries; ND, no data available. Sources: UNDP 1996, 1997, 1999, World Bank 1996.)

Region	Country	Area in 10^3 km^2	Population (millions) (1997)	PPP $ (1997)	HDI (1997)	HDI rank (1997)	GDI (1997)	HPI-1 (1997)
Africa	Ethiopia	1097	58.2	510	0.298	172	0.287	55.8
	Uganda	236	20.0	1160	0.404	158	0.397	40.6
	Kenya	580	28.4	1190	0.519	136	0.517	28.2
	Rwanda	26	6.0	660	0.379	164	ND	ND
South and Southeast Asia	Papua New Guinea	463	4.5	2654	0.570	129	0.564	27.8
	Burma/ Myanmar	677	43.9	1199	0.580	128	0.576	32.3
	Bhutan	47	1.9	1467	0.459	145	0.444	41.8
	Nepal	141	22.3	1090	0.463	144	0.441	51.9
	India	3288	966.2	1670	0.545	132	0.525	35.9
	Pakistan	796	144.0	1560	0.508	138	0.472	42.1
Central Asia	Afghanistan[a]	653	20.0	819	0.229	Not listed	ND	ND
	Kyrgyzstan	198	4.6	2250	0.702	97	ND	ND
	Tajikistan	143	5.9	1126	0.665	108	0.662	ND
Latin America	Guatemala	109	10.5	4100	0.624	117	0.608	28.3
	Colombia	1139	40.0	6810	0.768	57	0.765	10.5
	Ecuador	284	11.9	4940	0.747	72	0.728	16.8
	Peru	1285	24.4	4680	0.739	80	0.726	16.6
	Bolivia	1099	7.8	2880	0.652	112	0.641	21.1

[a] The data for Afghanistan are based on estimates for 1993.

mountain regions with a simultaneous demand for the disaggregation of indicators and their downscaling from the global level to the household level. Both these approaches require further discussion.

Quality-of-life indicators are based on the assumption that development is based on universal categories and not on localized experiences and different value systems. However, there are few options for a comparative approach. These indicators have been selected because they reflect certain basic elements of livelihood that are a focus for major institutions concerned with promoting change. Indeed, international organizations such as the United Nations, the World Health Organization (WHO), the Food and Agriculture Organization (FAO), and the World Bank introduce development programs in order to induce social change and improve the quality of life (Figure 2). To analyze disparities in mountain regions, the approach presented here therefore proposes to use such established indicators while still questioning the quality of the data they yield. We shall see that very few data are available for any kind of comparative discussion on appropriate levels.

Quality-of-life indicators

Two major indicators proposed here have been applied by the United Nations Development Program (UNDP) to give a comprehensive picture of the state of development: the Human Development Index (HDI) and the Human Poverty Index (HPI).

The Human Development Index

The HDI consists of 3 equal components: per capita income (purchasing power parity, or PPP, in US$), standard of education, and quality of living conditions. These aspects are of paramount importance when applied to high mountain regions. Data are generally provided only at the country level. The 1997 data for mountainous countries (Table 1) show a broad range from the countries in the low and middle development categories, with Afghanistan and Ethiopia at the bottom, to the Latin American countries at the top followed by the post-Soviet Union Central Asian republics. The latter is not surprising, as high export values and social infrastructure count heavily in the HDI. This sta-

FIGURE 2 Kyrgyz nomads in the Little Pamir (Afghanistan) belong to remote groups in high mountain regions who depend to a major degree on self-sufficiency but sometimes still rely on external aid for survival. (Photo by H. Kreutzmann, June 2000)

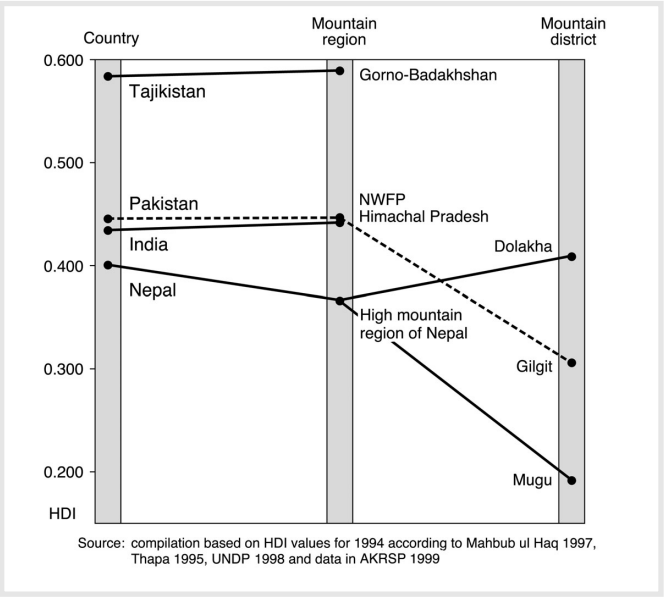
tistical aggregation provides insight into the level of development in nation-states that contain mountainous regions.

There is a lack of information about regional disparities between highlands and lowlands. Disaggregated data are available only in a few cases (Figure 3). Comparing country, region, and district levels, it becomes obvious that development is unbalanced. In Tajikistan, the disparities between the nation-state as a whole and the mountainous region of Gorno-Badakhshan are less prominent than elsewhere. Similar results occur for India and Pakistan down to the provincial level, but the Karakoram district of Gilgit ranks much lower than the rest of Pakistan.

In Nepal, the high mountain region seems to be less well off than the country's average. Great differences are obvious between the poorest Mugu and the well-off Dolakha districts. Nepal represents one of the rare cases where regionalized data are available. In all respects, these disaggregated data on the Nepalese district level show extreme differences between central places, eg, the Kathmandu basin and a remote high mountain district such as Mugu (Figure 4). While Kathmandu ranks at the top within Nepal, Mugu District is at the bottom. The gap reflects a life expectancy of 74 years in Kathmandu and only half of this, 37 years, in Mugu. The difference in educational levels is even greater, with an adult literacy ratio in Mugu of 23% compared with Kathmandu's 71%. Separating all districts by region, the Middle Mountains of Nepal, including the Kathmandu Basin, fare best, with an HDI of 0.421, followed by the Terai lowlands (HDI 0.389), while the high mountain region in the northern belt ranks lowest, with an HDI of 0.365. On a district level, the regional inequalities between different ecological zones as well as between individual administrative units can be identified (Figure 4). The capital region commands more facilities and infrastructure than any other, while the remote high mountain districts of the western development zone have the least. There is a significant east–west and lowland–highland decrease in human development, while the urban centers of the capital region, Pokhara and Morang in the Terai, are exceptions.

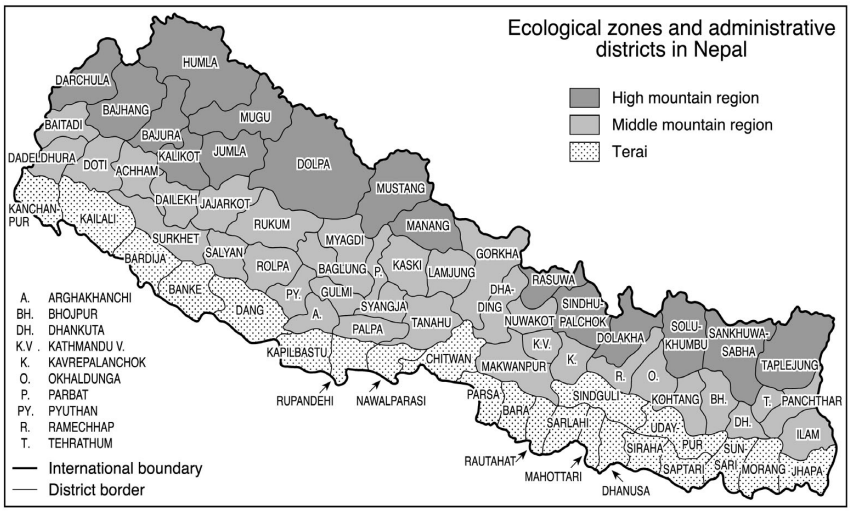
By contrast, the Indian Himalayan province of Himachal Pradesh closely resembles the country's average, which is indicated by a similar HDI value (Figure 3) far above Nepal's average. Both countries and all their mountain regions are in the low human development category (HDI < 0.500). Major gaps are obvious between Tajikistan and Pakistan. With respect to the 3 dimensions of the HDI (Figure 5), the Pamirian autonomous *oblast* (province) of Gorno-Badakhshan has values similar to those for the rest of the country. The Soviet model of bringing remote regions up to par seems to have worked. Tajikistan was the poorhouse of the Soviet Union and is now in a difficult position altogether. In Pakistan, the Karakoram district of Gilgit is significantly below the country average. The biggest gap occurs in the standard of living, while educational levels are not far apart. Although the Hunza Valley is an important part of the Gilgit District, the popularly recognized longevity of its inhabitants is not an asset that puts Gilgit on a par with or above the average life expectancy in Pakistan.

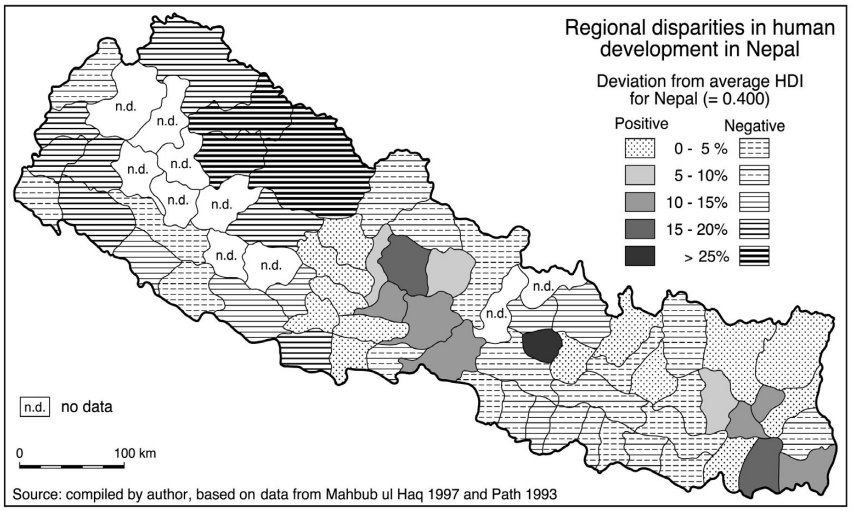
FIGURE 3 Human development indices for selected mountain regions in South and Central Asia.

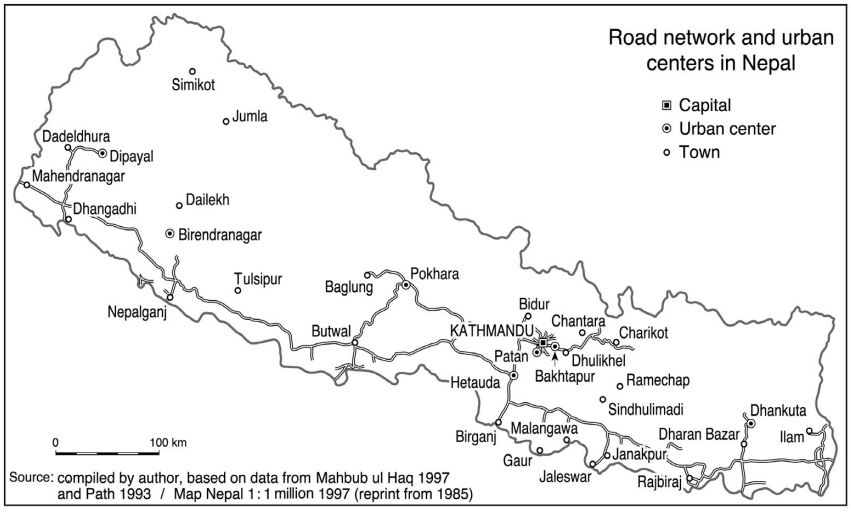


Source: compilation based on HDI values for 1994 according to Mahbub ul Haq 1997, Thapa 1995, UNDP 1998 and data in AKRSP 1999

FIGURE 4 Regional disparities and disaggregated human development indices at the district level in Nepal. (Maps by Hermann Kreutzmann)







There is an obvious lack of more disaggregated data of this kind for identifying regions and problems. Nevertheless, the general discussion of the HDI raises important issues for future research, including the following:

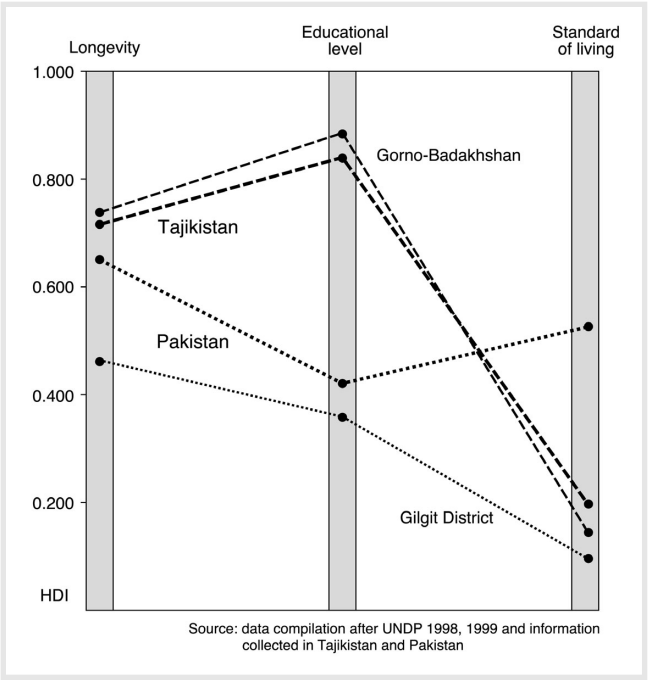
- Knowledge about monetary income on regional, local, and household levels is an important parameter for assessing the availability of cash and market participation among mountain dwellers. Consumption and production patterns are linked to entrepreneurial behavior and external marketing.
- The extent of formal education in mountain communities indicates their participation in a "modern" social infrastructure. In peripheral regions, this aspect of integration is crucially important to the future development of livelihood strategies.
- Demographic variables, such as life expectancy, are indirect indications of the supply of basic infrastructure in remote regions with difficult access. It is less interesting to search for the valley of the centenarians than to look into the accessibility of hospitals and dispensaries, the availability of medical services, and the groups that are excluded from access.

Highlighting gender-related inequalities, a Gender Development Index (GDI) was introduced in the 1995 *Human Development Report* in order to show the deprivation and exclusion of women from access to basic resources and infrastructure. The difference between HDI and GDI is a measure of the developmental gap between men and women (Table 1). The HDI is an appropriate measure to reveal societal deficits and indicates scope for improving equity but does not provide any information on the groups and communities involved.

The Human Poverty Index

The Human Poverty Index (HPI) is one of the latest additions to the set of UNDP indicators and is meant to complement the poverty debate with nonmonetary parameters (Table 1). It emphasizes the fact that rising cash income does not necessarily

FIGURE 5 Disparities in human development in the late 20th century in selected nation-states and mountain regions of Central Asia.



indicate an elimination of poverty. The basic dimensions of poverty and human deprivation are addressed in the Human Poverty Indicator for developing countries (HPI-1) and resemble those assessed in the HDI as follows:

- Life expectancy, the percentage of people who probably do not live longer than the age of 40, is taken as a measure of overall living conditions.
- Education is covered in terms of restricted access to basic educational facilities, reflected in the prevalence of illiteracy among adults.
- The absence of a minimum standard of living is related to the lack of accessible public and private amenities, subdivided into 3 equal variables that measure the percentage of people with access to health services and safe drinking water and the percentage of under- or malnourished children below age 5.

The groups excluded from social infrastructure and deprived of basic needs are identified, but this indicator provides us only with country data so far (Table 1). It reveals that, in Ethiopia and Nepal, more than half the population belongs to deprived groups, while this percentage is lowest in Latin American societies (10.5% in Colombia and 28.3% in Guatemala) and in Kenya (28.2%). More disaggregated data are required for regional identification and comparison.

Fields of research on livelihood strategies

A wide variety of research topics in remote and marginalized areas can be identified by examining the spectrum of specific UNDP development indicators and projecting them onto high mountain regions. All the indicators emphasize different aspects but are related to basic development goals. Hence, they vary to some extent on a country level. They have mainly been introduced as a tool for further inquiry at different regional levels. At the same time, they display a variety of possible approaches and methods in defining comparable indicators for development.

Environmental extremes, harsh and risky conditions for production and reproduction, and remoteness from participatory decision making and centers of power characterize high mountain environments. While these regions offer niches for highly competitive collection and production of specialized items, they are endangered in terms of demographic and socioeconomic destabilization. As they are extremely dependent on external supply, their sustainability is at stake, but the factors regulating this development are by no means the ones controlled by the mountain dwellers alone. Exchange relations and the overall incorporation of mountain regions into nation-states cannot be neglected and require further investigation.

Based on these considerations, current fields of research on livelihood strategies for survival in high mountain regions can be identified. The following 3 strategies should be included from the perspective of cultural geography.

(1) Territorial appropriation, settlement strategies, and population change: Demographic processes in high mountain regions are always related to transition and mobility phenomena. Pioneering extension of settlements and utilization of marginal resources at the upper limit of cultivation are linked to migration of individuals and communities in regions of disaster, regions of refuge, and regions of opportunity (Skeldon 1985; Kreutzmann 1994, 1995a; Ehlers 1995; Uhlig 1995; Hewitt 1997; Libiszewski and Bächler 1997; Sökefeld 1997). Narrowing the room for maneuvering in these areas results in creation of boundaries and causes conflicts. Consequently, majority and minority issues, issues of state power versus group interests, and issues related to sociocultural participation and political marginalization are gaining importance. If developments such as the globalization of international trade and regionalization of economic cooperation lead to a modified role for the nation-state, sociopolitical deprivation of peripheral areas becomes a highly relevant topic in development-related high mountain research.

(2) Entrepreneurship and livelihood strategies: In projecting the demand for overall satisfactory economic development onto agricultural and nutritional sustainability in high mountain regions, general aspects of division and

allocation of labor and participation related to food resources become prominent (Bishop 1990; Dittrich 1998; Stellrecht and Bohle 1998; Banskota et al 2000; Clemens and Nüsser 2000; Ehlers and Kreutzmann 2000; Stöber and Herbers 2000). Securing adequate means for survival is part of a strategy in which the local agricultural sector and the factor of gender in domestic tasks seem to be as instrumental as the generation of external monetary and material forms of income and their distribution among household members.

(3) Resource management and energy supply: The provision of a permanent supply of energy resources cannot be guaranteed by utilizing traditional sources while demand is growing. New solutions and the tapping of underutilized sources are required to sustain growing demand in all sectors of society in both the mountains and the lowlands (Graner 1997; Schweizer and Preiser 1997; Schickhoff 1998a,b). The availability of natural resources and their distribution among entitled communities and households cause substantial conflicts at different scales. Water and timber resources are targeted by different groups (Kreutzmann 2000; Price and Butt 2000). In this context, community-based property rights require special attention (Lynch and Maggio 2000). Without substantial state intervention, adequate legislation, and protective measures, marginal groups can easily be sidelined in the competition for dwindling resources.

These 3 areas were chosen on the basis of recent research results, with a view to directing future research in high mountain regions. Transdisciplinary approaches have recently been introduced and are being implemented in a number of international research programs, such as the Dynamics of Land Use/Land Cover Change in the Hindukush-Himalaya program, a part of the international research network on global change.

Conclusion

In attempting to remove methodological constraints in transdisciplinary approaches, the need for cooperation becomes obvious. Two assumptions laid the foundations for development research in searching for parameters in comparative high mountain research. First, development concepts applied in other regions should also be applied to mountain regions in developing countries. Second, comparable indicators could help improve both our understanding of disparities on different spatial levels and the function of deprived groups. This would lead to a wide but focused range of research topics. The advantage of these indicators lies in their wide application, although they have seldom been projected onto mountain regions. The major impetus for introducing indicators comes from the often-heard but rarely realized demand to improve the livelihood of mountain dwellers. An experiment with quality-of-life indicators might stimulate a debate about appropriate measures for comparison and about the uniqueness of value systems. The first step could be to identify regions and actors, while the second step is in the hands of decision makers and the agents of change in cooperation and communication with the people living in mountain regions.

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REFERENCES

Aga Khan Rural Support Programme (AKRSP). 1999. *Data on human development in Northern Pakistan.* Gilgit (communication by letter).
Banskota M, Papola TS, Richter J, editors. 2000. *Growth, Poverty Alleviation and Sustainable Resource Management in the Mountain Areas of South Asia.* Feldafing: Deutsche Stiftung für internationale Entwicklung.
Bishop BC. 1990. *Karnali Under Stress. Livelihood Strategies and Seasonal Rhythms in a Changing Nepal Himalaya.* Geography Research Paper 228-29. Chicago: University of Chicago Press.
Clemens J, Nüsser M. 2000. Pastoral management strategies in transition: indicators from the Nanga Parbat region (NW-Himalaya). *In:* Ehlers E, Kreutzmann H, editors. *High Mountain Pastoralism in Northern Pakistan*. Erdkundliches Wissen 132. Stuttgart: Franz Steiner Verlag, pp 151–187.
D'Antonio WV, Sasaki M, Yonebashi Y, editors. 1994. *Ecology, Society and the Quality of Social Life*. New Brunswick, London: Transaction.
Dittrich C. 1998. High mountain food systems in transition. Food security, social vulnerability and development in Northern Pakistan. *In:* Stellrecht I, Bohle H-G, editors: *Transformation of Social and Economic Relationships in Northern Pakistan*. Culture Area Karakorum Scientific Studies 5. Köln: Rüdiger Köppe Verlag, pp 231–354.
Ehlers E. 1995. Die Organisation von Raum und Zeit—Bevölkerungswachstum, Ressourcenmanagement und angepaßte Landnutzung im Bagrot/Karakorum. *Petermanns Geographische Mitteilungen* 139(2):105–120.
Ehlers E, Kreutzmann H, editors. 2000. *High Mountain Pastoralism in Northern Pakistan.* Erdkundliches Wissen 132. Stuttgart: Franz Steiner Verlag.
Giddens A. 1984. *The Constitution of Society. Outline of the Theory of Structuration*. Cambridge: Polity.

Goudie A. 1994. *The Human Impact on the Natural Environment.* 4th ed. Cambridge, MA: Massachusetts Institute of Technology Press.
Graner E. 1997. *The Political Economy of Community Forestry in Nepal.* Freiburger Studien zur Entwicklungsforschung 14. Saarbrücken: Breitenbach.
Hewitt K. 1997. Risk and disasters in mountain lands. *In:* Messerli B, Ives J, editors. *Mountains of the World. A Global Priority*. New York, London: Parthenon, pp 371–408.
Ives J, Messerli B. 1989. *The Himalayan Dilemma. Reconciling Development and Conservation*. London: Routledge.
Kasperson JX, Kasperson RE, Turner II BL, editors. 1995. *Regions at Risk: Comparisons of Threatened Environments*. Tokyo: United Nations University Press.
Khadija Haq. 1999. *Human Development in South Asia. The Crisis of Governance*. Oxford, New York, Karachi: Oxford University Press.
Kreutzmann H. 1994. Habitat conditions and settlement processes in the Hindukush-Karakoram. *Petermanns Geographische Mitteilungen* 138:337–356.
Kreutzmann H. 1995a. Sprachenvielfalt und regionale Differenzierung von Glaubensgemeinschaften im Hindukusch-Karakorum. Die Rolle von Minderheiten im Konfliktfeld Nordpakistans. *Erdkunde* 49:106–121.
Kreutzmann H. 1995b. Globalization, spatial integration, and sustainable development in Northern Pakistan. *Mountain Research and Development* 15:213–227.
Kreutzmann H, editor. 2000. *Sharing Water. Irrigation and Water Management in the Hindukush-Karakoram-Himalaya*. Oxford, New York, Karachi: Oxford University Press.
Libiszewski S, Bächler G. 1997. Conflicts in mountain areas: a predicament for sustainable development. *In:* Messerli B, Ives J, editors: *Mountains of the World. A Global Priority*. New York, London: Parthenon, pp 103–130.
Liverman D, editor. 1998. *People and Pixels. Linking Remote Sensing and Social Science*. Washington DC: National Research Council.
Lynch OJ, Maggio GF. 2000. *Mountain Laws and Peoples: Moving Towards Sustainable Development and Recognition of Community-Based Property Rights*. Washington, DC: Center for International Environmental Law.
Mahbub ul Haq. 1997. *Human Development in South Asia 1997*. Oxford, New York, Karachi: Oxford University Press.
Messerli B, Ives J, editors. 1997. *Mountains of the World. A Global Priority.* London: Parthenon.
Meyer W, Turner II BL. 1999. The earth transformed: trends, trajectories, and patterns. *In:* Johnston RJ, Taylor PJ, Watts MJ, editors: *Geographies of Global Change. Remapping the World in the Late Twentieth Century*. Oxford: Blackwell, pp 302–317.
Path R, editor. 1993. *Population Census 1991. General Characteristics, Tables.* Volume 1, Part 1. *Nepal.* Kathmandu: Central Bureau of Statistics (published by the HMG National Planning Commission Secretariat).
Petschel-Held G, Block A, Schellnhuber H-J. 1995. Syndrome des globalen Wandels. Ein systemarer Ansatz für Sustainable-Development-Indikatoren. *Geowissenschaften* 13:81–87.
Price M, editor. 1999. *Global Change in the Mountains*. New York, London: Parthenon.
Price M, Butt N, editors. 2000. *Forests in Sustainable Mountain Development. A State of Knowledge Report for 2000*. International Union of Forest Research Organizations (IUFRO) Research Series 5. Oxon, New York: CAB International.
Reusswig F, Schellnhuber H-J. 1998. Die globale Umwelt als Wille und Vorstellung: Zur transdisziplinären Erforschung des globalen Wandels. *In:* Daschkeit A, Schröder W, editors. *Umweltforschung quergedacht. Perspektiven integrativer Umweltforschung und -lehre*. Berlin, Heidelberg, New York: Springer, pp 259–308.
Rhoades RE. 1997. *Pathways Towards a Sustainable Mountain Agriculture for the 21st Century: The Hindu Kush-Himalayan Experience*. Kathmandu: International Center for Integrated Mountain Development (ICIMOD).
Schellnhuber H-J. 1997. *Earth System Analysis: Integrating Science for Sustainability*. Berlin: Springer.
Schickhoff U. 1998a. Socio-economic background and ecological effects of forest destruction in Northern Pakistan. *In:* Stellrecht I, editor. *Karakorum-Hindukush-Himalaya: Dynamics of Change*. Culture Area Karakorum Scientific Studies, 4/I. Köln: Rüdiger Köppe Verlag, pp 287–302.
Schickhoff U. 1998b. Interrelations between ecological and socio-economic change. The case of the high-altitude forests in the Northern Areas of Pakistan. *In:* Israr-ud-din, editor. *Studies in Pakistan Geography*. Peshawar: Department of Geography, pp 29–38.
Schweizer P, Preiser K. 1997. Energy resources for remote highlands. *In:* Messerli B, Ives J, editors. *Mountains of the World. A Global Priority*. New York, London: Parthenon, pp 157–170.
Sène El Hadji, McGuire D. 1997. Sustainable mountain development: Chapter 13 in action. *In:* Messerli B, Ives J, editors. *Mountains of the World. A Global Priority*. New York, London: Parthenon, pp 447–453.
Skeldon R. 1985. Population pressure, mobility, and socio-economic change in mountainous environments: regions of refuge in comparative perspective. *Mountain Research and Development* 5:233–250.
Sökefeld M. 1997. Migration and society in Gilgit, Northern Areas of Pakistan. *Anthropos* 92:83–90.
Stellrecht I, Bohle H-G, editors. 1998. *Transformation of Social and Economic Relationships in Northern Pakistan*. Culture Area Karakorum Scientific Studies 5. Köln: Rüdiger Köppe Verlag.
Stern P, et al, editors. 1997. *Environmentally Significant Consumption: Research Directions.* Committee on the Human Dimension of Global Change, Commission on Behavioural and Social Sciences and Education. Washington DC: National Academy Press.
Stöber G, Herbers H. 2000. Animal husbandry in domestic economies: organization, legal aspects and present changes of combined mountain agriculture. *In:* Ehlers E, Kreutzmann H, editors. *High Mountain Pastoralism in Northern Pakistan*. Erdkundliches Wissen 132. Stuttgart: Franz Steiner Verlag, pp 37–58.
Thapa S. 1995. The Human Development Index: a portrait of the 75 districts in Nepal. *Asia-Pacific Population Journal* 10(2):3–14.
Thompson M. 1997. Security and solidarity: an anti-reductionist framework for thinking about the relationship between us and the rest of nature. *The Geographical Journal* 163:141–149.
Thompson M, Warburton M, Hatley T. 1986. *Uncertainty on a Himalayan Scale*. London: Ethnographica.
Turner II BL. 1997. The sustainability principle in global agendas: implications for understanding land-use/cover changes. *Geographical Journal* 163:133–140.
Uhlig H (edited by H. Kreutzmann). 1995. Persistence and change in high mountain agricultural systems. *Mountain Research and Development* 15(3):199–212.
United Nations Development Program (UNDP). 1996. *Human Development Report.* New York: Oxford University Press.
United Nations Development Program (UNDP). 1998. *Tajikistan Human Development Report 1998*. Dushanbe: UNDP.
United Nations Development Program (UNDP). 1999. *Human Development Report 1999. Globalization with a Human Face*. New York: Oxford University Press.
Vitousek P, et al. 1997. Human domination of the earth's ecosystems. *Science* 277:485–499.
Wilbanks T. 1994. "Sustainable development" in geographic perspective. *Annals* 84:541–556.
World Bank. 1996. *World Development Report.* Oxford, New York: Oxford University Press.