Conservation Science
Translating Knowledge into Actions

# Conservation Biology of the Himalayas

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The need for Conservation Biology of specific species and ecosystems has been widely acknowledged worldwide. This is demonstrated by, among other things, scientific publications devoted to conservation biology of specific species and ecosystems (e.g. Glenn et al. 2001, Gower and Wilkinson 2005, Pratt 2009). The goal of conservation biology is to document the full range of biological diversity (species, genetic variation, and ecosystems), investigate human impact on biological diversity, and finally develop practical approaches to prevent the biodiversity loss (Primack 2013). In this editorial note of the special issue "*Conservation Biology of Himalayas*" of this newly established journal, *Conservation Science*, I would like to discuss conservation problems of Himalaya that require multidisciplinary perspective. Let me start with a few examples that show interconnectedness of Himalayan ecosystems and livelihoods. I argue that Conservation Biology of Himalaya can be an essential framework to unify innovative tools and approaches needed to perverse Himalayan biodiversity. My hope is that the journal will bring many of such exciting ideas to deal with the problems related to the nature conservation, often with an interdisciplinary perspective.

Himalayas are the world's youngest and highest mountain chains (Molnar 1964), and they are one of the biological treasures of the world. For example, the Himalayas cover 29 ecoregions, which include eight out of 200 globally important ecoregions of the world (Olson and Dinerstein 1998). The region is also home for several endemic birds (www.birdlife.org) and centers for plant diversity (WWF/IUCN 1995). However, in the last 30 years, the region has already lost more than 15% of its forest area, and by 2100, may have lost half of its forests (www.conservation.org). Conservation International (CI) lists entire the Himalayan region as a globally important biodiversity hotspot for its great biological diversity and high levels of endemism, which are under immediate threat of species extinctions and habitat destruction (Mittermeier et al. 2005, Conservation International 2011). Furthermore, recent studies show that climate change has already caused a worrying situation in Himalaya such as changes in precipitation trends (Ma et al. 2009, Shrestha et al. 2000, Xu et al. 2007), shifting monsoon patterns (Shrestha et al. 2000) and shrinking of glaciers (Shrestha and Aryal 2011). These threats including direct exploitation (e.g. deforestation) may act synergistically and destroy Himalayan biodiversity (Anderson & Bowe 2008; Hansen et al. 2008; Solomon et al. 2009). Here, my aim is to show why

## Editorial

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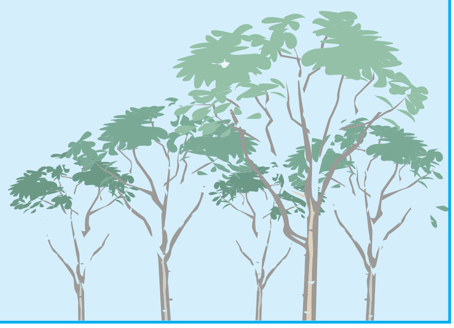

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Himalayas need an interdisciplinary perspective to solve their conservation problems.

**The distribution of species in Nepal Himalayas and their Conservation**

Due to the highly heterogeneous geography and large altitudinal gradient, a significant focus of research in the Himalayas involves identifying patterns of species diversity along the Himalayan elevational gradient. Most of such studies show the highest concentration of species at intermediate elevations (upper subtropical to temperate regions). For example, species richness in Nepal Himalayas peaks at 2500 m for mosses (Grau et al. 2007), 3000 m for liverworts (Grau et al. 2007), 3100 m – 3400 m for lichens (Baniya et al 2010), 1550 m for orchids (Acharya et al. 2011) and 1500 m for trees (Bhattarai and Vetaas 2006). However, these regions with highest biodiversity remain unprotected (Shrestha et al. 2010). The forests of mid-elevation zones are highly fragmented and wildlife and ecosystems in these regions are particularly affected by anthropogenic activities (Paudel and Kindlmann 2012a).

In Himalayas, elevational range of species extend towards either to lower elevation or to higher elevation, making mid-elevation zones a dynamic and intermediary landscape between high mountain and lowlands, both of which are biodiversity hotspots. Therefore, Himalayan biodiversity will be vulnerable to changing climate and conservation efforts would be more efficient and successful if they were focused at the level of whole ecosystems and landscapes of Himalaya, rather than on individual species (Primack et al. 2013).

**Altitudinal connectivity in Nepal Himalayas**

Nowhere in the world have as heterogeneous landscapes as in Himalaya due to largest elevational gradient in the world (70 - 8848 m) in the shortest horizontal distances (200 km). However, there are no studies focused on how species partition resources along the Himalayan elevational gradient (e.g. altitudinal migration) and how ecosystem services (e.g. water recharge, nutrient retention) vary across the landscape. Until recently, such studies were emerging and were devoted mainly to climate change induced range shift of the species (e.g. Forrest et al. 2012). Many species that were once widely distributed across a large altitudinal gradient of Himalayas are now confined into small isolated habitat patches (e.g., Paudel and Kindlmann 2012b, Green 1979). For example, Himalayan serow (Capricornis thar) was historically present from subtropical to subalpine regions, but is now fragmented into small populations and confined to either lower or higher elevations (Paudel and Kindlmann 2012b). Tigers still exist from subtropical to subalpine regions (700-4100 m) of Bhutan (Sangay and Wangchuk 2005), but in Nepal they are only found in the subtropical lowlands. Understanding the distribution pattern of species and ecosystems along Himalayan elevational gradient also helps to understand potential responses of taxa to the global climate change. This is a fundamental requirement for the development of effective long-term conservation strategies for the Himalayan region.

**Himalayan people: conservation and management**

Himalayas are an overwhelmingly rural and people depend on agrarian economy. Here, traditional crop–livestock mixed farming is the basis of livelihood of local communities (Saxena et al. 2004). In recent years, politico-historical and socio-economic changes have resulted in commercialization of biological resources in the mountains, which have consequently resulted in the loss of biodiversity, including other off-site benefits such as the regulation of hydrological flows. For example, alpine medicinal plant trade contributes 3 to 44% (average of 12%) of the annual household income in Nepal Himalaya (Olsen and Larse 2003). Now, it appears that seasonal migration in the vertical gradient of Himalaya (highland for medicinal herb collection and animal husbandry, and lowland for agriculture production) has been a part of livelihood strategy. However, spatially explicit scientific information (e.g., upland-lowland interaction) focusing the linkages between livelihood and biodiversity (e.g., species and ecosystem services) is scarce. Such information has a broader implication for conservation and management of Himalayan biodiversity.

**Conclusion**

Conservation Biology is well established as an integrated multidisciplinary discipline that brings together various professionals (e.g., ecologists, sociologists, geologists and economists) to provide a scientific basis of biodiversity conservation. The challenges in biodiversity conservation are of multidisciplinary nature, and these challenges are rapidly increasing. This urgently needs innovative approaches focusing on particular species and ecosystems. Himalayas contain interconnected and complex ecosystems that scientists from Himalayan regions or elsewhere should focus on identifying connectedness between these ecosystems and livelihood (see sections in the main text). Such studies will carve an important position for Himalayan biodiversity as a distinct subdiscipline of the conservation biology. *Conservation Science* aims to provide a venue for such emerging issues in the growing number of journals dealing with conservation.

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