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Biodiversity assessment of yakchey area (Lachung range) in North Sikkim, India

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Abstract
A total of 75 species under 68 genera falling in 49 plant families, and 6 of ferns and fern-allies were recorded along 27 sampling plots were laid, covering an area of 0.27 ha during May 2014. We covered the temperate coniferous forest & sub-alpine forest and the elevation ranges between 2800m to 3200m asl. The topmost canopy covers species such as *Tsuga dumosa*, *Picea smithiana*, *Daphniphyllum himalense* and *Rhododendron arboreum.* Amongst them most dominant taxa are *Tsuga dumosa* and *Rhododendron* species was found growing up to 3000 m asl. The common shrub species such as *Viburnum erubescens*, *Daphne cannabina*, *Rosa sericea*, *Salix* sp., with herb species such as *Arisaema griffithii*, *Fragaria nubicola* and *Paris polyphylla*, were recorded. Apart from these, the area has rich diversity of bird species. Yakchey (Lachung Range) is one of the biodiversity hotspot in this region. The study area is located near Shingba Rhododendron Sanctuary, home to *Rhododendron niveum*, an endangered and endemic plant in this area. The area is disturbance by natural and anthropogenic pressure. So, it may cause great loss of biodiversity.

Keywords: yakchey area, rapid biodiversity assessment**,** lachung forest, temperate forest, biodiversity

Introduction
Yakchey area is fall under Lachung Range in North Sikkim at an altitude of 2583 meters above sea level, which is located between latitude $27^0$41'27.6"N and longitude $88^0$44'35.9"E. This area is a paradise for nature lovers with a magnificent flora and fauna species. Forests types of the study area are characterized by temperate coniferous forest to sub alpine forest. The topmost canopy cover species such as *Abies densa*, *Acer campbellii*, *Betula utilis*, *Rhododendron arboreum*, *Taxus baccata*, *Tsuga dumosa*, *Larix griffithii*, etc., found mainly at Lachen, Lachung, Jakthang and Zemu in temperate coniferous forest. *Rhododendron niveum* is a state tree which is abundantly distributed at Yakchey area in North Sikkim. A wide variety of *rhododendron* species are found in this region. The ground vegetation such as *Paris polyphylla*, *Arisaema* sp., *Primula* sp., *Pedicularis* sp., *Potentillai* sp., *Juncus thomsonii*, *Euphorbia sikkimensis*, *Panax pseudoginseng*, *Cotoneaster* sp., *Berberis* sp., etc., were dense in the forest floor.
Apart from these, the area is also known to harbor many of the faunal species such as Serow, Barking deer, Goral, etc., as well as bird diversity such as varieties of magpies and laughing thrush and many more. Some of these animals are included in the list of Schedule I species of the Wildlife Protection Act, 1972.

Study Area
The rapid biodiversity survey was conducted during May 2014, at Yakchey Area under Lachung Range, covering a distance *ca*. 7km along 27 random sampling plots of 0.27 ha. The elevation of the study sites ranges between 2800m to 3200m asl showing aspects of E, N and NE with the slope angle falling between 5 and 40 degree inclination. The study area is located near Shingba Rhododendron Sanctuary, home to *Rhododendron niveum*, an endangered and endemic plant in the area. Forest types are characterized by temperate coniferous forest to sub-alpine forest. The climate is characterized by a long moist season followed by a dry spell during the winters. Snow is common and heavy at the sites and high winds. Small landslips are frequent in the area with occasional case of avalanches.

Forest Types

Fig 1: Temperate Coniferous Forest

Fig 2: Sub-Alpine Forest

Materials and Methods

Flora

The plot of 10m X 10m was laid, depending upon the site feasibility. Within the main plot, all the standing tree species were enumerated & measured (CBH) at 1.37 m from the ground by using measuring tape. Circumference at breast was taken for the determination of tree basal area. Total basal area is the sum of basal area of all species present in the forest. Basal area (m2 / ha) was used to determine the relative dominance of a tree species. Within the subplots, 5m X 5m were laid for recording the sapling (no. of species & its height) & shrub for the percent cover was recorded. Within the main plot, 1m X 1m plots were laid in 4 corners and 1 at centre point for seedling species were enumerated. In the same plot was used for recording the herb percentage in the area. The location and altitude of the plots were recorded by global positioning system (GPS; Garmin eTrex) and the humus depth was measured with the help of measuring scale. Plant species were identified through herbarium record and flora published (Hooker JD, 1888-1890, Hooker JD 1849, Pradhan & Lachungpa, 1990, Kholia, 2010) [5, 7-8]. The unidentified plants species in the field were photographed, and later identified by consulting plant taxonomist), & BSI and web references (www.efloras.org; www.flowersofindia.net & www.floraofchina.org) were made and by referring to local people too. All the sampling plots were geo-tagged for reference under for long-term monitoring.

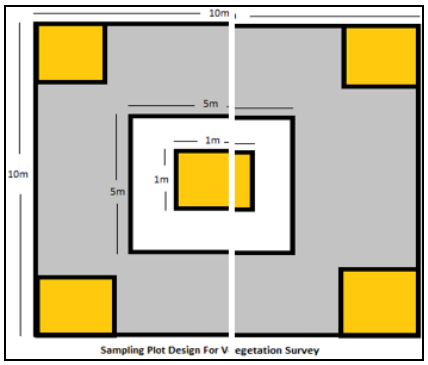

Fig 3: Sampling plot design for vegetation survey

Methodology

Fauna

Different sampling methods were applied in the field for the faunal survey. The conventional sampling methods for the assessment of diverse fauna depending upon the feasibility of the terrain were conducted. Faunal survey was conducted through direct evidences (direct sighting) and indirect evidences (pellets, pugmarks, feathers, scats) will be recorded GPS location and the evidences was by taking photograph, it should be easy to identified. During the collection of data in faunal survey, in an around the evidences the general plant species and other associated species were also recorded.

Findings and Discussion

The study revealed a total of 75 species under 68 genera falling in 49 plant families, and 6 of ferns and fern-allies were recorded. Herb represented the highest number of species (36 species, 31 genera, 22 families and 1 unidentified) followed by small shrub/scrub (14 species, 13 genera, 8 families) and large tree (11 species, 10 genera, 8 families) and other remaining floral species along 27 sampling plots, covering an area of 0.27 ha during May 2014. We covered the temperate coniferous forest & sub-alpine forest between 2800m to 3200m asl. This protected area can be reached from Lachung which is main entry point of this region [Table 1: Fig1]. The topmost canopy cover species such as *Tsuga dumosa, Picea smithiana Daphniphyllum himalense, Populus jacquemontiana, Rhododendron arboreum, Pieris ovalifolia, Picea smithiana, Rhododendron hodgsonii, Prunus sp, Betula utilis, Salix* sp, *Cupressus torulosa, Acer campbellii, Sorbus ursine, Magnolia globosa, Larix griffithii* and *Acer caudatum*, etc. *Populus jacquemontiana* was distributed at 2700m asl in sampling plot which have good medicinal property. The bark is used to make tonic, stimulants and blood purifier. *Cupressus torulosa* was scarcely distributed.

Fig 4: *Larix griffithii* (Sikkim Larch)

Fig 5: *Daphniphyllum himalense*

The most dominant taxa are *Tsuga dumosa* and *Rhododendron* species were found growing up to 3000m asl along the sampling plot. *Tsuga dumosa* is ecology significance in the forest ecology for animal and bird shelter and many other epiphytic species such as orchids, ferns, *Vaccinum* sp., was found to favour on the tree. If tree is lost in the forest, it may cause significant loss of biodiversity. *Picea smithiana, Daphniphyllum himalense* & *Larix griffithii* were dominated taxa all along the sampling plots; ranges between 2800m-3000m asl. Under the canopy of *Picea smithiana* species, minimum numbers of herb were recorded; however under the canopy of *Tsuga dumosa* the enormous number of herbaceous plants species including

medicinal plants were encountered. *Rhododendron hodgsonii* was recorded at an elevation of 3222 m asl. Plenty of *Rhododendron arboreum* was recorded in the forest. *Rhododendron arboreum* is used for various medicinal purposes. The dried flower is crushed and mixed with few drop of water to cure excessive bleeding of female. Fresh leaves chewed stop dysentery. Flower petals clear throat choking due to fish or chicken bone Fresh petal is used to cure throat infection and tonsillitis (Pradhan & Badola, 2008) [13].

Fig 6: *Rhododendron arboreum*

The shrub species such as *Viburnum erubescens* followed by *Daphne cannabina*, *Rosa sericea*, *Salix* sp., *Berberis aristata*, *Gaultheria nummularioides*, *Rhododendron camelliiflorum*, *Rhododendron lepidotum*, *Ribes griffithii*, *Ribes himalense*, *Ribes alpestre*, *Salix calyculata*, *Salix psilostigma*, *Salix wallichiana*, *Prinsepia utilis*, *Rubus* sp., *Rhododendron lanatum*. *Piptanthus nepalensis*, *Cotoneaster microphyllus* and *Enkianthus deflexus* were inventoried.

The forest floor was covered by *Arisaema griffithii*, *Fragaria nubicola*, *Paris polyphylla*, *Rumex nepalensis*, *Ligularia fischeri*, *Eragrostis cilianensis*, *Polygonatum multiflorum*, *Viola biflora*, *Euphorbia sikkimensis*, *Rumex nepalensis*, *Artemisia wallichiana*, *Polygonatum* sp., *Viola biflora*, *Sinopodophyllum hexandrum*, *Gaultheria hookeri*, *Rheum acuminatum*, *Triosetum himalayanum*, *Fragaria nubicola*, *Panax sikkimensis*, *Panax* sp., *Anaphalis*, *Potentilla*, *Hemiphragma heterophyllum*, *Primula* sp., *Paris polyphylla*, *Mazus dentatus*, *Gaultheria nummularioides*, *Sedum ewersii*, *Streptopus simplex*, *Juncus thomsonii*, *Clintonia udensis*, *Cardamine macrophylla*, *Ranunculus hirtellus*, *Hackelia* sp., *Delphinium*, *Pedicularis* sp., etc., were recorded along the sampling path.

The only one bamboo species (*Himalayacalamus hookerianus*) was recorded at an elevation of 3000 m asl. It was found that *Pleione hookeriana*, the highest growing orchid species, grows favorably in the branches of *Tsuga dumosa*. Another species which contain high medicinal property such as *Paris polyphylla*, *Cardamine macrophylla* and *Panax pseudoginseng* were recorded. The uses of above medicinal plants, the rhizome part of *Paris polyphylla* herb is used for various medicinal purposes and used for treatment of liver, stomach, nose lung, and throat and breast cancer in traditional Chinese medicine (Maity *et al*., 2004) [12]. Paste is applied as an antidote to snake bites and poisonous insects bite. Chewing a piece of the underground parts is believed to heal internal wounds below the throat while applied on cut it heals external wounds (Madhu *et al.*, 2010) [14]. *Cardamine macrophylla* herb called' Bhutia Sag or Mangana Sag' which is used medicinally. The young shoots and leaves parts are eats as a vegetable purpose especially in Tibet and China. This herb is abundantly found in elevation along 3000m asl and habitat occupies stream sides, damp forests, river banks, rock crevices, meadows, damp woodlands and mountain slopes. *Panax pseudoginseng* is versatile medicinal plants species use in anti-cancer activity agent.

One of the endemic *Rhododendron* species (*R. niveum*), which have a suitable habitat in Yakchey area near to Shingba Rhododendron Sanctuary, North Sikkim. Yakchey is famous for the *Rhododendron niveum*, the state tree of Sikkim. This area is also a home to several *rhododendrons* species, wild orchids, mosses, ferns and fern-allies, mushroom and lichens etc.

Most of the climber species such as *Rubia cordifolia*, *Clematis Montana*, *Schisandra grandiflora*, *Smilax ferox*, *Vaccinium nummularia* and *Holboellia latifolia* etc., were observed and recorded. Pure patches of *Osmunda claytoniana* fern species was recorded in open slopes.

Table 1: A checklist of flora species encountered along the sampling path

Botanical Name	Family	Local Name	Altitude (m)
Tree			
Acer campbellii Hook. & Thom. Ex Hiern	Sapindaceae	Kapasey	2100-3600
Acer caudatum Wallich.	Sapinadaceae	Kapasey	1700 – 4000
Betula utilis D. Don	Betulaceae	Lekh Saur	2700 – 3300
Cupressus torulosa D. Don	Cupressaceae		1800-3300
Daphniphyllum himalense (Bentham)	Daphiniphyllaceae	Lall Chandan	1200 -2800
Larix griffithiana Carriere	Pinaceae		2800-4000
Magnolia globosa Hook. f. & Thoms.	Magnoliaceae	Champ	2400-3000
Picea smithiana (Wallich) Boiss.	Pinaceae		2100-3600
Pieris ovalifolia (Wall) D. Don.	Ericaceae	Angeri	2300 -3000
Populus jacquemontiana Dode var. glauca (Haines)	Salicaceae		2600-2900
Prunus sp.	Rosaceae		
Rhododendron arboreum var. *arboreum* (CB Clarke)	Ericaceae	Lali Gurans	1800 - 3600
Rhododendron hodgsonii Hook.f.	Ericaceae	Korlinga	3000-3800
Rhododendron niveum	Ericaceae		
Salix longiflora	Salicaceae		
Sorbus ursina (Wall.) Decne	Rosaceae	Lek Pasi	2900-4300
Tsuga dumosa (D.Don) Eichler	Pinaceae		2100-3500

Shrubs/shrub lets			
Viburnum erubescens Wallich ex DC	Sambucaceae	Asharey	1500-3000
Salix daltoniana Anderson	Salicaceae	Bais	2600-3400
Salix longiflora Anderson	Salicaceae	Bais	3000
Prinsepia utilis Royle	Rosaceae		1200-2700
Rubus sp.	Rosaceae		1000-2600
Rhododendron lanatum Hook. f.	Ericaceae	Bhutle chimal	
Piptanthus nepalensis (Hook.) D.Don	Fabaceae		2100-3600
Lonicera sp.	Caprifoliaceae		
Spiraea bella Sims.	Rosaceae		2100-3600
Ilex sikkimensis	Aquifoliaceae		
Ilex intricata	Aquifoliaceae		
Berberis asiatica Roxb. ex DC	Berberidaceae		1800-3500
Enkianthus deflexus (Griffith) Schneider	Ericaceae		2500-3300
Cotoneaster microphyllus Wallich ex Lindley	Rosaceae		2000-5400
Artemisia wallichiana Besser	Asteraceae		2800-5500
Rosa sericea Lindley	Rosaceae		2100-4500
Ribes griffithii Hook. f. & Thoms	Grossulariaceae		2700-4000
Ribes himalense Royle ex Decne.	Grossulariaceae		2400-3300
Ribes alpestre Wallich ex Decne.	Grossulariaceae		2400-3600
Daphne cannabina	Thymeleaceae		
Herb			
Arisaema griffithii Schott	Araceae		2400-3000
Astilbe rivularis Buch.-Ham. ex D.Don	Saxifragaceae		1800-3300
Anaphalis triplinervis (Sims) C.B. Clarke	Asteraceae		1800-3300
Cardamine macrophylla Willd	Brassicaceae	Mangana Sag	3000-5000
Cardiocrinum giganteum (Wallich) Makino	Liliaceae		1800-3000
Carex sp.	Cyperaceae	Harkatto	3000
Centella asiatica Linn.	Apiaceae	Golpatta	1500-2700
Circium sp.	Asteraceae		
Clintonia udensis Trautv. & Meyer	Liliaceae		3000-4000
Cynodon dactylon Linn			3000
Delphinium sp.	Ranunculaceae		2700- 4000
Elsholtzia sp.	Nyctaginaceae		1500-4000
Eragrostis cilianensis (All.) Lut. Ex Janchen	Poaceae	Banso	800 – 3500
Euphorbia sikkimensis Boissier	Euphorbiaceae		600-4500
Euphorbia wallichii Hook. f	Euphorbiaceae		2300-3600
Fragaria nubicola Lindley ex. Lacaita	Rosaceae	Bhuei Aiselu	1800-3800
Galium boreale L. NORTHERN BEDSTRAW	Rubiaceae		2700-3000
Gaultheria nummularioides D. Don	Ericaceae	Dhasingre	2100-4000
Gaultheria trichophylla Royle	Ericaceae	Dhasingre	2700-4500
Geranium sp.	Geraniaceae		3000
Hackelia uncinata (Royle ex Benth)	Boraginaceae		2700-4200
Hemiphragma heterophyllum Wallich	Scrophulariaceae		1800-3600
Heracleum nepalensis D.Don	Apiaceae		1800-3600
Hypericum elodeoides Choisy	Clusiaceae		1500-3000
Impatiens sp.	Balsaminaceae		1700-2900
Juncus thomsonii Buchenau	Juncaceae		3000-5200
Juncus himalensis Klotzsch	Juncaceae		3000-5000
Ligularia fischeris (Ledeb.) Turcz.	Asteraceae		2100-3600
Mazus dentatus Wallich ex Benth	Scrophulariaceae		1800-2400
Panax bipinnatifidus Seem	Araliaceae		
Panax pseudoginseng Wallich	Araliaceae	Ginseng	2100-4300
Paris polyphylla Smith	Liliaceae	Satuwa	2000-3000
Parochetus communis Buch.-Ham. ex D.Don	Fabaceae		1000-4300
Pedicularis elwesii Hook. f.	Scrophulariaceae		3600-4800
Pedicularis rhinanthoides Schrenk	Scrophulariaceae		3300-4800
Persicaria capitata D. Don	Polygonaceae	Ratnaulo	600-2900
Persicaria runcinata (Buch.-Ham.) Masam.	Polygonaceae	Ratnaulo jhar	600-2800
Pilea scripta (Buch.-Ham. ex D. Don)	Urticaceae		1000-2500
Pilea umbrosa Blume.	Urticaceae		
Poa sp.	Poaceae		
Polygonatum prattii Baker	Liliaceae		2300-3300
Polygonatum multiflorum (L.) All	Liliaceae		1500-2700
Potentilla cuneata Wallich ex Lehm	Rosaceae		2400-4500
Potentilla fruticosa L.SHRUBBY CINQUEFOIL.	Rosaceae		2400-5500
Potentilla peduncularis D. Don	Rosaceae		3000-4500
Primula denticulata Smith	Primulaceae		1500-4500

Ranunculus hirtellus Royle ex D. Don	Ranunculaceae		3000-4800
Rheum acuminatum Hook. f. & Thom.	Polygonaceae	Khokim	3600-4300
Rhododendron camelliiflorum Hook. f.	Ericaceae		2700-3600
Rhododendron triflorum Hook.f	Ericaceae		2400-3300
Rumex nepalensis Spreng	Polygonaceae	Halhalley	1200-4300
Salvia campanulata Wallich ex Benth	Labiateae		2700-4000
Sambacus adnata Wallich ex DC	Sambucaceae		1500-3700
Sedum ewersii Ledeb	Crassulaceae		2700-4500
Selinum tenuifolium Wallich ex C.B. Clarke	Apiaceae		2700-4000
Sinopodophyllum hexandrum (Royle) T. S. Ying	Berberidaceae		2400-4500
Smilacina oleracea (Baker) Hook. f	Liliaceae		2400-3600
Smilacina purpurea Wallich	Liliaceae		2400-4200
Streptopus simplex D. Don	Liliaceae		2500-3700
Thalictrum sp.	Ranunculaceae		
Trillidium govanianum D.Don	Liliaceae		2700-4000
Triosetum himalayanum Wall	Caprifoliaceae		3000-3800
Viola sp.	Violaceae		2400-4500
Viola biflora L.	Violaceae		2400-4500
Ferns and fern-allies			
Polypodium lachnopus Wall. Ex Hook.f.	Polypodiaceae	Uniyu	1500-3000
Lepisorus mehrae Fraser-Jenk	Polypodiaceae	Uniyu	1500-3000
Odontosoria chinensis (L.) J. Smith	Lindsaeaceae	Uniyu	1500-3000
Polystichum sp.	Dryopteridaceae	Uniyu	1500-3000
Lycopodium japonicum Thunb	Lycopodiaceae	Uniyu	1500-3000
Osmunda claytoniana L.	Osmundaceae	Uniyu	2900
Climbers/Epiphytic			
Clematis montana Buch.-Ham. ex DC	Ranunculaceae	Pinasay lahara	1800-4000
Rubia manjith Roxb. ex Fleming	Rubiaceae	Majito	1200-3000
Schisandra grandiflora (Wallich) Hook.f. & Thoms	Berberidaceae		2100-3300
Holboellia latifolia Wallich	Lardizabalaceae	Gufla	1500-4000
Vaccinium nummularia Hook.f. & Thoms	Ericaceae		2400-4000
Bamboo			
Himalayacalamus hookerianus	Poaceae	Pareng	2400-3000

Table 2: Site Characteristics of Yakchey Area (Lachung Range) North Sikkim

Site code	Elevation	GPS		Humus Depth (cm)	Slope (o)	Slope (aspect)	Canopy cover (%)	Disturbance	
		Latitude	Longitude					Anthropogenic	Natural
Y1	2876	27'42" 45.0	88'44"57.3	1	5	E	0	Grazing	
Y2	2931	27'42" 51.1	88'44"53.4	1	40	N	5	Grazing	
Y3	2950	27'42" 53.6	88'44"55.4	0.5	15	E	0	Grazing	
Y4	2919	27'43" 05.7	88'45"07.1	1.5	5	N	5		landslide
Y5	2937	27'42" 59.4	88'44"59.0	0.5	20	NE	0		Natural
Y6	3048	27'43" 11.1	88'45"00.6	0.5	40	E	5		Natural
Y7	3003	27'43" 09.6	88'44"57.2	1	10	NE	0		Natural
Y8	3016	27'43" 09.6	88'44"54.9	1	15	NE	5		Natural
Y9	3044	27'43" 09.7	88'44"53.7	1	10	E	10		Natural
Y10	3005	27'43" 13.3	88'44"53.1	1	10	E	5		Natural
Y11	3012	27'43" 15.1	88'44"55.7	0.5	15	E	5		Natural
Y12	3046	27'43" 27.8	88'44"54.5	0.5	15	E	5		Natural
Y13	2977	27'43" 22.1	88'45"08.1	0.5	5	E	5		Natural
Y14	2952	27'43" 16.9	88'45"08.0	0.5	0	E	5		Natural
Y15	3099	27'43" 37.0	88'44"50.7	0.5	10	E	10		Natural
Y16	2964	27'43" 19.0	88'45"05.7	0.5	10	E	0		Natural
Y17	3097	27'43" 31.8	88'44"47.5	0.5	20	E	5	Grazing	
Y18	3114	27'43" 31.6	88'44"45.3	0.5	20	E	5		Natural
Y19	3148	27'43" 40.9	88'44"40.6	1	40	E	5		Natural
Y20	3202	27'43" 42.3	88'44"37.1	0.5	15	E	5		Natural
Y21	3216	27'43" 43.3	88'44"34.5	0.5	15	E	5		Natural
Y22	3222	27'43" 39.3	88'44"32.9	0.5	15	E	5		Natural
Y23	3220	27'43" 36.8	88'44"43.2	1	40	E	5	Grazing	
Y24	3101	27'43" 35.6	88'44"46.7	0.5	5	E	0	Grazing	
Y25	3116	27'43" 41.4	88'44"31.8	0.5	5	E	5		Natural
Y26	3148	27'43" 36.9	88'44"38.8	0.5	5	E	5		Natural
Y27	3081	27'43" 24.9	88'44"46.6	0.5	40	E	10		Natural

Fig 7: *Osmunda claytoniana*

Fig 10: *Enkianthus deflexus*

Fig 8: *Paris polyphylla*

Fig 11: *Cotoneaster microphyllus*

Fig 9: *Cardamine macrophylla* (Habitat & Full Blooming)

Fig 12: *Prinsepia utilis*

Fig 13*: Salix* sp

Fig 14: *Artemisia wallichiana*

Fig 15: *Rosa sericea*

Fig 16: *Viburnum erubescens*

Fig 17: *Gaultheria hookeri*

Fig 18: *Rhododendron lepidotum*

Fig 19: *Rhododendron baileyi*

Fig 20: *Fragaria nubicola*

Fig 21: *Panax bipinnatifidus*

Fig 22: *Hemiphragma heterophyllum*

Fig 23: *Streptopus simplex*

Fig 24: *Viola biflora*

Fig 25: *Trillidium govanianum*

Fig 26: *Polygonatum prattii*

Fig 27: *Delphinium* sp

Fig 28: *Arisaema nepenthoides*

Fig 29: *Arisaema griffithii*

Fig 30: *Euphorbia sikkimensis*

Fig 31: *Acanthopanax cissifolius*

Finding

Fauna

During the trail sampling, a total five species of birds were recorded from Yakchey Area (Lachung Range) along the sampling paths. The faunal species was encountered along the sampling path up to 3500m asl was done. Other fauna species were also recorded and evidences photograph was taken and GPS was recorded. Indirect sighting (pellet, scat, kill, dung, digging/foraging sign, dropping and feathers was recorded.

Birds Encountered Along the Sampling Path

Fig 32: *Corvus macrorhyncus* (Large billed Crow)

Fig 33: *Streptopelia orientalis* (Oriental Turtle)

Fig 34: *Lanius tephropotus* (*Shrike*)

Fig 35: *Dicrurus macrocerus* (Drongo)

Fig 36: *Chaimarrornis leucocephalus* (White Capped Redstart)

Butterfly

Fig 37: *Heliophorus* sp.

Fig 38: Indian fritillary

Some of the Direct Evidences

Species Name: *Eonycteris* sp.
Common Name: Common dawn bat lesser dawn bat
Evidences: Direct sighting Photo captured
Latitude: $27^0$43'35.6"N
Longitude: $88^0$44'46.7"E
Altitude: 3101m asl
Habitat: Open slopes with *Tsuga dumosa, Rhododendron niveum, Acer* sp., *Betula utilis, Salix, Rumex nepalensis, Hemiphragma heterophyllum, Ligularia fischeri, Carexi s*p., & *Poa* sp. etc., were recorded.

Species Name: *Ochotona* sp.
Common Name: Pika
Evidences: Direct sighting photo capture
Latitude: $27^0$43'26.4"N
Longitude: $88^0$44'42.1"E
Altitude: 3106m asl
Habitat: Shrubberies of *Potentilla* sp., *Fragaria nubicola, fern, mosses, Lichens, Anaphalis* sp., *Paris polyphylla, Arisaema griffithii, Arisaema nepenthoides* and under tree canopy of *Tsuga dumosa*, *Rhododendron* niveum and other *Rhododendron* species were recorded.

During the present survey a total of 5 species of birds were recorded in Yakchey Area sampling path. Some of the evidences are from direct sightings (sighting, photo-capture) and indirect evidences (pellet, scat, killed, dung, digging/foraging sign, droppings and feathers) were observed and recorded. The present rapid biodiversity assessment found that the temperate coniferous forest have high diversity plant species. However, it concludes that rapid survey needs to be conducted on a seasonal basis to get the overall picture of alpha diversity of the species in the study sites.

Conservation Recommendation and Conclusion

Through the rapid biodiversity survey, it has been observed that the area have rich diversity of floral and faunal species. The area is one of the biodiversity hotspot in this region. Biodiversity is an essential tool for human survival and for economic and ecosystem functioning and stability. The present study revealed rich diversity of vegetation in the forest. It might be due to elevation, slope and aspects play significant role in the forest. The study area is near to Shingba Rhododendron Sanctuary, home to *Rhododendron niveum*, an endangered and endemic plant in the area. Rhododendrons are the only plant group that has continuum in maintaining ecotone in the forest ecosystem. This area is major threat for the endangered of endemic species due to natural and anthropogenic pressure. The natural disturbance such as climate is characterized by a long moist season followed by a dry spell during the winters. Snow is common and heavy at the sites and high winds. Small landslips are frequent in the area with occasional case of avalanches. Anthropogenic pressure such as yak grazed and maximum tourist flow in this region. So, it may cause great loss of biodiversity.

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References

1. En.wikipedia.org/*wiki/Populus jacquemontiana*
2. Flora of India. BSI. Pub Govt. of India, New Delhi, 2000,1993.
3. Polunin O Stainton A. *Flowers of the Himalaya*. Oxford University Press. New Delhi.
4. Hajra PK, Verma DM. Flora of Sikkim. (Monocotyledons). Deep Printers, New Delhi, 1996, 1.
5. Hooker JD. The Rhododendrons of Sikkim-Himalaya. L. Reeve & Co., London, 1849.
6. Hooker JD. Flora of British India. Reeve & Co., London. 1872-1897; 1:1-7.
7. Kholia BS. Ferns and fern-allies of Sikkim Part I. Beracah Printing & Stationeries, Gangtok, 2010.
8. Kholia BS. Ferns and fern-allies of Sikkim Part II. Beracah Printing & Stationeries, Gangtok, 2014.
9. Ali S. *The birds of Sikkim*. Oxford University Press, New Delhi, 1989.
10. Arawatia ML, Tambe S. Biodiversity of Sikkim, exploring and conserving a global hotspot. Information and Public Relation Department, Government of Sikkim,Gangtok. Eds, 2011.
11. Cowan, Cowan. The trees of Northern Bengal including shrubs, woody climbers, bamboos, palms and tree ferns. International Book Distributors, Dehra Dun, 1929.
12. Maity D, N Pradhan, Chauhan AS. Folk uses of some medicinal plants from North Sikkim. Indian Journal of Traditional Knowledge. 2004; 3(1):66-71
13. Pradhan, BK, Badola HK. Ethno medicinal plant use by Lepcha tribe of Dzongu valley, bordering Khangchendzonga Biosphere Reserve, in North Sikkim, India. Journal of Ethno biology and Ethno medicine, 2008; 1746(4269):4-22. doi: 10.1186/,
14. Madhu KC, Sussana P, Pramod PJ. ECOLOGICAL STUDY OF PARIS POLYPHYLLA SM. Ecological Society (ECOS), Nepal, ECOPRINT. 2010; 17: 87-93, 2010 ISSN 1024-8668 Nepal www. nepjol. Info /index. php/eco; www.ecosnepal.com,
15. Curtis JT, McIntosh RP. The interrelation of certain analytic and synthetic phyto-sociological characters. Ecology. 1950: (31):12-25.