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RHODODENDRON DIVERSITY ALONG THE KUSONG-PANCH POKHARI TRANSECT IN KHANGCHENDZONGA BIOSPHERE RESERVE, THE EASTERN HIMALAYA: A CONSERVATION PERSPECTIVE

Prem K. Chhetri [1], Bijoy Chhetri [2] & Hemant K. Badola [3]

[1,2,3] G.B. Pant National Institute of Himalayan Environment and Sustainable Development, Sikkim Unit, Pangthang, Gangtok, Sikkim 737101, India
[1] Forest Environment & Wildlife Management Department, Govt. of Sikkim, Pakyoung, East Sikkim 737106, India
[3] Present address: D-408, Aditya Doonshire Apartments, Sailok Phase II, GMS Road, Dehradun, Uttarakhand 248001, India
[1] chettriprem22@gmail.com, [2] chhetribijoy@yahoo.co.in, [3] hkbadola@gmail.com (corresponding author)

Abstract: Sikkim Himalaya, India is part of one of the richest global biodiversity hotspots, exhibiting a significant amount of native flora including *Rhododendron* (Ericaceae) species, which are particularly well represented with 37 species, 11 subspecies, seven varieties and two natural hybrids occurring along the rolling mountains between 1,500m to 6,000m. Most of the habitats of rhododendrons in Sikkim Himalaya have not only been threatened by climate change but also by emerging eco-tourism and economic activities vis-à-vis trekking corridors. In recent decades, it has been observed that the climate-governed phenology of rhododendrons of eastern Himalaya is shifting; further the urbanization, tourism influx, and clearances for the footpaths have adversely impacted the diversity of many forest areas. To better understand the effects of trekking corridors on *Rhododendron* species for the tourist destinations, we performed a pilot survey along the Kusong-Panch Pokhari transect in relatively virgin forest of the northern part of Sikkim to assess the status of both *Rhododendron* diversity and potential environmental management strategies that can be employed within the transect as a new tourist destination in the Sikkim Himalaya. Along with this transect, we recorded 23 *Rhododendron* species, with five eastern Himalayan endemics. Our results indicate that the diversity of rhododendrons seem good along the Kusong-Panch Pokhari transect and we further recommend it could be a new potential eco-tourism destination as an alternative income generating source for the local people, provided that appropriate conservation management strategies are in place.

Keyword: Conservation management, diversity, eastern Himalaya, Rhododendron, Sikkim, tourist destination.

Occupying 0.2% India's geographic area of India, the Sikkim eastern Himalaya, is a part of one of the richest global biodiversity hotspots. This is home to over 150 species of mammals, 550 species of birds, 650 species of butterflies and moths, 33 species of reptiles, 16 species of amphibians, 48 species of fishes and over 4,500 species of flowering plants (Sikkim Biodiversity Action Plan 2012; Badola et al. 2016). At present, 37 species, 11 subspecies, seven varieties and two natural hybrids of rhododendrons are reported from Sikkim, which is quite significant when compared with the total number of *Rhododendron* species (73 species, 22 subspecies, 25 varieties and three natural hybrids) of India (Pradhan & Lachungpa 1990; Mao 2010; Sastry & Hajra 2010). Anthropogenic pressures and other environmental factors have exerted a heavy pressure on the natural availability of many rhododendrons, resulting in several species becoming threatened (Pradhan & Lachungpa 1990; Badola & Pradhan 2010a,b; Gibbs et al. 2011). The deforestation and unsustainable extraction of fuel woods are posing considerable threats to natural

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populations of rhododendrons in many areas. Climate change, however, is yet another growing threat to the existence of rhododendrons (Badola 2010) besides the burgeoning eco-tourism economics in Sikkim (Menon et al. 2001; Chettri et al. 2002). Many of these rhododendrons are of both economic and cultural importance to the local ethnic people, for their ethno-medicinal and local beverage values. For example, the crushed dried flowers of *R. arboreum* is used in diarrhoea and blood dysentery (Paul et al. 2005); when mixed with water they help in stopping excessive bleeding in women during menstrual cycles and chewing fresh leaves stops dysentery (Pradhan & Badola 2008). Similarly, the chewed leaf juice of *R. campanulatum* helps to relieve cough (Pradhan & Badola 2008). The *Rhododendron* species in Sikkim are abundantly distributed throughout upper-elevation zones, between approximately 1,500–6,000m (Pradhan & Lachungpa 1990). In addition, rhododendrons make thick high altitude shrubberies offering suitable ecological niches to many threatened species as well as charismatic species of pheasants like *Ithaginis cruentus* and *Tragopan satyra*, and mammals such as *Ailurus fulgens, Pseudois nayaur, Uncia uncia Moschus chrysogaster* and so on. Like other parts of eastern Himalaya, the rich floristic diversity of Sikkim Himalayas has been under stress seeking appropriately effective conservation programs (Paul et al. 2005). Many epiphytic species including rhododendrons are in a vulnerable state because they already have very low populations in natural habitats (Badola & Pradhan 2010a,b). Additionally, the trees are deforested rapidly in many areas due to increasing human settlements, tourism influx and clearance for foot paths and these factors contribute to the depletion of rhododendrons from many natural habitats. The assessment of potentially rich areas for rhododendrons is one of the priorities for conservation management in protected areas. Therefore, the present study was carried out in the Khangchendzonga Biosphere Reserve (KBR; the core zone, Khangchendzonga National Park has recently been inscribed as world heritage site on 17 July 2016 by UNESCO) of Sikkim Himalaya. We identified the Kusong-Panch Pokhari transect of KBR in northern Sikkim as one of the unexplored landscapes to assess the extent of rhododendron diversity and also in offering potential environmental management strategies that can be employed within the transect.

METHODS

Study area

The Kusong-Panch Pokhari transect falls in Khangchendzonga Biosphere Reserve (KBR). The KBR (27°15'-27°57' N & 88°02'–88°40' E; Fig. 1) covers 2913.12km^2 spatial area (after inclusion of transition zone in 2010; Badola & Subba 2012) in Sikkim eastern Himalaya (India). The core zone of KBR, as the national park and a UNESCO world heritage site, has 1,784km^2 area. The Kusong Village is the trailhead, surrounded by rich temperate forests forming a lush green valley, meandering streams, and waterfalls with snow-capped

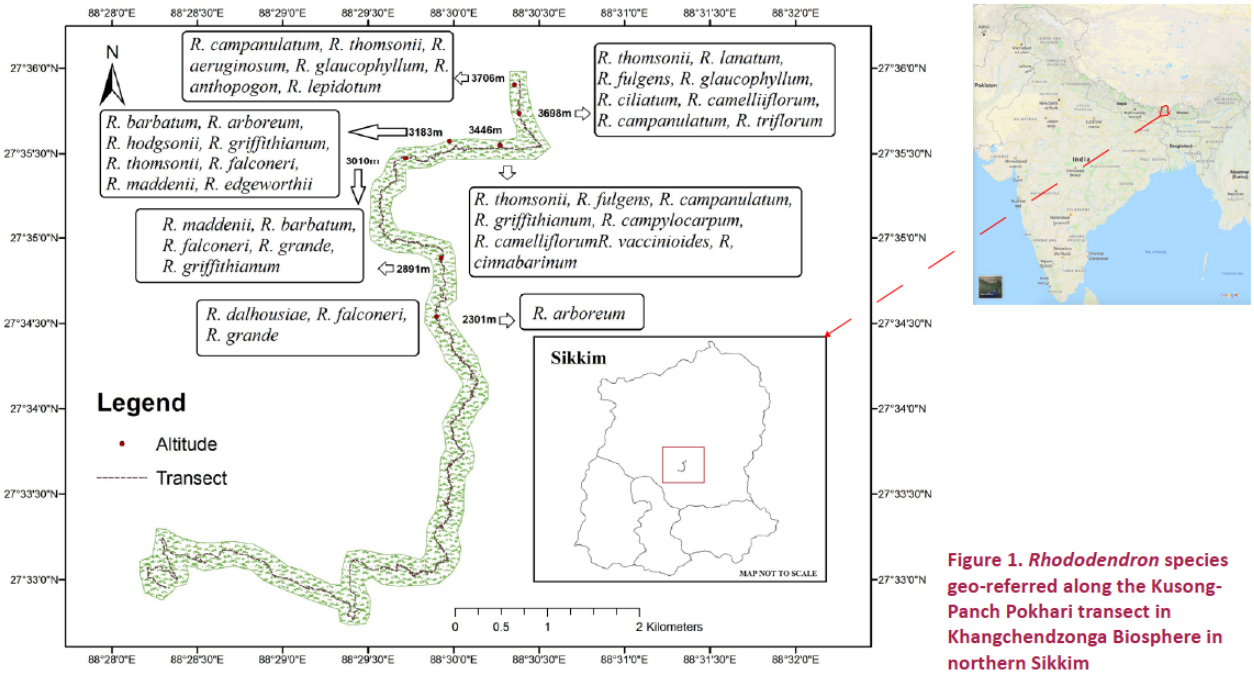

Figure 1. *Rhododendron* species geo-referred along the Kusong-Panch Pokhari transect in Khangchendzonga Biosphere in northern Sikkim

mountains in the backdrop of the picturesque landscape. The Lepcha community village has 37 households with a population of approximately 906 individuals. The villagers totally depend on cardamom cultivation for their economy; they also grow agricultural produce like potatoes, peas and maize as subsistence farming. Nowadays, local people expect tourism product-based economic benefits, particularly because they have been experiencing loss of cardamom cash crop due to disease infestation and subsequent insufficient production. Therefore, local people are looking forward to promoting an eco-tourism trek route, i.e., "Kusong to Panch Pokhari" with its unique glimpse into rhododendron diversity, numerous high altitude lakes and panoramic view of the Mt. Khangchendzonga (8,586m) along with other snow-capped mountains, offering a new vista for adventure tourism.

The first exploration was conducted during the Kusong-Panch Pokhari transect (Fig. 1; also a part of, hitherto seldom used, trekking corridor) extending approximately 25km along 1,500–3,800 m in KBR. It is a steep terrain extending to a small-extended plain in the slopes of the mountains. The landscape experiences cool temperate climate; tough rocky terrain maintaining high precipitation and a winter with heavy snow fall (so far no weather data available for the study transect). The Kusong-Panch Pokhari transect broadly has four forest types, viz.: warm broad leaved temperate forest, cold broad leaves / mixed conifer forest, subalpine and alpine scrub, and grasses.

Methods

From June to December 2016, we conducted two randomized systematic survey (following Pradhan & Badola 2008) in Kusong to Panch Pokhari vertical transect in KBR in Dzongu landscape (1,500–3,800 m). Plant species including rhododendrons were identified in the field, without disturbing the natural habitat. Besides authors' earlier field experience in rhododendron collection, Hooker (1849), Pradhan & Lachungpa (1990), Polunin & Stainton (2006) and numerous photographs were used in identification. As the major study area falls in Khangchendzonga National Park, in the case where instant identification was a little difficult, photographs were taken to identify the species with the help of the herbarium of Botanical Survey of India, Gangtok. In addition, coordinates were recorded (latitude, longitude and altitude) with the help of a hand held GPS (Global Positioning System) at each point where any rhododendron population was encountered. We then modeled the distribution of *Rhododendron* spp. native and/or naturalized along the transect using ArcGIS Version 9.3 with Map Source Software (ESRI 2011) and Microsoft Excel (2010), and the quantified correlation between the present altitudinal range of *Rhododendron* species and their past altitudinal range available in the literature for the Sikkim Himalaya using Spearman Rho Test (SPSS Version 21).

Results and Discussion

Along the Kusong-Panch Pokhari transect in Khangchendzonga Biosphere Reserve (northern Sikkim), we recorded 23 species of rhododendrons (Fig. 1; Table 1), of which five are considered as eastern Himalayan endemics, viz.: *Rhododendron grande*, *R. camelliiflorum, R. ciliatum, R. glaucophyllum* and *R. lanatum*. Although the *R. maddenii* populations are reported as rare in Sikkim State (Badola & Pradhan 2010b), IUCN records these species under Data Deficient category. At low altitudes (2,300–2,800 m), we recorded the sparse populations of *R. dalhousiae, R. falconeri, R. grande* and *R. arboreum*, in association with *Acer campbellii*, *Acer* spp., *Quercus* spp., etc. Towards subalpine sites, the presence of *R. fulgens* makes the scene enchanting. On reaching rocky heights towards Panch Pokhari area, we observed small epiphytic shrubs of *R. vaccinioides* growing on other rhododendron species colonizing the southeastern-facing rocky outcrops. We encountered *Rhododendron griffithianum* as the dominant and most widespread species in the valley, ascending from 3,010–3,446 m. We correlated the present altitudinal range of the species in the study site with their historical altitudinal range and found a positive correlation between them (r=0.749, at the significant level >0.05, Spearman's rho). Amongst identified species, 10 are considered threatened locally (Table 1; Pradhan & Lachungpa 1990; Mao et al. 2002; Mao 2010), viz.: *R. triflorum, R. campanulatum* subsp. *aeruginosum, R. falconeri, R. grande, R. campylocarpum, R. edgeworthii, R. lepidotum, R. ciliatum, R. cinnabarinum* and *R. anthopogon*. The sparse populations of *R. lanatum*, *R. fulgens* and *R. maddenii* may be threatened in the future in the Sikkim Himalaya. Some of these species need immediate conservation attention for their long-term survival. The historical records of altitudinal distribution of the *Rhododendron* species of the Sikkim Himalaya show that a few species have been shifting their altitudinal range as per our present observations. It could be one of the reasons many *Rhododendron* species of eastern Himalaya are very sensitive to climatic changes (Mao 2010; Badola 2010; Gaira et al. 2014). It is reported that the eastern Himalaya have

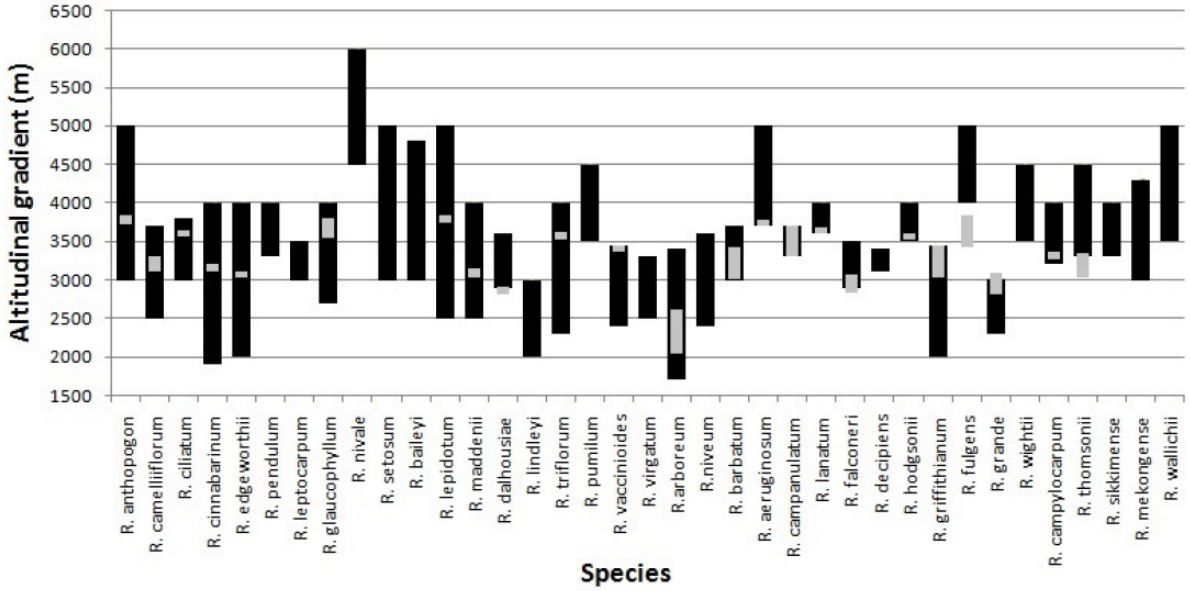

Figure 2. ***Rhododendron*** **species recorded from Sikkim and Kusong-Panch Pokhari transect in Khangchendzonga Biosphere in northern Sikkim, showing their altitudinal gradients reported in literature (all species in black bars) and actually recorded species in study transect (embedded in black bars as gray)**

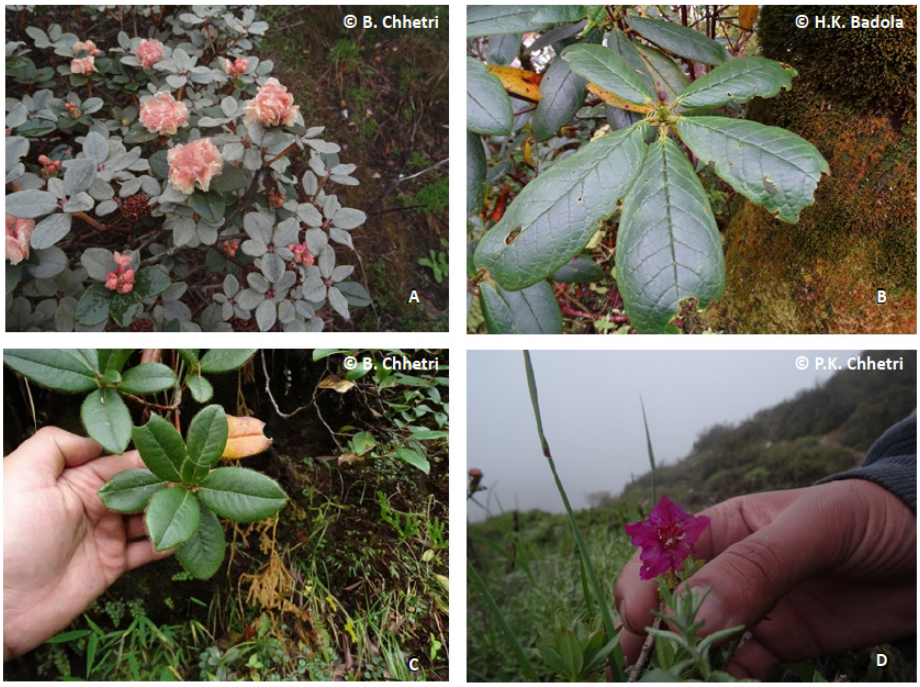

Image 1. Photos of ***Rhododendron anthopogon*** **(A),** ***Rhododendron barbatum*** **(B),** ***Rhododendron ciliatum*** **(C) and** ***Rhododendron lepidotum*** **(D) in the study area**

been experiencing a slightly increasing mean annual temperature (IPCC 2014). Consequently, many species of warm temperate forests have become dominant over the cold temperate forest communities (Beaugrand et al. 2002). In the entire transect, we found only two small populations of *R. maddenii* at 3,183–3,010 m growing under *Abies densa*, experiencing habitat loss due to encroachment by *R. griffithianum* (Gibbs et al. 2011). We observed a steady change in *Rhododendron* species from 2,800m onwards, as a very distinct feature from this altitude zone (Acharya et al. 2011). For being very steep, rocky type, this transect is one of the best habitats for rhododendrons. The transect manifested a sign of fuel wood collection and lopping of timber in the lower zone around 1,500–2,500 m and other anthropogenic pressures also in the lower zone. The

Image 2. Photos of *Rhododendron lanatum* (E), *Rhododendron glaucophyllum* (F), *Rhododendron grande* (G) and *Rhododendron dalhousieae* (H) in the study area

Image 3. Photos of *Rhododendron thomsonii* (I), *Rhododendron falconeri* (J), *Rhododendron campanulatum* (K) and *Rhododendron campylocarpum* (L) in the study area

sign of natural calamities like avalanches and landslides are common at a few places along the higher zone. These activities may be detrimental to rhododendron diversity and populations in Sikkim Himalaya.

The 23 recorded *Rhododendron* species along Kusong-Panch Pokhari transect comprised large trees (02 species), shrubs or small trees (06 species), epiphytic shrubs (04 species) and shrubs (11 species). Amongst them, *R. griffithianum* has been observed as the most dominant taxa followed by other species such as *R. grande*, *R. hodgsonii*, *R. campanulatum R. thomsonii*; however, these stands transitioned into *Abies densa* communities closer to the timberline at 3,600m. In Sikkim, 37 rhododendrons species (with several sub-

Table 1. *Rhododendron* diversity along the Kusong- Panch Pokhari trekking corridor (Dzongu) in Khangchendzonga Biosphere Reserve in Sikkim eastern Himalaya (India)

	Botanical name	Vernacular name	Lat.-Long.	Habit	Broad habitats	Altitudinal range (m)	Global distribution	Regional conservation status based on literature	Availability in study transect
1	*Rhododendron anthopogon* D.Don	Dhupi Gurans	27.5983611111ºN & 88.5059166667ºE	Shrub	Occur in the open, rocky slope in the alpine region	3500–4500	Bhutan, China India (Uttar Pradesh, Sikkim, West Bengal, Arunachal Pradesh), Myanmar, Nepal	Threatened	Moderate
2	*Rhododendron arboreum* Sm.	Lali gurans	27.5756388889ºN & 88.4983333333ºE	Tree	Temperate broad leaved mixed forest to sub alpine	1800–3000	Bhutan, Nepal, China, India (Arunachal Pradesh, Sikkim, Nagaland, Manipur, West Bengal	Vulnerable	High
3	*Rhododendron barbatum* Wall. ex G. Don	Lal chimal	27.5911388889ºN & 88.4953055556ºE	Shrub or small tree	Sub alpine forest	3000–3700	Nepal, Bhutan, China, India (Sikkim, West Bengal)	Non-Threatened	Low
4	*Rhododendron camelliiflorum* Hook. f.	Chya phule Gurans	27.5924722223ºN & 88.5045277776ºE	Shrub usually epiphytic	Subalpine areas	3000–3700	Bhutan, China, Pakistan, India (Sikkim, Arunachal Pradesh), Nepal	Non-Threatened	Low
5	*Rhododendron campanulatum* D.Don	Nilo Pate Chimal	27.5955694444ºN & 88.5063888889ºE	shrub	Alpine, rocky scrub, open ridges and slopes	3300–4000	Bhutan, China, India (Jammu-Kashmir to Arunachal Pradesh), Nepal	Non-threatened	High
6	*Rhododendron campanulatum* subsp. *aeruginosum* (Hook. f.) D.F. Chamb.	Nile-pate chimal	27.598361112ºN & 88.5059166668ºE	Shrub	Alpine, rocky scrub, open ridges and slopes	3700–4500	Bhutan Nepal, India (Arunachal Pradesh Sikkim, West Bengal)	Threatened	Low
7	*Rhododendron campylocarpum* Hook. f.	Bango phale gurans	27.5924722222ºN & 88.5045277778ºE	Shrub	Sub alpine forest	3200–4000	Bhutan, China, India (Arunachal Pradesh, Sikkim, West Bengal), Myanmar, Nepal	Threatened	Low
8	*Rhododendron ciliatum* Hook. f.	Junge Chimal	27.5955694444ºN & 88.5063888889ºE	Shrub	Alpine, rocky scrub, open ridges and slopes	3000–3800	Bhutan, China, India (Sikkim), Nepal	Threatened	Moderate
9	*Rhododendron cinnabarinum* Hook. f.	Sano Chimal	27.5924722222ºN & 88.5045277778ºE	Shrub	Juniper-Rhododendron scrub	2700–4000	Bhutan, China, India (Sikkim, West Bengal), Nepal	Threatened	Low
10	*Rhododendron dalhousieae* Hook. f.	Laharey Chimal	27.5813333333ºN & 88.4987777778ºE	Epiphytic or Shrub	Epiphytic or terrestrial in forests or trees, cliffs, hillsides, dry rocky areas and boulders	1500–2500	Bhutan, China India (Sikkim, West Bengal, Arunachal Pradesh), Nepal	Non-threatened	Low
11	*Rhododendron edgeworthii* Hook. f.	Edgeworth ko Chimal	27.5928611111ºN & 88.4995833333ºE	Shrub often epiphytic	Rhododendron Oak Forest in *Quercus lamellose, R. grande*, etc.	2100–3300	Bhutan, China, India (Arunachal Pradesh, Sikkim, West Bengal), Myanmar	Threatened	Very low
12	*Rhododendron falconeri* Hook. f.	Pahelo kurlinga	27.5911388889ºN & 88.4953055556ºE	Shrub or Small tree	Moist shady mixed forests, conifer forest and ridges	2700–3500	Bhutan, India (Arunachal Pradesh, Sikkim, West Bengal), Nepal	Threatened	High
13	*Rhododendron fulgens* Hook. f.	Chimal	27.5955694444ºN & 88.5063888889ºE	Shrub or small tree	Shady area in alpine region	3500–5000	Bhutan, China, India (Arunachal Pradesh, Sikkim, West Bengal, Assam), Myanmar, Nepal	Rare	Very low
14	*Rhododendron glaucophyllum* Rehder	Takma chimal	27.598361112ºN & 88.50591666ºE	Shrub	Alpine, rocky scrub, open ridges and slopes	2700–4000	Bhutan, China, India (Arunachal Pradesh, Sikkim), Nepal	Not-Threatened	Low

	Botanical name	Vernacular name	Lat.-Long.	Habit	Broad habitats	Altitudinal range (m)	Global distribution	Regional conservation status based on literature	Availability in study transect
15	*Rhododendron grande* Wight	Patle Korlinga	27.5911388889ºN & 88.4953055556ºE	Tree	Temperate mixed forest	2000–3100	Bhutan, China, India (Arunachal Pradesh, Sikkim, West Bengal), Nepal	Threatened	High
16	*Rhododendron griffithianum* Wight	Seto Chimal	27.5928611111ºN & 88.4995833333ºE	Shrub or Small tree	Moist shady mixed forests, conifer forest and ridges	1800–3500	Bhutan, China, India (Sikkim, West Bengal, Assam, Meghalaya), Nepal	Not-Threatened	High
17	*Rhododendron hodgsonii* Hook. f.	Gulabi Korlinga	27.5928611111ºN & 88.4995833333ºE	Shrub or small tree	Temperate and subalpine region	3000–4000	Bhutan, China, India (Sikkim, West Bengal, Assam, Meghalaya), Myanmar, Nepal	Non-threatened	High
18	*Rhododendron lanatum* Hook. f.	Bhutle Gurans	27.5955694444ºN & 88.5063888889ºE	Shrub	In Abies forest, amidst Rhododendrons and bamboo, on cliffs	3000–4500	Bhutan, China India (Arunachal Pradesh, Sikkim)	Non-threatened	Very low
19	*Rhododendron lepidotum* Wall. ex G. Don	Bhale sunpati	27.5983611111ºN & 88.5059166667ºE	Terrestrial Shrub	Alpine, rocky scrub, open ridges and slopes	2500–5000	Bhutan, China, Pakistan, India (Himachal Pradesh, Jammu-Kashmir, Punjab, Sikkim, Uttar Pradesh, West Bengal, Arunachal Pradesh, Assam, Meghalaya), Myanmar, Nepal	Threatened	Low
20	*Rhododendron maddenii* Hook. f.	Major madden ko chimal	27.5911388889ºN & 88.4953055556ºE	Shrub	In dense forest, open ridges and slopes, rocks, cliffs, and scrubby thickets	700–3500	Bhutan, China, India (Arunachal Pradesh, Nagaland, Sikkim), Myanmar, Thailand, Vietnam	Endangered	Very low
21	*Rhododendron thomsonii* Hook. f.	Dr. Thomson kogurans	27.5983611111ºN & 88.5059166667ºE	Shrub or small tree	In rhododendron forest, *Abies* densa forest, rocky slopes and open hillsides	2900–4000	Bhutan, China, India (Arunachal Pradesh, Assam, Meghalaya, West Bengal Sikkim), Nepal	Vulnerable	High
22	*Rhododendron triflorum* Hook. f.	Pahenle Chimal	27.5955694444ºN & 88.5063888889ºE	Shrub	On hillsides, forest margins, cliffs and on rocks	2100–4000	Bhutan, China, Burma India (Arunachal Pradesh, Meghalaya, Assam Nagaland, Sikkim, West Bengal), Myanmar, Nepal	Threatened	Low
23	*Rhododendron vaccinioides* Hook.	Khiaune-pate Gurans	27.5924722222ºN & 88.5045277778ºE	Shrub or epiphytic	Epiphytic or terrestrial in forests or trees, cliffs, hillsides, dry rocky areas and boulders	2000–3700	Bhutan, Tibet, Burma, China India (Sikkim, West Bengal, Arunachal Pradesh), Myanmar, Nepal	Non-Threatened	Very low

species and varieties) occur along 1,500–6,000 m gradient (Pradhan & Lachungpa 1990; Mao 2010; Badola & Pradhan 2010a). In our study transect, the highest diversity (15 species) of rhododendrons occurred between 3,100–3,700 m, whereas, the lower elevation (2,300–2,800 m) recorded with only two species.

In Kusong-Panch Pokhari transect, we encountered many other floral elements, including important high-value medicinal plants such as *Aconitum* spp., *Rheum* spp., *Picrorhiza kurrooa*, *Cordyceps sinensis*, and so on. The faunal elements like Himalayan Black Bear *Ursus thibetanus*, Himalayan Thar *Hemitragus jemlahicus*, Blood Pheasant *Ithaginis cruentus*, Himalayan Goral *Naemorhedus goral*, Barking Deer *Muntiacus vaginalis*, Satyr Tragopan *Tragopan satyra*, Kalij Pheasant *Lophura leucomelanos*, Common Leopard *Panthera pardus*, Red Junglefowl *Gallus gallus*, Red Panda *Ailurus fulgens*, Himalayan Monal *Lophophorus impejanus* and so

Table 2. Diversity of major faunal species in Kusong- Panch Pokhari trekking corridor (Dzongu) in Khangchendzonga Biosphere Reserve in Sikkim eastern Himalaya (India)

Sno	Scientific name	Common name	IUCN status *	Presence	Our observations (evidences)
1	*Ailurus fulgens* F. Cuvier	Red Panda	EN	Reported	Local people
2	*Gallus gallus* Linnaeus	Red jungle fowl	NE	Reported	Local people
3	*Hemitragus jemlahicus* Smith	Himalayan Thar	NT	Confirmed	Sightings, hair
4	*Ithaginis cruentus* Hardwicke	Blood Pheasant	LC	Confirmed	Feather, feces
5	*Lophura leucomelanos* Latham	Kalij pheasant	LC	Confirmed	Feces, feather
6	*Lophophorus impejanus* Latham	Himalayan Monal	LC	Reported	Local people
7	*Muntiacus muntjak vaginalis* Zimmermann	Barking Deer	LC	Confirmed	Sightings
8	*Naemorhedus goral* Hardwicke	Himalayan goral	NT	Confirmed	Feces
9	*Panthera pardus* Meyer	Common leopard	VU	Reported	Local people
10	*Tragopan satyra* Linnaeus	Satyr Tragopan	NT	Confirmed	Sighting, feather
11	*Ursus thibetanus* G. Cuvier	Himalayan Black Bear	VU	Confirmed	Trace

* Vulnerable (VU), Not evaluated (NE), Least concern (LC), Near Threatened (NT)

Image 4. A picturesque landscape of the Kusong-Panch Pokhari trial in Khangchendzonga Biosphere Reserve

on (Table 2) are found along the transect. Our local Lepcha guide and many villagers informed us that the Musk Deer and Red Panda populations in the studied landscape are stable, although further research into the validity of these perceptions is suggested. Although, all the 23 species recorded and identified in our survey are also reported from other areas of northeastern India, the size and status of these populations are yet to be assessed (Paul et al. 2005; Badola & Pradhan 2010a,b). This is the first time Kusong-Panch Pokahri transect in northern Sikkim was explored. The trail, which falls within KBR in northern Sikkim, is one of the potential repositories of biodiversity of Sikkim including diverse rhododendrons as well as faunal species for future conservation studies. The increasing human population and various anthropogenic activities through direct and indirect ways, along with natural calamities will cause habitat degradation. Like other Himalayan parts (Mao et al. 2001), at present Sikkim Himalayan rhododendrons and their habitats face significant threats from both changing climate and increased anthropogenic pressures (Badola 2010; Chettri 2015). In the past, illegal grazing and fuel wood extraction have led to the decline and degradation of many old growth forests in Sikkim Himalaya. As grazing has been banned in Sikkim since 1998, these adverse factors, viz., forest loss, gradual land-use changes and exploitation of forest resources, continue to put pressure on the resilience of rhododendron forests in Sikkim (Menon et al. 2012). Natural causes of *Rhododendron* forest decline include landslides; avalanche and wild fires, which eradicate smaller patches of forest. In Sikkim, high density rhododendron areas fall on trekking corridors, which are susceptible to disturbances (Chettri 2015). But, for its aesthetic beauty and the rich rhododendron diversity and the panoramic view of Mt. Khangchendzonga, the third highest peak in the world, along with many snow-capped mountains, the Kusong-Panch Pokhari transect could be an emerging and potential trekking destination. Caution must be taken when developing the Kusong-Panch Pokhari transect as a tourist corridor. Case studies suggest that promoting eco-tourism targeting high altitudes and wilderness should be more strategic from the long-term conservation perspective, in spite of its potential value in enhancing local economies. Moreover, similar environments along the Yuksom-Dzongri transect (west Sikkim) trekking corridor have shown continued pressures on biodiversity (Chettri

2015), as the tourist flow increases at a rapid rate each year, therefore, care must be taken by creating awareness and outreach to local communities, owners of home stays and guides on the value of biodiversity.

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