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# Biodiversity Conservation and Management in the Hindu Kush Himalayan Region: Are Transboundary Landscapes a Promising Solution?

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Maintaining the health of biodiversity and ecosystem services is becoming an increasingly important concern for the global community. The biodiversity-rich Hindu Kush Himalayan (HKH) region provides a myriad of ecosystem services but is experiencing rapid biodiversity loss and habitat degradation under the influence of climate change and other drivers of change. Biodiversity and ecosystem services often transcend geopolitical boundaries, and biodiversity management requires efforts that span larger landscapes. Globally, a landscape approach to management is recognized for its ability to reconcile objectives of biodiversity conservation and sustainable development. In order to institutionalize the landscape approach to enhance ecological integrity and sociocultural resilience in the region, the International Centre for Integrated Mountain Development, with its partners in 8 countries, pioneered transboundary landscape (TBL) conservation and development initiatives between 2007 and 2019. This article reviews processes, outputs, and outcomes of the

4 TBLs designated and operationalized in the HKH region and distills key learning from an in-depth external evaluation of the Kailash Sacred Landscape initiative. The article draws the inference that transboundary cooperation as a collaborative process is both dynamic and evolutionary. Evidence, collaborations, inclusive partnerships, ownership, cross-border learning, joint policy influencing, and systemic thinking are key ingredients for any transboundary cooperation. TBLs have the potential to galvanize regional cooperation processes that help individual countries collectively address biodiversity conservation and development-related milestones, targets, and impacts.

**Keywords:** biodiversity conservation; landscape approach; multi-stakeholder partnerships; regional cooperation; transboundary landscapes; Hindu Kush Himalaya.

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## Introduction

Biodiversity and ecosystem services often transcend geopolitical boundaries (López-Hoffman et al 2010; Erg et al 2012). Several biodiversity conservation and management issues, such as wildlife trade, forest fires, migration of animals, watershed restoration, corridor and connectivity development, and transboundary protected area management, are transnational in nature (Liu et al 2007). Since many ecological, evolutionary, and social processes become evident at the landscape level, biodiversity management requires efforts that span larger landscapes (Baldwin et al 2018). The transboundary landscape (TBL) concept stands on the premise that ecosystem services flow beyond the administrative boundaries of any one nation and that the risk of biodiversity degradation can be reduced through common and coordinated cross-border measures (Hamilton and McMillan 2004; Sayer et al 2013).

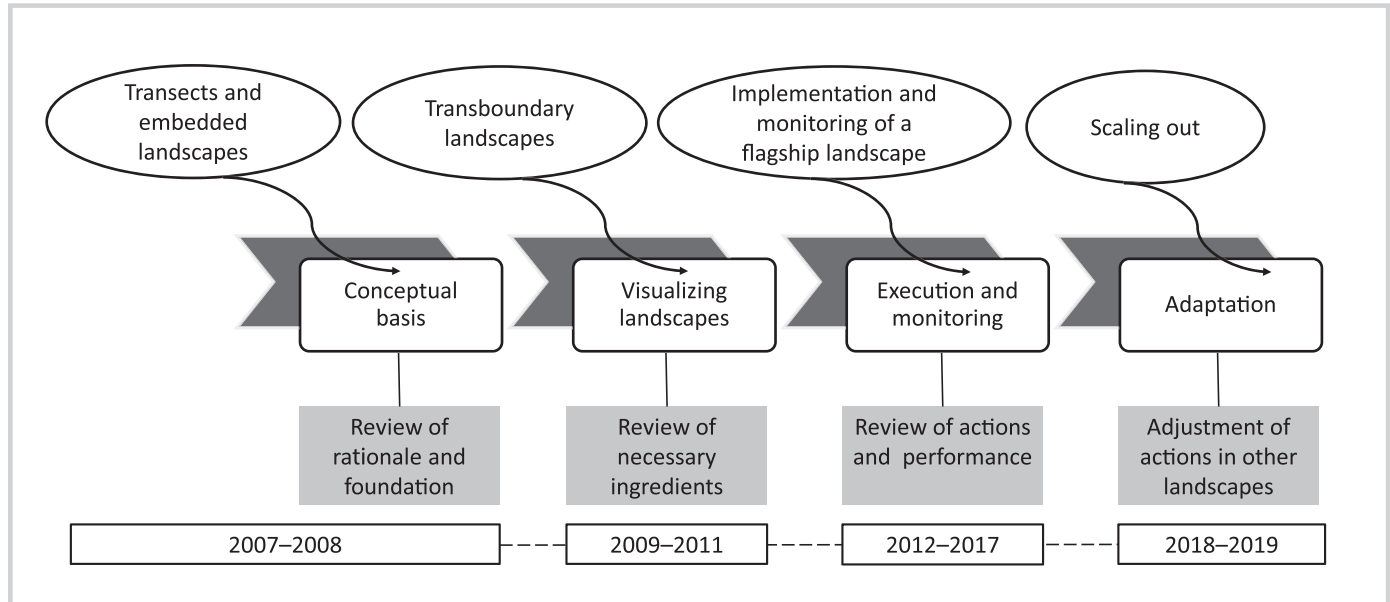
Globally, landscape management has gained attention as being vital to both long-term biodiversity management and equitable development (Reed et al 2016). It bridges boundaries across different discourses, disciplines, and values (ICIMOD 2019a) and allows biodiversity conservation measures to consider wider societal issues across political regimes (Dallimer and Strange 2015). Resource users and

managers have adopted integrated landscape approaches to sustainably reconcile objectives of biodiversity conservation and sustainable development (Frost et al 2006), build the resilience of ecosystems spread across 2 or more nations (Hamilton 2008), and address wider social, economic, and environmental objectives (Locke 2011).

As an area of high biodiversity richness, the Hindu Kush Himalayan (HKH) region hosts 4 of 36 global biodiversity hotspots, 60 of the 200 global ecoregions, and 330 Important Bird and Biodiversity Areas (Chettri et al 2008). This biodiversity provides a multitude of ecosystem services, namely food, fodder, timber, medicinal plants, genetic resources, freshwater and clean air, pollination, seed dispersal, disease regulation, hazard and erosion control, flood regulation, water purification, knowledge systems, recreation services, and provision of habitat, nutrient cycling and species evolution (Xu et al 2019). These benefit 1.9 billion people in the mountains and the downstream areas of the HKH region (Wester et al 2019).

The region is experiencing rapid biodiversity loss and habitat degradation (Sharma et al 2008). Mega-investments, such as the Belt and Road Initiative (Ascensão et al 2018), hydropower development, and regional waterways for economic development and food security (Rasul et al 2019) present new challenges to efforts aimed at conserving the

**FIGURE 1** The 4-step process used in this article to review the transboundary landscapes.



region's biodiversity resources. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) highlights that while protected area coverage in the Asia Pacific region has increased substantially, most protected areas do not effectively accommodate important biodiversity hotspots affected by economic development (IPBES 2018). In addition, the economic transformation in the Asia Pacific region will have high environmental costs, including further degradation and loss of biodiversity.

For the HKH region, sustaining the flow of ecosystem services into the future is a key challenge, as biodiverse habitats are rapidly degrading and the existing biodiversity protection mechanisms are inadequate (Xu et al 2019). Social challenges, such as poverty, inequity, cultural degradation, and vulnerable livelihoods, add to the complexity of effective biodiversity management (Gioli et al 2019). Natural resources policies and governance are not adequately decentralized (Pasakhala et al 2017) and do not acknowledge transboundary cooperation as a mechanism enabling governance for long-term biodiversity conservation (Xu et al 2019). Moreover, conservation and development strategies often conflict between sectors (Sharma et al 2010).

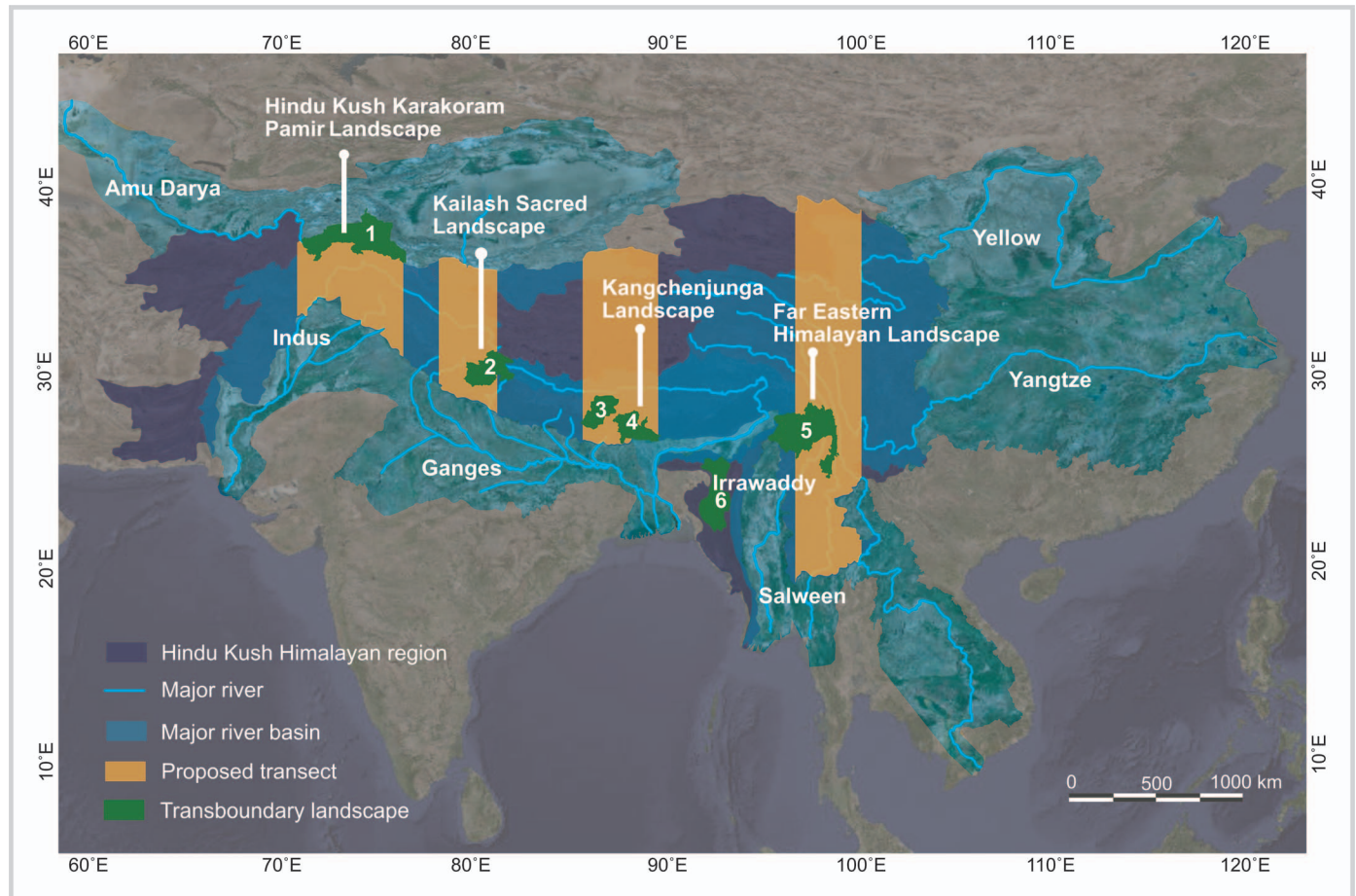
Despite many positive global actions by parties and stakeholders to achieve the Aichi Targets of the Convention on Biological Diversity, countries in the HKH region have yet to adequately consider the cross-border mechanisms and networks related to social, ecological, and economic issues that are linked to biodiversity use and conservation (Sharma et al 2007). In order to institutionalize the concept of long-term transboundary cooperation to enhance ecological integrity and sociocultural resilience in the region, as well as to help countries in the HKH link their national commitments to global conservation goals, the International Centre for Integrated Mountain Development (ICIMOD) partnered with its 8 member countries to conceptualize and operationalize the concept of trans-Himalayan transect and embedded landscapes (Sharma and Chettri 2005). In this article, we review the processes, outputs, and outcomes of

the 4 TBLs designated and operationalized in the HKH region. We consider whether TBLs can be a promising solution to facilitate collaboration for biodiversity conservation and management in a region that is geopolitically sensitive and has a rich biodiversity, a poor rural economy, and high climate change risks (Chettri et al 2010).

## Methodology

The article is based on a review of key procedures of conceptualizing, initiating, executing, and adapting TBL initiatives in 4 landscapes (Figure 1) to demonstrate whether the TBLs are a promising solution for facilitating effective biodiversity conservation and management in the region. The state-of-art review is based on analysis of project reports from HimalDoc (<https://lib.icimod.org>) and published resources. The review summarizes a process of learning, unlearning, and relearning regional cooperation for biodiversity conservation and management in the HKH region between 2007 and 2019. We begin by outlining the TBL and the trans-Himalayan transect conceptual framework that set the rationale and foundation for TBLs. This helped to define the scope and significance of TBLs in prompting an effective science–practice–policy connect for biodiversity conservation and management. Next, we elaborate on the 4 TBLs that were implemented to facilitate regional cooperation among countries to strengthen conservation and long-term monitoring outcomes. We then elaborate the operationalization and evaluation of a flagship landscape initiative—the Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI)—a TBL initiative to secure dedicated funding for full-fledged implementation (ICIMOD 2009). Finally, we reflect on the adaptation of actions in other landscapes as a part of lessons learned from KSLCDI. We conclude the article by discussing the key enabling features of the TBLs that facilitate regional cooperation for biodiversity conservation and management in countries with contiguous biodiversity resources as well as

**FIGURE 2** ICIMOD's transboundary landscapes embedded within 4 north-south trans-Himalayan transects.



common cross-border biodiversity management challenges and opportunities.

## Results and discussion

### The conceptual framework

A conceptual framework of trans-Himalayan transects and TBLs (Figure 2) was co-designed by ICIMOD and its partners in Afghanistan, Bhutan, China, India, Myanmar, Nepal, and Pakistan (ICIMOD 2008). It arose from the realization that combating the threats to biodiversity and ecosystem services is a global issue requiring strong interfaces across science, practice, policy, and societies at different scales (Sharma et al 2010). The essence was to carve an effective pathway for regional cooperation, capturing milestones and targets set by global multilateral instruments (Chettri and Shakya 2010). The framework elaborated on the 4 fundamental principles of promoting integrated and participatory approaches in ecosystem management, integrating multi-stakeholders priorities, promoting regional acceptance of common frameworks between nations, and collectively contributing to global policy processes (Shakya et al 2012). It served as a holistic framework to address the biodiversity data gap in the region as indicated by the fourth report of the Intergovernmental Panel on Climate Change (IPCC 2007), and to simultaneously tackle environmental, socioeconomic, and political challenges for biodiversity conservation and

management beyond the administrative and management boundary of one nation (Bennett et al 2015).

### Orchestrating 4 transboundary landscapes

The TBLs were designated to serve as a prospective geographic unit to operationalize the framework described earlier. They were conceptualized as entry points to facilitate long-term regional cooperation for biodiversity conservation and monitoring (Chettri et al 2009) and to trigger ecological and socioeconomic resilience (Shakya et al 2012). In order to be representative of the entire HKH region, 6 TBLs were identified, but operationalized in 4 landscapes (see Figure 2; Table 1). The rationale was to select a landscape where 2 or more countries could participate and where countries have some level of ecosystem, economic, and sociocultural connection (Sharma and Chettri 2005).

The approach to conservation and development in the 4 TBLs included codefining challenges and opportunities with institutions in partner countries sharing the landscapes, building a shared understanding of pressing issues that cut across different countries, coformulating impact pathways based on common transnational contexts and visions, and facilitating interventions promoting transboundary cooperation (Sharma and Chettri 2005; Gurung et al 2019). The theory of change pathway (Figure 3) included analysis of intermediary outcomes that served as milestones to achieve the intended long-term impact or shared goals. These were: enhanced biodiversity and ecosystem services; reduced



**TABLE 1** Key geographical features of the 4 transboundary landscapes in the Hindu Kush Himalaya.

Landscape (west to east)	Participating countries	Key landscape feature	Total area (km <sup>2</sup> )	Total population
Hindu Kush Karakoram Pamir Landscape (HKPL)	Afghanistan, China, Pakistan, Tajikistan	High alpine and endangered species	67,506	1,000,000
Kailash Sacred Landscape (KSL)	China, India, Nepal	Sacred landscape with high cultural significance	31,000	1,300,000
Kangchenjunga Landscape (KL)	Bhutan, India, Nepal	Corridors and habitat connectivity	25,085	7,248,293
Landscape Initiative for the Far-Eastern Himalaya (HI-LIFE)	China, India, Myanmar	Biodiversity hotspots and high endemism	71,452	213,600

poverty through sustainable use of rich biodiversity and sociocultural resources; enhanced resilience with better capacities, skills, institutions, and governance; and adaptive learning to combat future uncertainties (ICIMOD 2014b). The focus was on continuous deliberation, negotiations, and adaptive learning under a common regional cooperation framework (RCF) as well as on integration of multiple institutions to increase accountability and ownership among the institutions (ICIMOD et al 2017a). The long-term goals for transboundary cooperation provided various avenues for countries to discuss more-win and less-loss outcomes for biodiversity management and sustainable development in the region (Kotru et al 2020).

Process-wise, cooperation through TBLs takes time. In the context of the 4 TBLs, it took 1–2 years of consultation to set the stage for transboundary collaboration, followed by 4–5 years of joint actions and capacity enhancement and 2–3 years of evaluation and iterative refining of impact pathways (Kotru et al 2020). Designating the boundaries of a functional TBL was a crucial first step. It required an iterative, inclusive, and consultative process among a range of stakeholders comprising representatives from relevant government and nongovernment institutions, development institutions, academia, community-based institutions, and private sectors at local, subnational, and national scales (Zomer and Oli 2011). Likewise, regional-scale discussions among the countries were necessary to develop shared understanding among countries and to define long-term impact pathways for the TBL (ICIMOD 2014a; Gurung et al 2019). The other crucial step was the endorsement of the RCF as a soft guideline for cooperation jointly developed by the relevant government agencies of the individual countries (ICIMOD et al 2017a). The RCF outlined principles for regional cooperation and investments needed, partnerships, and institutional modalities. It reinforced the ownership of transboundary interventions by governments of individual countries and their commitments toward joint implementation and emphasized the roles of third-party institutions and donor partners in influencing the pace of regional cooperation.

### Operationalizing the flagship Kailash Sacred Landscape initiative

KSLCDI was implemented between 2011 and 2017 (Box 1). The objective was to strengthen relationships between the governments of China, India, and Nepal to mainstream sustainable ecosystem management approaches and

practices into local and national policies and plans for inclusive socioeconomic development (ICIMOD 2009).

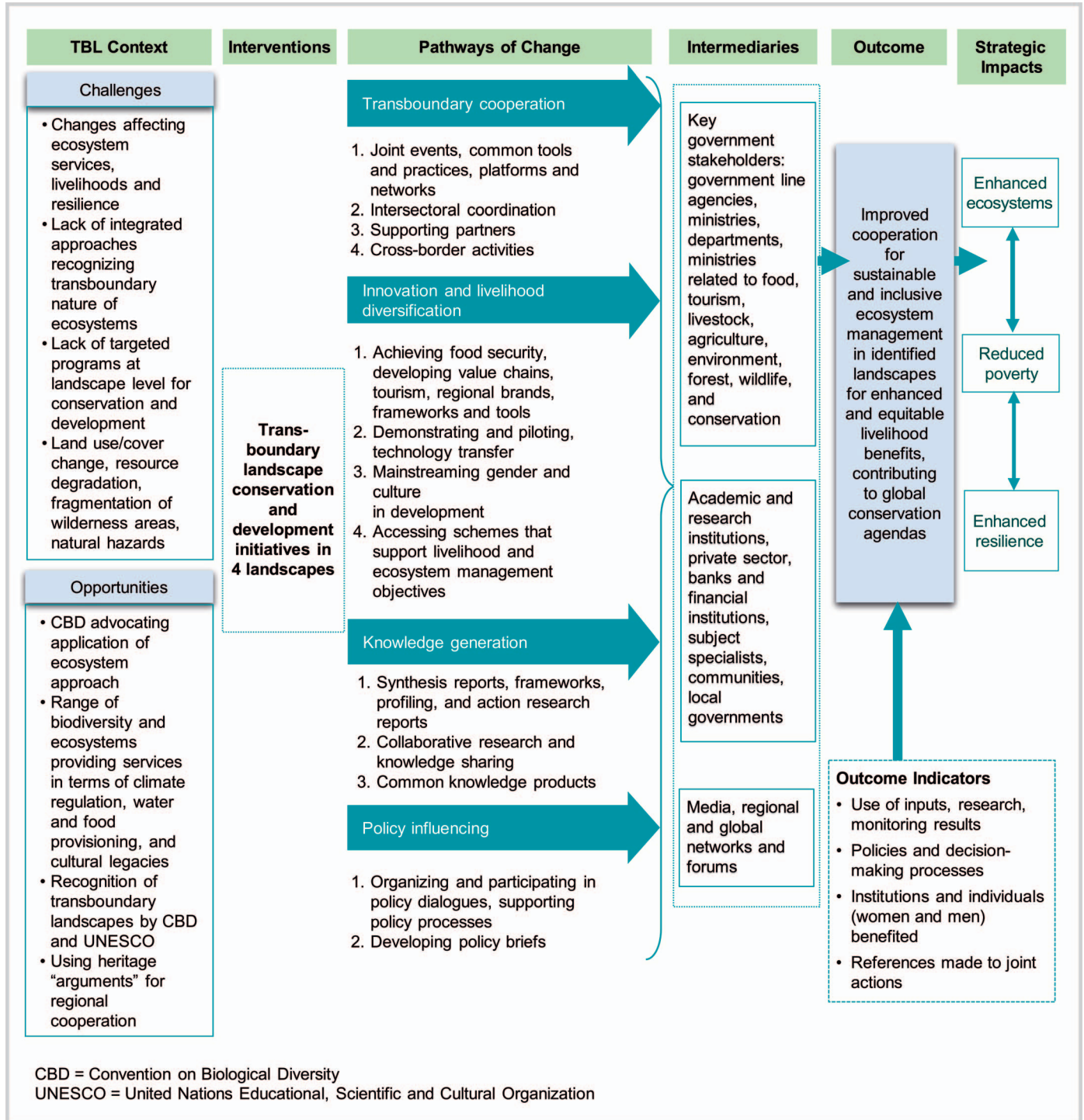
The initiative adopted 5 programmatic components: innovative livelihoods; ecosystem management; access and benefit sharing; long-term environmental and socioecological monitoring; and regional cooperation, enabling policies, and knowledge management. The initiative was reviewed through a rigorous external evaluation (Box 2). It concluded that despite a slow start transboundary cooperation has improved intercountry cooperation and was successful in terms of setting milestones and impacts through iterative consultative processes.

In the following we distill the key positive impressions from the review:

- **Successful facilitation of shared vision and impact pathway.** The process clarified knowledge, behavior, skills, and relationships among actors to identify what could be collectively achieved. Developing a shared vision served as the basis for collaborative and adaptive landscape-level planning and formalization of partners' agreements and implementation plans (ICIMOD 2013).
- **Development of harmonized frameworks, manuals, tools, and protocols.** These included a framework for long-term environmental and socioecological monitoring (Chettri et al 2015), integrated ecosystem services management (Yi et al 2017), assessment of cultural ecosystem services of sacred natural sites (Pandey et al 2016), a manual on invasive alien species (Bisht et al 2016), rangeland assessment protocol (Joshi et al 2019), ecosystem services (Bubb et al 2017), and a landscape journey process tool (Rathore et al 2019). These documents have been globally recognized as important tools to aid regional cooperation (ADB 2019) and were meant to strengthen the scientific evidence base.
- **Multi-stakeholder engagement and partnerships development.** The process enabled joint actions among a wide range of actors with different perspectives, strengths, opinions, ideas, experience, and expertise, for example, on cross-border trade fairs and festivals (ICIMOD 2019c; Wallrapp et al 2019), value chain development (ICIMOD 2016; Adhikari et al 2018), flagship species conservation (Ning et al 2016), and protected areas networking (ICIMOD 2019c).

The effectiveness of the TBLs was also highlighted in terms of interdisciplinary scientific contributions and outreach. These included understanding traditional practices and knowledge of indigenous communities (Negi et

FIGURE 3 Impact pathway for implementing conservation and development initiatives in transboundary landscapes of the Hindu Kush Himalaya.



al 2018), understanding cultural heritage (Pandey et al 2016), sustainable utilization of non-timber forest products (Upreti et al 2016), assessment of forest composition (Kunwar et al 2019), valuation of ecosystem services (Nepal et al 2017, 2018), identification of invasive alien species (Thapa et al 2018), management of agrobiodiversity (Aryal et al 2017), incorporation of traditional agricultural and medicinal practices (Atreya et al 2017; Chaudhary et al 2017), and creation of a science–policy interface focusing on access and benefit sharing (UBD 2017).

The review also drew attention to the limitations of TBLs, particularly as a time-consuming and consultation-intensive process, requiring sensitivity to geopolitical uncertainties. If policy-level synergies are weak, impacts on the ground can be difficult to achieve or ground efforts are wasted. Also, a significant amount of time and resources are needed to address national-level institutional issues and capacities for regional cooperation. Thus, the focus remained more on implementing conservation and innovative livelihoods

**BOX 1: KSLCDI objectives in 4 stages**

**Preparatory stage (2007–2008)** was for the countries to understand, acknowledge, and agree to the need for regional cooperation in a certain geographic area of transboundary relevance. It garnered strategic agreement toward developing the TBL initiative. Stakeholder mapping was also carried out.

**Start-up stage (2009–2010)** was to begin the consultative process and develop shared understanding, carry out feasibility and baseline studies, discuss the theory of change for defining result chain logic, and prepare integrated strategies, action plans, and a cooperation framework, including regional monitoring and evaluation framework and strategies.

**Pre-implementation stage (2011–2012)** was to define partnerships engagement mechanisms including governance and institutional setups and communication strategies for implementation.

**Implementation stage (2013–2017)** was to roll out regional- and national-level interventions related to research, management, policy, and capacity strengthening, including reflective monitoring and reviews as well as knowledge dissemination.

Source: Kotru et al 2017; ICIMOD 2019d

development actions in pilot areas, and scaling out was not spontaneous.

**Adaptation in other landscapes**

TBL concepts in other landscapes were further refined using the lessons from KSLCDI and had more focus on transboundary cooperation at the regional scale. Priority was given to joint monitoring of protected areas (ICIMOD 2019d), biodiversity knowledge mapping across the landscapes (Basnet et al 2019; Kandel et al 2019, Joshi et al 2020), biodiversity research gaps and trends (Kandel et al 2016), assessment of habitat suitability and distribution of key species (ICIMOD et al 2017b; Uddin et al 2019), human-wildlife conflicts (ICIMOD 2019b), and regional ecotourism (Lama et al 2019). Bilateral provisions for environmental conservation, protected areas, and forest management (Kotru et al 2015) as well as transboundary trade (ICIMOD 2019c) were emphasized, together with opportunities for collaborative leveraging of funds (Sharma 2017), and for technology transfer and capacity building (ICIMOD 2019d).

**Conclusion**

Transboundary cooperation built on consultative and iterative dialogues—where sovereign nations have a mutual understanding of the landscape approach—has the potential to overcome cultural and historical barriers, tackle common challenges over natural resources, and promote long-term biodiversity conservation and management (ICIMOD 2019c). The TBLs in the HKH region have received global attention for their ability to facilitate mutual understanding of shared ecosystems across international boundaries and joint decision-making and management (SGS 2016). They can be a

**BOX 2: External review and evaluation of KSLCDI**

The KSLCDI evaluation was conducted by a third party and based on Paris Aid Effectiveness criteria as suggested by the Organisation for Economic Co-operation and Development's Development Assistance Committee (OECD-DAC). The overall rating was based on 5 criteria: *relevance* (are we doing the right thing?), *effectiveness* (can project objectives be achieved?), *impact* (are we contributing to the overarching result of conservation and development?), *efficiency* (are objectives being achieved in cost-effective ways), and *sustainability* (are the result achieved durable?). The initiative was rated successful with an overall score of 12.4 out of 16 points, with 14 points for *relevance and sustainability*, 13 for *effectiveness*, 12 for *impact*, and 9 for *efficiency* (ICIMOD 2019d). Prior to the external evaluation, the project also underwent a full midterm review in 2016. This included in-depth in-country assessments of the project progress. It assessed the 5 module objectives: establishment of biodiversity corridors, adoption of approaches to ecosystem management and conservation, enhanced household incomes, organizational structure and monitoring processes of ICIMOD as the facilitating institution, and knowledge platforms for developing cooperation. The external review also considered the findings of the midterm review, which concluded that the module objective related to improving the state of ecosystems was achievable and realistic, whereas the module related to sustainable livelihoods was overambitious. Likewise, the review acknowledged the pivotal role of intergovernmental organizations, such as ICIMOD, toward facilitating collaboration and coordination at all scales—local, subnational, national, regional, and global.

Source: ICIMOD 2019d

promising solution for promoting transboundary cooperation for biodiversity conservation and management through the following:

- **Triggering collaboration with a nonpolitical entry point.** This refers to technical collaborations and research on themes of global concern, such as climate change, biodiversity conservation, wildlife management, ecosystem services and valuation, and human-wildlife conflict, rather than issues of political sensitivity, such as illegal trade and migration. Codevelopment of knowledge on landscape elements, such as resource availability, distribution, and use, are vital to providing a realistic scenario for transboundary cooperation.
- **Communicating risk and scientific evidence.** Achievements, lessons, and risks have to be regularly monitored and evaluated, and proactive communication and institutional pathways are required for the uptake of scientific findings for policies, as in the case of caterpillar fungus (*Ophiocordyceps sinensis*) management in KSLCDI (MoFSC 2017). The state government of Uttarakhand, India, and the national government of Nepal used scientific learnings from KSLCDI to improve the policy on and practice of managing caterpillar fungus. Essentially, this is about



careful articulation of the needs of local stakeholders and their narrowing down to ground-level conservation and development challenges, while forging cooperation between actors and sectors at scale.

- **Developing early and inclusive partnerships.** Landscape-level stakeholder interfaces support greater understanding of a TBL and the opportunities it presents. Such interfaces influence partner synergy, ownership, local stewardships, participatory planning, demand-oriented policies development, and landscape financing (eg by linking interventions to public schemes at district level).
- **Strengthening ownership by countries.** Biodiversity management and sustainable development require long-term national commitments and investments. Efforts to leverage intra- and intercountry resources should start from the early stages of transboundary cooperation. Effective coordination with strategic, implementation, knowledge, and development partners and proactive communication of knowledge and evidence from the ground level create ownership. It is necessary to capitalize on subnational delivery systems where public investments are handled.
- **Creating a local-national-global cross-border interface for learning and policy influencing.** Biodiversity and environmental governance need to bring positive local outcomes and must be supported through subnational and national policy mechanisms. Transboundary cooperation built upon mutual areas of interest, such as national commitments to global agendas, trigger effective cross-exchange of policy learning and adoption at the national level. Regular engagement with decision-makers enhances country ownership of TBLs and strengthens existing cross-border institutional mechanisms already endorsed by countries.

In regions, such as the HKH, where the rural economy relies on the diversity of ecosystem services and benefits from biodiversity resources, the TBLs can scale the process of cooperation to restore the intricate balance between economic interests and ecological imperatives (Molden et al 2017). In the HKH region, facilitating regional cooperation for conservation and management was possible through robust partnerships among governments, academia, businesses, and civil society, complemented with effective communication and learning among the countries (Kotru et al 2020). Strong scientific evidence on the ground triggered policy engagement around key transnational issues and global commitments. Institutional efforts at all scales were vital to innovating science–practice–policy processes. Although the TBL approach comes with a wide range of risks—political sensitivity, conflicts, disasters, and security situations—it can be concluded that TBLs have the potential to be a promising solution for galvanizing regional cooperation processes to help individual countries collectively address biodiversity conservation and development-related milestones, targets, and impacts.

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## REFERENCES

- ADB [Asian Development Bank]**. 2019. *Strengthening the Environmental Dimensions of the Sustainable Development Goals in Asia and the Pacific: Tool Compendium*. Metro Manila, Philippines: ADB and UN Environment [United Nations Environment Programme].
- Adhikari L, Shrestha AJ, Dorji T, Lemke E, Subedee BR**. 2018. Transforming the lives of mountain women through the Himalayan nettle value chain: A case study from Darchula, Far West Nepal. *Mountain Research and Development* 38(1): 4–13.
- Aryal K, Poudel S, Chaudhary RP, Chettri N, Ning W, Shaoliang Y, Kotru R**. 2017. Conservation and management practices of traditional crop genetic diversity by the farmers: A case from Kailash Sacred Landscape, Nepal. *Journal of Agriculture and Environment* 18:15–28.
- Ascensão F, Fahrig L, Clevenger AP, Corlett RT, Jaeger JA, Laurance WF, Pereira HM**. 2018. Environmental challenges for the Belt and Road Initiative. *Nature Sustainability* 1(5):206–209.
- Atreya K, Pyakurel D, Thagunna KS, Bhatta LD, Uprety Y, Kotru R, Oli BN, Rimal S, Chaudhary RP**. 2017. *Traditional Agricultural and Medicinal Practices in the Kailash Sacred Landscape, Nepal*. ICIMOD Working Paper 2017/12. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Baldwin RF, Trombulak SC, Leonard PB, Noss RF, Hilty JA, Possingham HP, Scarlett L, Anderson MG**. 2018. The future of landscape conservation. *BioScience* 68(2):60–63.
- Basnet D, Kandel P, Chettri N, Yang Y, Lodhi MS, Htun NZ, Uddin K, Sharma E**. 2019. Biodiversity research trends and gaps from the confluence of three global biodiversity hotspots in the far-eastern Himalaya. *International Journal of Ecology* 2019. <https://doi.org/10.1155/2019/1323419>.
- Bennett EM, Cramer W, Begossi A, Cundill G, Diaz S, Egoh BN, Geizendorfer IR, Krug CB, Lavorel S, Lazos E**. 2015. Linking biodiversity, ecosystem services, and human well-being: Three challenges for designing research for sustainability. *Current Opinion in Environmental Sustainability* 14:76–85.
- Bisht N, Joshi S, Shrestha BB, Yi S, Chaudhary RP, Kotru R, Wu N**. 2016. *Manual on Invasive Alien Plant Species in Kailash Sacred Landscape-Nepal*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Bubb P, Soesbergen AV, Bisht N, Singh S, Joshi S, Aryal K, Danks FS, Rawat GS, Bhuchar S, et al**. 2017. *Planning Management for Ecosystem Services—An Operations Manual*. ICIMOD Manual 2017/5. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Chaudhary RP, Bhattarai SH, Basnet G, Bhatta KP, Uprety Y, Bhatta LD, Kotru R, Oli BN, Sharma LN, Khanal S, Sharma UR**. 2017. *Traditional Practice and Knowledge of Indigenous and Local Communities in Kailash Sacred Landscape, Nepal*. ICIMOD Working Paper 2017/1. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Chettri N, Bubb P, Kotru R, Rawat G, Ghate R, Murthy MSR, Wallrapp C, Pauli H, Shrestha AB, et al**. 2015. *Long-term Environmental and Socio-ecological Monitoring in Transboundary Landscapes: An Interdisciplinary Implementation Framework*. ICIMOD Report. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Chettri N, Shakya B**. 2010. Conservation connectivity in transboundary landscapes. In: Grekin J, editor. *Biodiversity and Climate Change: Achieving the 2020 Targets*. Abstracts of Posters Presented at the 14th Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity, 10–21 May 2010, Nairobi, Kenya. Technical Series No. 51. Montreal, Canada: SCBD [Secretariat of the Convention on Biological Diversity], pp 42–44.
- Chettri N, Shakya B, Thapa R, Sharma E**. 2008. Status of a protected area system in the Hindu Kush-Himalayas: An analysis of PA coverage. *International Journal of Biodiversity Science and Management* 4(3):164–178.
- Chettri N, Sharma E, Shakya B, Thapa R, Bajracharya B, Uddin K, Oli KP, Choudhury D**. 2010. *Biodiversity in the Eastern Himalayas: Status, Trends and Vulnerability to Climate Change*. Climate Change Impact and Vulnerability in the Eastern Himalayas Technical Report 2. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Chettri N, Sharma E, Thapa R**. 2009. Long term monitoring using transect and landscape approaches within Hindu Kush Himalayas. In: Sharma E, editor. *Proceedings of the International Mountain Biodiversity Conference, Kathmandu, 16–18 November 2008*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development], pp 201–208.



- Dallimer M, Strange N.** 2015. Why socio-political borders and boundaries matter in conservation. *Trends in Ecology & Evolution* 30(3):132–139.
- Erg B, Vasilijević M, McKinney M.** 2012. *Initiating Effective Transboundary*. Gland, Switzerland, and Belgrade, Serbia: IUCN [International Union for Conservation of Nature].
- Frost P, Campbell BM, Medina G, Usongo L.** 2006. Landscape-scale approaches for integrated natural resource management in tropical forest landscapes. *Ecology and Society* 11(2):30. <http://www.ecologyandsociety.org/vol11/iss2/art30/>.
- Gioli G, Thapa G, Khan F, Dasgupta P, Nathan D, Chettri N, Adhikari L, Mohanty SM, Aurino E, Scott LM.** 2019. Understanding and tackling poverty and vulnerability in mountain livelihoods in the Hindu Kush Himalaya. In: Wester P, Mishra A, Mukherji A, Shrestha AB, editors. *The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People*. Cham, Switzerland: Springer, pp 421–455. <https://doi.org/10.1007/978-3-319-92288-1>.
- Gurung J, Chettri N, Sharma E, Ning W, Chaudhary RP, Badola HK, Wangchuk S, Uprety Y, Gaira KS, Bidha N.** 2019. Evolution of a transboundary landscape approach in the Hindu Kush Himalaya: Key learnings from the Kangchenjunga Landscape. *Global Ecology and Conservation* 17:e00599. <https://doi.org/10.1016/j.gecco.2019.e00599>.
- Hamilton L.** 2008. How Can Biosphere Reserve Managers Address the Impacts of Climate Change and Global Warming on Biodiversity? An Overview of Some Global Efforts [unpublished paper presented at the conference Mauvais temps pour la nature? Schlechtes Wetter für Die Natur? Fischbach bei Dahm, Germany, 21–22 October 2008. Available from corresponding author of this article.
- Hamilton LS, McMillan L.** 2004. *Guidelines for Planning and Managing Mountain Protected Areas*. Gland, Switzerland and Cambridge, United Kingdom: IUCN [International Union for Conservation of Nature].
- ICIMOD [International Centre for Integrated Mountain Development].** 2008. *Proceedings of the International Mountain, Biodiversity Conference*. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2009. *Kailash Sacred Landscape Conservation Initiative: Developing a Transboundary Cooperation Framework for Conservation and Sustainable Development in the Greater Mt Kailash of China, India, and Nepal*. Project Flyer. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2013. *Monitoring and Evaluation Framework for Kailash Sacred Landscape Conservation and Development Initiative (KSLCDI)*, Project Countries: China, India and Nepal. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2014a. *Institutionalizing Theory of Change & Impact Pathways: The Case of ICIMOD*. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2014b. *Towards Developing the Brahmputra-Salween Landscape—Conservation and Development Initiative*. Report on the Third Regional Consultation on Developing Transboundary Cooperation for Brahmputra-Salween Landscape Conservation and Development Initiative (BSLCDI). Internal Report. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2016. *Building Climate Resilient Value Chains in the Kailash Sacred Landscape, Nepal*, 26–27 May 2016. Workshop Report. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2019a. *Bridging Boundaries: Strengthening Regional Cooperation Across Transboundary River Basins and Landscapes in the Hindu Kush Himalaya*. ICIMOD Report No. 4. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2019b. *Converting Conflicts to Consensus: A Road Map for Mitigating Human–Wildlife Conflict in the Kangchenjunga Landscape*. Flyer. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2019c. *Harmonizing Conservation and Development Along the Silk Road. Facilitating a Network of Protected Areas in the Hindu Kush, Karakoram, and Pamir*. ICIMOD Proceedings 2019/1. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development].** 2019d. *Kailash Sacred Landscape Conservation and Development Initiative Phase I Report 2012–2017*. ICIMOD Report. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development], WCD [Wildlife Conservation Division], GBPNIHESD [GBPant National Institute of Himalayan Environment and Sustainable Development], RECAST [Research Centre for Applied Science and Technology].** 2017a. *Kangchenjunga Landscape Conservation and Development Strategy and Regional Cooperation Framework*. ICIMOD Working Paper 2017/2. Kathmandu, Nepal: ICIMOD.
- ICIMOD [International Centre for Integrated Mountain Development], WCD [Wildlife Conservation Division], GBPNIHESD [GBPant National Institute of Himalayan Environment and Sustainable Development], RECAST [Research Centre for Applied Science and Technology].** 2017b. *Kangchenjunga Landscape Feasibility Assessment Report*. ICIMOD Report No. 9. Kathmandu, Nepal: ICIMOD.
- IPBES [Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services].** 2018. *Summary for Policymakers of the Regional Assessment Report on Biodiversity and Ecosystem Services for Asia and the Pacific of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. Bonn, Germany: IPBES Secretariat.
- IPCC [Intergovernmental Panel on Climate Change].** 2007. *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: IPCC.
- Joshi S, Shrestha L, Bisht N, Wu N, Ismail M, Dorji T, Dangol G, Long R.** 2020. Ethnic and cultural diversity amongst yak herding communities in the Asian highlands. *Sustainability* 12:957.
- Joshi S, Yi S, Jinniu W, Pasakhala B, Ismail M, Bisht N, Qamar FM, Long R, Wu N, Foggín M, et al.** 2019. *Rangeland Resource and Use Assessment Protocol, Manual*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Kandel P, Chettri N, Chaudhary RP, Badola HK, Gaira KS, Wangchuk S, Bidha N, Uprety Y, Sharma E.** 2019. *Kangchenjunga Landscape*. Eastern Himalayas. *Plant diversity* 41(3):153–165 DOI: 10.1016/j.pld.2019.04.006.
- Kandel P, Gurung J, Chettri N, Ning W, Sharma E.** 2016. Biodiversity research trends and gap analysis from a transboundary landscape, Eastern Himalayas. *Journal of Asia-Pacific Biodiversity* 9(1):1–10.
- Kotru R, Chaudhari S, Lemke E, Mueller M, Chettri R, Basnet S, Shaoliang Y.** 2017. *Kailash Sacred Landscape Conservation and Development Initiative (2012–2017). Annual Progress Report 2016*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Kotru R, Pradhan N, Shakya B, Amatya S, editors.** 2020. *Beyond Boundaries: Contouring Transboundary Landscapes in the Hindu Kush Himalaya*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Kotru R, Rathore BMS, Pradhan N, Bhatta LD, Acharya G, Karky B, Sigdel S, Bhojvaid PP, Gera N, Sharma S.** 2015. *Transforming Mountain Forestry in the Hindu Kush Himalayas: Toward a Third-Generation Forest Management Paradigm*. ICIMOD Working Paper 2015/9. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Kunwar R, Fadiman MH, Suwal M, Adhikari Y, Baral K, Bussmann R, Ramakrishnan S.** 2019. Composition of forests and vegetation in the Kailash Sacred Landscape, Nepal. *Journal of Forestry Research* online first. <https://doi.org/10.1007/s11676-019-00987-w>.
- Lama AK, Kandel P, Chaudhary S, Dema K, Uprety Y, Gaira K, Pandey A, Dorji T, Chettri N.** 2019. *Transboundary Ecotourism in the Kangchenjunga Landscape: Opportunities for Sustainable Development Through Regional Cooperation*. ICIMOD Working Paper 2019/4. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Liu J, Dietz T, Carpenter SR, Folke C, Alberti M, Redman CL, Schneider SH, Ostrom E, Pell AN, Lubchenco J.** 2007. Coupled human and natural systems. *AMBIO: A Journal of the Human Environment* 36(8):639–650.
- Locke H.** 2011. Transboundary cooperation to achieve wilderness protection and large landscape conservation. *Park Science* 28(3):24–28.
- López-Hoffman L, Varady RG, Flessa KW, Balvanera P.** 2010. Ecosystem services across borders: a framework for transboundary conservation policy. *Frontiers in Ecology and the Environment* 8(2):84–91.
- MoFSC [Ministry of Forest and Soil Conservation].** 2017. *Yartsagumba Management: Collection and Transportation Directive*. Kathmandu: Government of Nepal.
- Molden D, Sharma E, Shrestha AB, Chettri N, Pradhan NS, Kotru R.** 2017. Advancing regional and transboundary cooperation in the conflict-prone Hindu Kush – Himalaya. *Mountain Research and Development* 37:502–508. doi: 10.1659/MRD-JOURNAL-D-17-00108.1.
- Negi VS, Pathak R, Sekar KC, Rawal RS, Bhatt ID, Nandi SK, Dhyani PP.** 2018. Traditional knowledge and biodiversity conservation: a case study from Byans Valley in Kailash Sacred Landscape, India. *Journal of Environmental Planning and Management* 61(10):1722–1743.
- Nepal M, Das S, Rai RK, Bhatta LD, Somanathan E, Kotru R, Khadayat MS, Rawal RS, Negi GCS.** 2017. *Valuation of Ecosystem Services in the Kailash Sacred Landscape*. ICIMOD Research Report 2017/2. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Nepal M, Rai KR, Das S, Bhatta DL, Kotru R, Khadayat SM, Rawal SR, Negi CG.** 2018. Valuing cultural services of the Kailash Sacred Landscape for Sustainable Management. *Sustainability* 10:3638. DOI: 10.3390/su10103638.
- Ning W, Shaoliang Y, Joshi S, Bisht N.** 2016. *Yak on the Move: Transboundary Challenges and Opportunities for Yak Raising in a Changing Hindu Kush Himalayan Region*. Special Publication. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Pandey A, Kotru R, Pradhan N.** 2016. *A Framework for the Assessment of Cultural Ecosystem Services of Sacred Natural Sites in the Hindu Kush Himalayas: Based on Fieldwork in the Kailash Sacred Landscape Regions of India and Nepal*. ICIMOD Working Paper 2016/8. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Pasakhala B, Ghate R, Kotru R.** 2017. *Integrating Conservation and Development in Transboundary Landscapes: Looking Back to Move Forward*. ICIMOD Working Paper 2017/18. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Rasul G, Neupane N, Hussain A, Pasakhala B.** 2019. Beyond hydropower: Towards an integrated solution for water, energy and food security in South Asia. *International Journal of Water Resources Development* online first. <https://doi.org/10.1080/07900627.2019.1579705>.
- Rathore B, Shakya B, Rawal R, Semwal R, Kotru R, Dorji T.** 2019. *Landscape Journey: A Process Tool for Facilitating Conservation and Sustainable Development*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].
- Reed J, Van Vianen J, Deakin EL, Barlow J, Sunderland T.** 2016. Integrated landscape approaches to managing social and environmental issues in the

tropics: learning from the past to guide the future. *Global Change Biology* 22(7):2540–2554.

**Sayer J, Sunderland T, Ghazoul J, Pfund JL, Sheil D, Meijaard E, Venter M, Boedhihartono AK, Day M, Garcia C, Van Oosten C.** 2013. Ten principles for a landscape approach to reconciling agriculture, conservation, and other competing land uses. *Proceedings of the National Academy of Sciences* 110(21):8349–8356.

**SGS.** 2016. *Annual Report (The Sustainability Report)*. Geneva, Switzerland: SGS. <https://www.sgs.com/en/our-company/corporate-sustainability/sustainability-reports/2016-report>, accessed on 31 July 2020.

**Shakya B, Chettri N, Rawat GS.** 2012. *Transboundary Landscape Management Framework for Ecological and Socioeconomic Resilience*. ICIMOD Working Paper 2012/7. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].

**Sharma E.** 2017. China–India collaborative opportunities on science and technology for sustainable development of the Hindu Kush Himalaya. *Science Bulletin* 10:673–674.

**Sharma E, Chettri N.** 2005. ICIMOD's transboundary biodiversity management initiative in the Hindu Kush–Himalayas. *Mountain Research and Development*. 25(3):278–282.

**Sharma E, Chettri N, Gurung J, Shakya B.** 2007. *The Landscape Approach in Biodiversity Conservation: A Regional Cooperation Framework for Implementation of the Convention on Biological Diversity in the Kangchenjunga Landscape*. ICIMOD Proceedings. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].

**Sharma E, Chettri N, Oli KP.** 2010. Mountain biodiversity conservation and management: A paradigm shift in policies and practices in the Hindu Kush-Himalayas. *Ecological Research* 25(5):909–923.

**Sharma E, Tse-ring K, Chettri N, Shrestha A.** 2008. Biodiversity in the Himalayas—Trends, perception and impacts of climate change. In: Sharma, E, editor. *Proceedings of the International Mountain Biodiversity Conference 2008*. Kathmandu, Nepal: ICIMOD, pp 40–53.

**Thapa S, Chitale V, Rijal SJ, Bisht N, Shrestha BB.** 2018. Understanding the dynamics in distribution of invasive alien plant species under predicted climate

change in Western Himalaya. *PLoS One* 13(4):e0195752. DOI:10.1371/journal.pone.0195752.

**UBD [Uttarakhand Biodiversity Board].** 2017. *Study on Science-Policy Interface focusing ABS and Trans-boundary Issues*. Kailash Sacred Landscape Conservation and Development Initiative. Dehradun, India: Uttarakhand Biodiversity Board.

**Uddin K, Chettri N, Yang Y, Lodhi MS, Htun NZ, Sharma E.** 2019. Integrating geospatial tools and species for conservation planning in a data-poor region of the Far Eastern Himalayas. *Geology, Ecology, and Landscapes* (2019):1–16.

**Upriy Y, Poudel RC, Chaudhary RP, Oli BN, Bhatta LD, Baral SP.** 2016. *Sustainable Utilization and Conservation of Nontimber Forest Products: Major Species of Kailash Sacred Landscape Nepal*. Ministry of Forests and Soil Conservation [MoFSC], Government of Nepal; Research Centre for Applied Science and Technology [RECAST], Tribhuvan University; and International Centre for Integrated Mountain Development [ICIMOD] Report. Kathmandu, Nepal: ICIMOD.

**Wallrapp C, Faust H, Keck M.** 2019. Production networks and borderlands: Cross-border yarsagumba trade in the Kailash Landscape. *Journal of Rural Studies* 66:67–76.

**Wester P, Mishra A, Mukherji A, Shrestha AB.** 2019. *The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People*. Basel, Switzerland: Springer Nature. DOI: 10.1007/978-3-319-92288-1.

**Xu J, Badola R, Chaudhary RP, Zomer R, Pokhrel B, Hussain SA, Pradhan S, Pradhan R.** 2019. Sustaining biodiversity and ecosystem services in the Hindu Kush Himalaya. In: Wester P, Mishra A, Mukherji A, Shrestha AB, editors. *The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People*. Basel, Switzerland: Springer Nature, pp 127–166. DOI: 10.1007/978-3-319-92288-1.

**Yi S, Rawat G, Wu N, Bubb P, Chettri N, Kotru R, Sharma E, Bhatta L, Bisht N, Aryal K, et al.** 2017. *Framework for Integrated Ecosystem Management in the Hindu Kush Himalaya*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].

**Zomer R, Oli KP.** 2011. *Kailash Sacred Landscape Conservation Initiative—Feasibility Assessment Report*. Kathmandu, Nepal: ICIMOD [International Centre for Integrated Mountain Development].