

## **Slow mountains: Bridging the gap between contextuality and globalised agendas in mountain development**

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### **Mountain research oriented towards sustainable development**

Sustainable development, like any other goal-oriented development, depends on available knowledge to enhance the quality of decision-making and the management of change. Sustainability science strives to produce relevant scientific knowledge in this field. With regard to mountains, a growing body of scientific knowledge is being produced covering biophysical, economic, and socio-cultural processes and dynamics of human-environment systems. However, defining sustainability is ultimately a social choice about what to develop, what to sustain, and for how long. This implies that any assessment related to sustainable development must carefully distinguish three types of knowledge: (i) systems knowledge, referring to the understanding of human-environment systems, their dynamics and processes; (ii) target knowledge, or the valuation of current problems and potentials emerging from a societal and political setting and leading to future development objectives; and (iii) transformation knowledge, or the understanding how objectives can be achieved given a particular human-environment system. Sustainable development-oriented research in mountains hence implies the integration of these three types of knowledge. Among the numerous challenges related to these tasks, the integration of knowledge across various disciplines and new modes of collaboration between scientists and decision-makers are perhaps the most prominent.

### **Slow mountains: the gap between rapidly changing global agendas and highly contextualized development options**

We illustrate the integration of system, target, and transformation knowledge using case studies from Kenya and Laos. This leads us to an important challenge for sustainable mountain development: it is well known that mountain regions manifest a high heterogeneity in biophysical, economic, and social characteristics in time and space. Moreover, external and often nested driving forces produce dissimilar development outcomes, thereby reinforcing the uniqueness of any local development context. As a result, such development contexts, understood as spatial and temporal units with similar development problems and opportunities, become more and more fragmented. No one place seems comparable to another; no strategy can be transferred from one village to another. Conversely, these contexts are increasingly interconnected and exposed to globalised drivers of change, which frequently occur at exponential rates. In terms of informed decision- and policy-making, the rapid changing drivers of development at higher levels of spatial scale stand in stark contrast to the need for highly contextualized and negotiated local mountain development. Integrated scientific knowledge production may remain useful for local development initiatives, but fails to inform relevant decisions taken at higher levels. It is neither possible to produce timely information on the infinite variety of development contexts; nor have the methodological challenges been resolved that would allow for meaningful up- and out-scaling of research results. As a result, decisions and policies are increasingly devoid of integrated knowledge, more strongly exposed to power distortions, and ultimately unable to support sustainable development.

## **Overcoming the gap: bridging scales and levels in mountain research**

Balancing highly contextual knowledge with generalization has been an important research priority for CDE in its NCCR North-South research programme. The debate on different knowledge systems in sustainable development has been linked to the debate addressing cross-scale and cross-level challenges in order to describe development contexts at the meso-level of spatial scale. The Kenyan case study shows how an *a priori* choice of an intervention context (e.g. administrative unit, watershed, economic zone) can be further differentiated by an analysis of the system and target knowledge. This has resulted in a comprehensive multi-level and multi stakeholder development strategy. In Laos, a narrow selection of development indicators allowed the analysis of recurrent linkages between poverty, resource use, market access, and policy drivers in their spatial variation. Aggregated into a typology of contexts for mountain development, this knowledge has supported national decision- and policy-making. Thereby, particular attention was paid to balancing the need for generalised policies with the call for spatially differentiated and contextualised development pathways.

## **Conclusions**

In light of progressing globalisation and global change, mountain research oriented towards sustainable development must contribute to informed decision-making beyond the local context. This ambition implies the challenge of describing different contexts of mountain development through hybrid approaches encompassing both perspectives on human-environment systems and perspectives on external claims and drivers of mountain development. Initial research reveals that recurrent patterns of such contexts emerge, which may not exclusively occur in mountain areas, but may nevertheless be considered to be typical for mountain development. We conclude that, in a perspective of sustainable development, mountains represent a distinct and relevant context that necessitates particular consideration. Given the challenge of identifying and negotiating adequate development pathways vis-à-vis rapidly changing global agendas, researchers will need to advocate for mountain contexts in the upcoming political deliberations on sustainable development.