भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Field Sampling Protocol

Mammalian Fauna in Trans-Himalayan Landscape Uttarakhand, India

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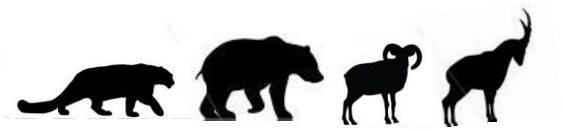

Dr. Bilal Habib
Sh. Shivam Shrotriya
Sh. Neeraj Mahar
Sh. Salvador Lyngdoh
Dr. G. S. Rawat
Dr. Dhananjai Mohan
Sh. Indranil Mondal

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Table of Contents

Introduction

Monitoring the populations of wild animals is one of the major tasks in wildlife management practices. A well-structured census for monitoring wildlife can inform the status of wildlife populations and identify the priority areas for management interventions. Although several techniques have been developed for monitoring carnivore and ungulate populations (Burnham et al. 1980; Eberhardt 1978; Sulkawa & Liukko 2007; Laing et al. 2003), these methods appear to perform differently under different field conditions (Suryawanshi et al. 2012). Estimating ungulate abundance in mountainous areas especially remains a challenge (Singh & Milner-Gulland 2011). Attempts at surveying wildlife abundance in such areas may be further complicated by the effects of low density on estimators (Barnes 2002). Even with the statistical advances in techniques, the logistical problem of surveying remote areas with constrained resources has not been well-addressed (Ransom et al. 2012).

Trans-Himalayan region of Uttarakhand is dry and has sparse vegetation, similar to Ladakh and Tibetan plateau, in most of its extent. Presence of wild animals is rare, constrained by the availability of food resources and suitable habitat. However, this landscape holds a number of unique fauna associated with the rareness of habitat features. Till date no landscape level census has ever been carried out in this landscape. Figure 1 shows the Trans-Himalayan region of the Uttarakhand state.

The protocol designed for large herbivores for Trans-Himalayan region of the Uttarakhand state (Figure 2) is developed on the techniques and methods used by Ransom et al. 2012 in similar habitat of Gobi desert in Mongolia; and carnivore survey is adapted from the Snow Leopard Information Management System (SLIMS) (Jackson & Hunter 1996) and modified to fit advanced statistical methods (Shrotriya et al. 2014). Sign surveys are applicable in monitoring large carnivores (Llaneza et al. 2014). The area has a variety of many rare kinds of animal species. The notable species include Snow leopard, Common leopard, Brown bear, Himalayan black bear, Bharal, Himalayan thar, Mainland serow and Himalayan musk deer etc.

We aim to cover ~8981.23 sq. km. (Total Area 14930.88 – 5949.65 area above an altitude of 4900m which is permanently snow bound) area in Trans Himalayan region of Uttarakhand for mammal survey (Fig. 2). Expected time required to cover the entire region shall be 10 - 15 days (This may vary depending upon the availability of staff). All the participants in the survey must go through a training workshop prior to the survey.

प्रस्तावना

वन्यजीवों की आबादी की निगरानी वन्यजीव प्रबन्धन का महत्वपूर्ण हिस्सा है। एक आदर्श गणना पद्धति से वन्यजीवों की आबादी की स्थिति की जानकारी और प्रबन्धन के लिये महत्वपूर्ण स्थानों का चिन्हिकरण सुलभ हो जाते हैं। हालांकि मांसाहारी एवं शाकाहारी वन्यजीवों की गणना के लिये विभिन्न तकनीकें विकसित की गई हैं, जैसे कि 'सम्पूर्ण गणना, ट्रेल यानी पगडन्डियों के साथ चलकर चिन्हों का विश्लेषण और लाइन ट्रान्जैक्ट'। लेकिन ये तकनीकें विभिन्न परिस्थितियों में विभिन्न परिणाम देती हैं (बर्नहम एवं अन्य 1980, एबरहार्ट 1978 सुलकावा एवं लियुको 2007, लैंग एवं अन्य 2003, सूर्यवंशी एवं अन्य 2012)। पर्वतीय क्षेत्रों में शाकाहारी (खुर वाले) पशुओं की गणना अभी भी एक बड़ी चुनौती है (सिंह एवं मिलर–गुलांड 2011)। वन्यजीवों की गणना इन क्षेत्रों में पशुओं के कम घनत्व के कारण भी कठिन हो जाती है (बार्न्स 2002)। गणित एवं सांख्यिकी के विकास के बावजूद दुर्गम क्षेत्रों में गणना करने के लिये साधनों की कमी पर अभी तक ठीक से ध्यान नहीं दिया गया है (रैन्सम एवं अन्य 2012)।

उत्तराखण्ड के ट्रान्स–हिमालयी क्षेत्रों में अधिकांश स्थान लद्दाख एवं तिब्बती पठार की तरह शुष्क व विरल वनस्पति वाले हैं। भोजन और उपयुक्त वास स्थान की कमी के कारण वन्यजीवों की उपस्थिति भी दुर्लभ हो जाती है। दुर्लभ क्षेत्रीय विशेषताओं से सम्बन्धित कई अद्वितीय पशुवर्ग इस भू–परिक्षेत्र में पाये जाते हैं। अभी तक इस समूचे क्षेत्र में अलग से कोई भी वन्यजीव गणना नहीं की गई है (चित्र संख्या–1)।

उत्तराखण्ड के ट्रांन्स हिमालयी क्षेत्रों (चित्र संख्या–2) में बड़े शाकाहारी वन्यजीवों की गणना के लिये इस प्रोटोकॉल को रैन्सम एवं अन्य (2012) द्वारा मंगोलिया के गोबी रेगिस्तान में विकसित तकनीक के आधार पर बनाया गया है; और मांसाहारी वन्यजीवों की गणना की तकनीक स्नो लेपर्ड इन्फॉर्मेशन मैनेजमैन्ट सिस्टम (SLIMS) (जैक्सन एवं हन्टर 1996) से उद्धरित की गई है। इन तकनीकों को आधुनिक सांख्यिकी के अनुसार परिवर्तित किया गया है (श्रोत्रिय एवं अन्य 2014)। मांसाहारी वन्यजीवों की निगरानी के लिये उनके चिन्हों की गणना उपयोगी है (लनेजा एवं अन्य 2014)। इस क्षेत्र में कई दुर्लभ वन्यजीव पाये जाते हैं। उल्लेखनीय वन्यजीव प्रजातियों में हिम तेन्दुआ, गुलदार, भूरा भालू, हिमालयी काला भालू, भरल़, हिमालयी थार, श्राव और कस्तूरी मृग आदि शामिल हैं।

स्तनपायी वन्यजीवों की गणना उत्तराखण्ड में ट्रान्स हिमालय के लगभग 8981.23 वर्ग कि0मी0 क्षेत्र (कुल क्षेत्र 14930.88– 5949.65 वर्ग कि0मी0 4900 मी0 ऊंचाई से ऊपर के वर्षभर हिमाच्छादित क्षेत्र) में होगी। पूरे क्षेत्र का सर्वेक्षण करने के लिये 10–15 दिनों का अपेक्षित समय लगेगा (यह सर्वेक्षकों की उपलब्धता पर निर्भर करेगा)। सभी सर्वेक्षकों को पूर्व निर्धारित प्रशिक्षण कार्यशाला में भाग लेना आवश्यक है।

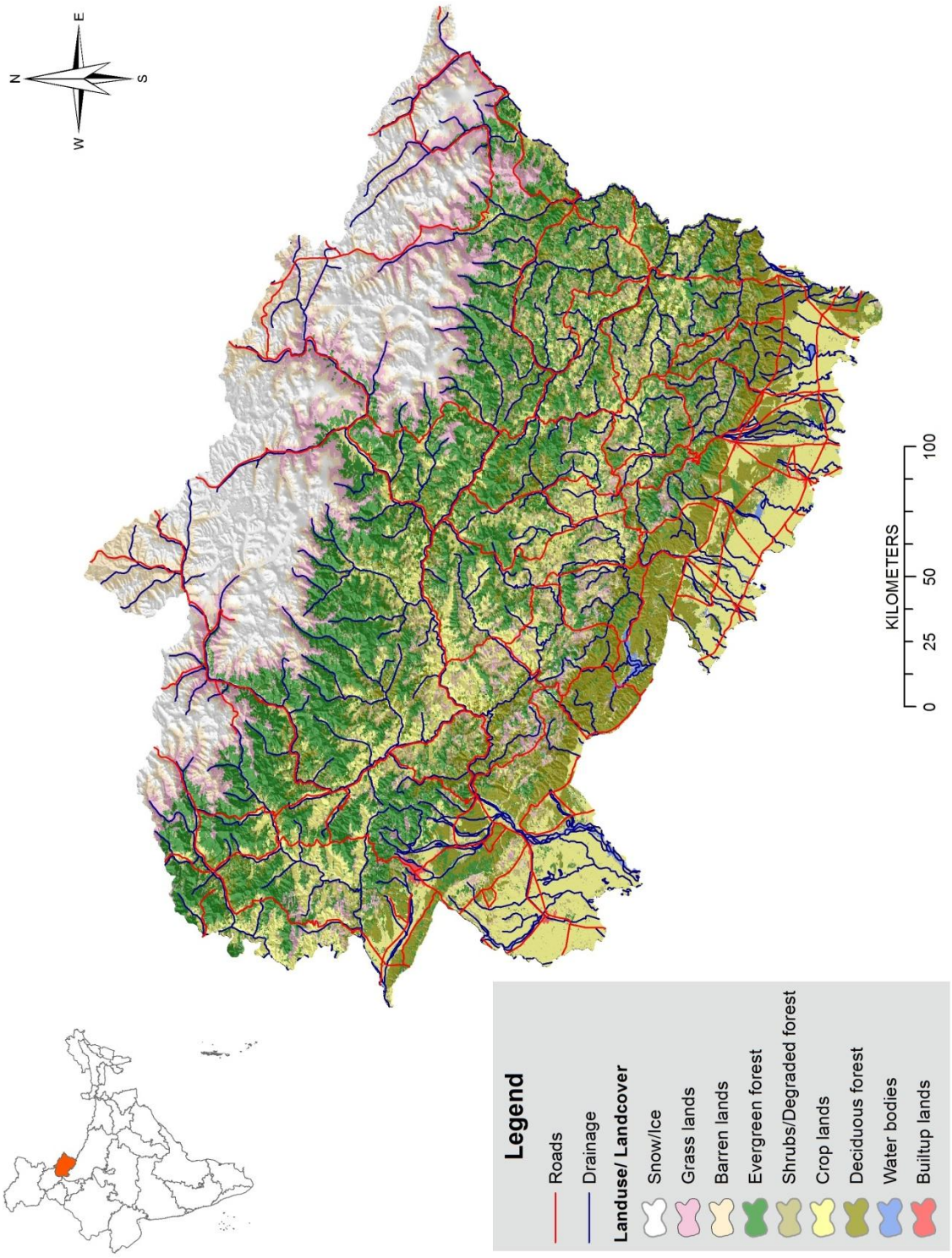

Figure 1: Vegetation map of within Uttarakhand, showing distinct Trans-Himalayan landscape

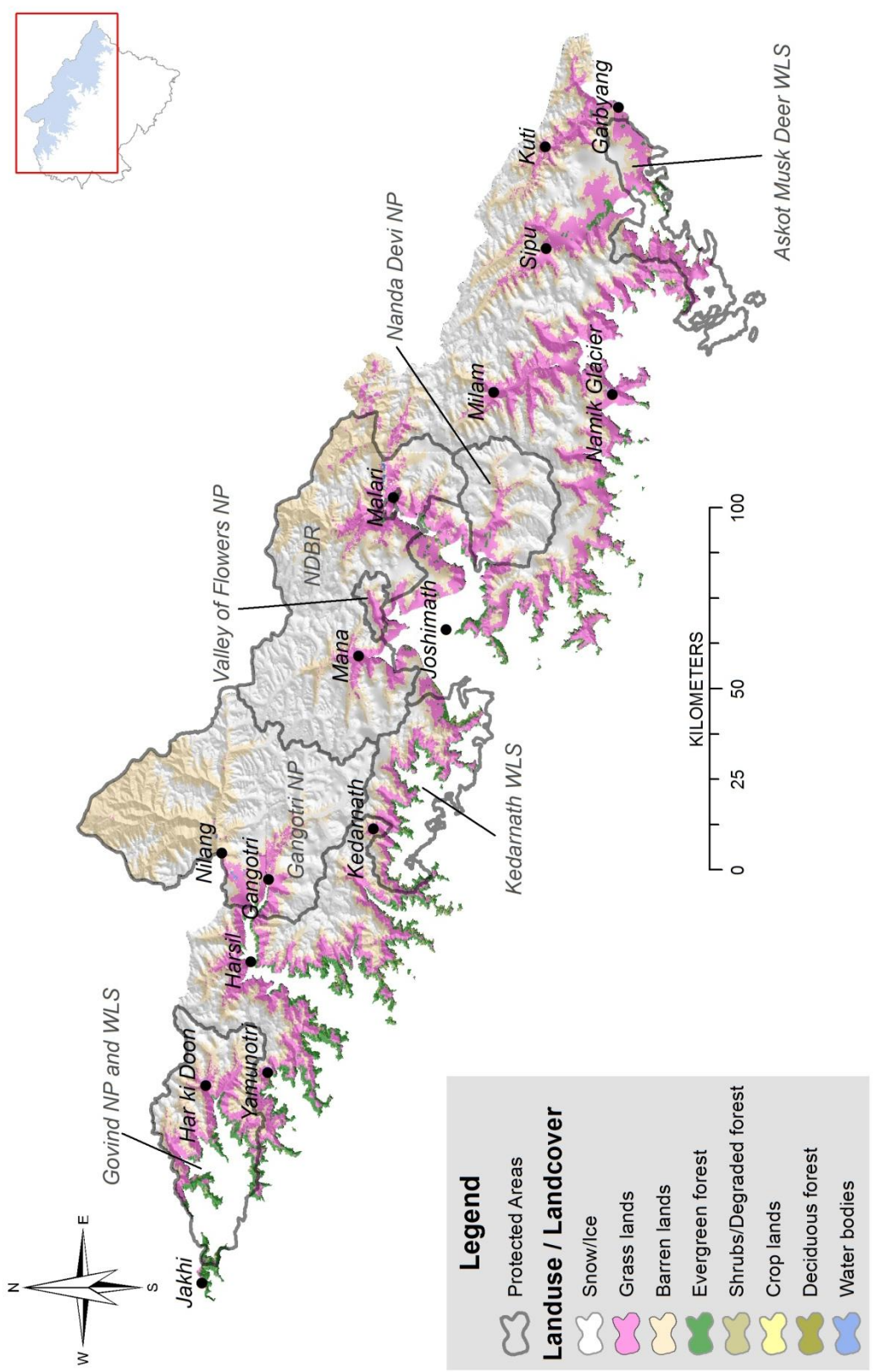

Figure 2: Landuse/Landcover Classification of Trans-Himalayan Landscape of Uttarakhand State

Field Protocol: Mammal Survey

फील्ड प्रोटोकॉलः स्तनपायी वन्यजीव सर्वेक्षण हेतु

- Total area will be gridded into 10x10 (144 grids) and 5x5 (571 grids) km sq. grids (Figure 3 & 4). After discussion with field staff and forest officers, decision shall be taken about the grid size with due consideration to be given to species of interest and availability of man power. Also depending upon availability of man power either all grids or alternate grids shall be selected for sampling.

- पूरे क्षेत्र को 10X10 वर्ग कि0मी0 (144 ग्रिड) और 5X5 वर्ग कि0मी0 (571 ग्रिड) के वर्गाकार ग्रिडों में बांटा गया है (चित्र संख्या–3 और 4) । ग्रिड के आकार तथा संख्या, सर्वेक्षकों की उपलब्धता और वन्यजीव प्रजातियों के आधार पर वन अधिकारियों एवं कर्मचारियों से विचार विमर्श के बाद निर्धारित किये जायेंगे। सभी अथवा वैकल्पिक ग्रिडों का सर्वेक्षण करने का निर्णय भी सर्वेक्षकों की उपलब्धता के आधार पर किया जायेगा।

- Every grid has ten random points for 5 x 5 km sq. grid and 20 random points for 10 x 10 km sq. grid, out of which only one has to be selected. Selection of the point shall be based on accessibility and logistics which will be decided by field staff during training workshop. Google earth maps to be prepared for each sampling location for reference.

- प्रत्येक 10X10 वर्ग कि0मी0 के ग्रिड में 20 और 5X5 वर्ग कि0मी0 के ग्रिड में 10 क्रमरहित सर्वेक्षण बिन्दु हैं, जिनमें से गणना के लिये केवल एक बिन्दु का चयन किया जाना है। सर्वेक्षण बिन्दु का चयन दुर्गमता और साधनों की उपलब्धता के आधार पर सर्वेक्षकों द्वारा प्रशिक्षण कार्यशाला के दौरान किया जायेगा। प्रत्येक सर्वेक्षण बिन्दु पर दिशा–स्थान की पहचान के लिये 'गूगल अर्थ सॉफ्टवेयर' द्वारा नक्शा तैयार किया जायेगा।

- The team shall be dropped at the nearest road head to the selected major sub-region. The team will perform survey in expedition mode.

- टीम को सर्वे क्षेत्र के निकटतम मोटर मार्ग तक पहुंचाया जायेगा तथा सर्वेक्षण को अभियान प्रारूप में पूरा किया जायेगा।

- Teams of 2-3 persons shall be formed to cover one grid at a time. After finishing one grid, the team shall be shifted to nearby gird. In each grid, a team shall complete 2 transects (together) and 26 prey species point counts (13 each for 2 people).

- एक ग्रिड के सर्वेक्षण के लिये 2–3 व्यक्तियों की टीम बनाई जायेगी। पहले ग्रिड के सर्वेक्षण के बाद टीम निकटतम दूसरे ग्रिड में स्थानान्तरित हो जायेगी। प्रत्येक ग्रिड में टीम को 2 ट्रान्जैक्ट

और खुर वाली प्रजातियों के लिये 26 बिन्दु गणनायें (2 व्यक्तियों के लिये 13 गणनायें प्रति व्यक्ति) पूरी करनी है।

- Each team shall be provided the following equipment for survey- GPS, Binoculars, Rangefinder, Compass, Measuring Scale, Clinometer, Watch, pictures for identification of animals and signs, ziplock bags for sample collection, set of data sheets and pens. Other logistic supports needed are food, water, sleeping bags and tents.

- प्रत्येक टीम को सर्वेक्षण के लिये निम्नलिखित उपकरण उपलब्ध कराये जायेंगे– जी0पी0एस0, दूरबीन, दूरी निर्धारक यंत्र, दिशा यंत्र, क्लिनोमीटर, स्केल, घड़ी, वन्यजीव और उनके चिन्हों की फोटो, जिपलॉक बैग, डाटा शीट और पेन। अन्य साधनों में भोजन, पानी, स्लीपिंग बैग और टैन्ट भी उपलब्ध कराये जायेंगे।

- Each team shall conduct two transects (before and after prey survey point) per grid. Transects data has to be entered together and total transects length should be 10 km (not in a straight line – not possible in Himalayas).

- प्रत्येक ग्रिड में टीम को 2 ट्रान्जैक्ट (बिन्दु गणना के पहले तथा बाद में) पूरे करने हैं। प्रत्येक ग्रिड में कुल 10 कि0मी0 के ट्रान्जैक्ट चलने हैं तथा डाटा पूरी टीम साथ में एकत्र करेगी।

- Identifiable scats of the carnivore species shall be collected and marked during carnivore transects and shall be entered in the transect data sheet.

- मांसाहारी वन्यजीवों के पहचान योग्य मल (विष्ठा) को जिपलॉक बैग में एकत्र कर जी0पी0एस0 लोकेशन की सहायता से बैग तथा ट्रान्जैक्ट डाटा सीट पर अंकित करना होगा।

- After reaching the survey point, the team shall pitch the tent and select an elevated location around, with maximum visibility for prey species survey.

- सबसे पहले सर्वेक्षण बिन्दु पर पहुंचने के बाद टीम अपने लिये टैन्ट लगाकर, बिन्दु गणना के लिये अधिकतम दृश्यता वाला एक ऊंचा बिन्दु चुनेगी।

- 13 repeated point of 10 minutes each counts shall be conducted from the elevated point by each of the two observers at the same point independently. Approximate timings for point counts are- 6:00 PM (on the day of reaching), 6:00 AM (next day morning), 7:00 AM, 8:00 AM, 9:00 AM, 10:00 AM, 11:00 AM, 12:00 Noon, 1:00 PM, 2:00 PM 3:00 PM 4:00 PM and 5:00 PM.

- खुर वाले (शाकाहारी) प्रजातियों के लिये 10 मिनट की बिन्दु गणना 2 व्यक्तियों द्वारा एक ही समय और स्थान पर बिना डाटा साझा किये अलग–अलग पूरी करनी है। प्रतिव्यक्ति प्रति सर्वेक्षण बिन्दु पर 13 गणनायें निम्नलिखित पूर्व निर्धारित समयों पर एक घण्टे के अन्तराल में पूरी करनी होगी– 6:00 PM (पहुंचने वाले दिन), 6:00 AM (अगले दिन सुबह), 7:00 AM, 8:00 AM, 9:00 AM, 10:00 AM, 11:00 AM, 12:00 PM, 1:00 PM, 2:00 PM, 3:00 PM, 4:00 PM और 5:00 PM ।

- All the carnivore and ungulate sightings out of the transects and prey points should be maintained separately, recording sighting time and GPS location.

- ट्रान्जैक्ट एवं बिन्दु गणना के अलावा शिकारी व खुर वाली प्रजातियों के दिखने की जानकारी समय और जी0पी0एस0 के साथ अलग से लिखी जायेगी ।

- Eleven major sub-regions selected for sampling as described in detail in table 3. Administrative forest ranges have been identified for each landscape, which will be responsible for logistics (camping gear, transportation, food etc.) and permission/inner-line permits if required.

- सर्वे के लिये कुल 11 बड़े सर्वे क्षेत्रों का चयन किया गया है जिनका विवरण निम्नलिखित सारणी में है (सारणी–3)। प्रत्येक भू–परिक्षेत्र के लिए प्रशासनिक वन रेंज चिन्हित कर दी गई हैं, जोकि सर्वेक्षण के लिए साधनों (कैम्पिंग, परिवहन भोजन आदि) तथा अनुमति व इनर–लाईन परमिट के लिए उत्तरदायी होगी।

- Data sheets and instructions to fill the carnivore transect (Appendix-I), to collect scat samples (Appendix-II) and prey species point counts (Appendix-III) are attached.

- ट्रान्जैक्ट एवं बिन्दु गणना की डाटा शीट भरने, जिपलॉक बैग पर मल (विष्ठा) जमा करने की जानकारी अंकित करने के निर्देश और डाटा शीट संलग्न हैं (संलग्नक–1 ,2 एवं 3)।

Table 1: Area under different Landuse/Landcover Categories of *Trans-Himalayan Landscape of Uttarakhand State*

Landuse/Landcover	Area (Sq. Km)
Snow/Ice	6690.30
Grassland	3393.52
Barren Land	3651.26
Evergreen Forest	736.18
Shrubs/Degraded Forest	136.5
Crop Land	13.35
Deciduous Forest	0.17
Water Bodies	9.24

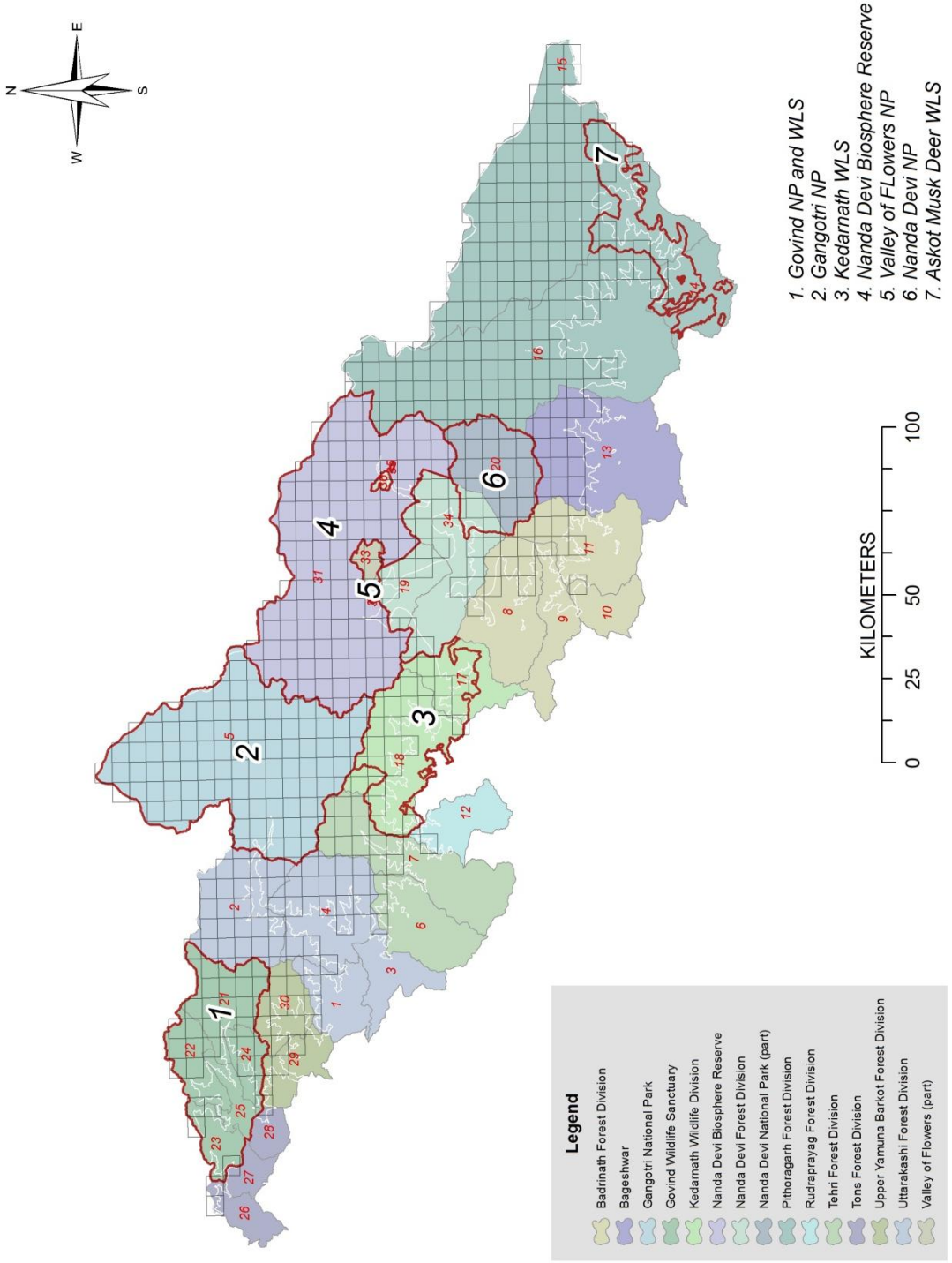

Figure 3: Gridded Map (5 x 5 km) of Trans-Himalayan Landscape of Uttarakhand State

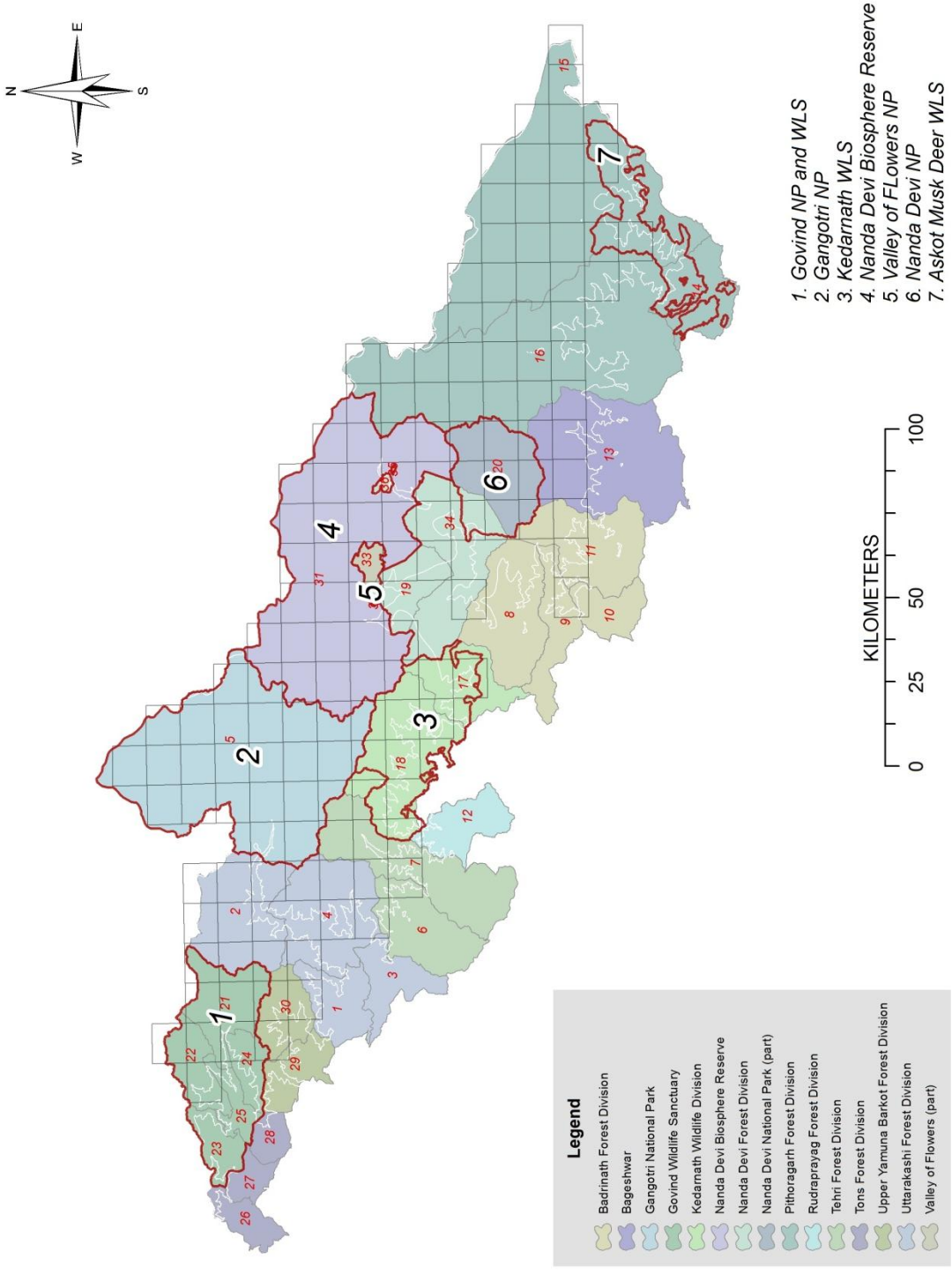

Figure 4: Gridded Map (10 x 10 km) of Trans-Himalayan Landscape of Uttarakhand State

Table 2: Circle/Division/Range as indicated in Figure 3 and 4 of Trans-*Himalayan Landscape of Uttarakhand State*

ID (On Map)	CIRCLE	DIVISION	RANGE
2	Bhagirathi Circle	Uttarakashi Forest Division	Gangotri Range
5	Under control of Wildlife HQ	Gangotri National Park	Gangotri National Park
11	Garhwal Circle	Badrinath Forest Division	Pindar East Range
13	North Kumaon Circle	Bageshwar	Kapkot Range
15	North Kumaon Circle	Pithoragarh Forest Division	Dharchula Range
16	North Kumaon Circle	Pithoragarh Forest Division	Munsyari Range
24	Under control of Wildlife HQ	Govind Wildlife Sanctuary	Sankri Range
25	Under control of Wildlife HQ	Govind Wildlife Sanctuary	Supin Range
32, 33	Director, Nanda Devi Biosphere Reserve	Nanda Devi National Park Division	Valley of Flowers
34, 35, 36	Director, Nanda Devi Biosphere Reserve	Nanda Devi National Park Division	Joshimath Range

Statistical Analysis

Density and abundance of prey species shall be calculated with a combine technique of distance sampling and mark-recapture (Ransom et al. 2012; Kissling & Garton 2006). Status of the large carnivores shall be calculated in occupancy framework (MacKenzie et al. 2006).

सांख्यिकीय विश्लेषण

खुर वाली प्रजातियों के घनत्व एवं प्रचुरता का विश्लेषण Distance Sampling और Mark-recapture तकनीकों के आधार पर किया जायेगा (रैन्सम एवं अन्य 2012, किस्लिंग एवं गार्टन 2006)। बड़े शिकारी वन्य जीवों की स्थिति का आंलकन Occupancy तकनीक द्वारा किया जायेगा (मैकिंजी एवं अन्य 2006)।

Expected outcome

- Density, abundance and distribution of large prey species of Trans-Himalayan landscape of Uttarakhand

- Occupancy and status of carnivore species in Trans-Himalayan landscape of Uttarakhand

अपेक्षित परिणाम

- उत्तराखण्ड के ट्रान्स हिमालयी क्षेत्र की बड़ी खुर वाली प्रजातियों का घनत्व, प्रचुरता एवं वितरण।

- उत्तराखण्ड के ट्रान्स हिमालयी क्षेत्र की बड़ी शिकारी प्रजातियों के इलाके और स्थिति।

Population Estimation for Snow Leopard:

Based on results from occupancy survey, area having higher intensive use can be selected for camera trapping exercise to estimate the population of the snow leopards in the area. That can be done separately, not as a part of this protocol.

हिम तेन्दुओं की संख्या का आंकलन

Occupancy सर्वे के परिणाम के आधार पर हिम तेन्दुओं द्वारा अधिकतम प्रयोग वाले क्षेत्रों का चयन कर, उन क्षेत्रों में Camera trapping द्वारा हिम तेन्दुओं की संख्या का आंकलन किया जा सकता है। यह आंकलन इस प्रोटोकॉल का हिस्सा नहीं है तथा इसे अलग से किया जा सकता है।

Blue Sheep *Pic: Shivam Shrotriya*

Table 3: Survey Zones, Team Composition, Time Frame and Logistics

Zone	Forest range	Sub Zone	Time Frame and Team Composition
Gangotri Landscape	Gangotri range of Gangotri NP & Gangotri range of Uttarkashi FD	Gangotri Valley	8 – 10 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
		Neelang valley	8 – 10 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
Nanda Devi Biosphere Reserve North	Joshimath & Valley of Flowers ranges of Nanda Devi NP Division	Niti Valley	12 -15 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
		Girthi Ganga Valley	12 -15 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
Askot Landscape	Munsyari & Dharchula ranges of Pithoragarh FD	Gori valley	8 - 10 Days of expedition mode. Two teams comprising WII researcher and 2-3 local forest staff each. (Team 1: Interior Gori valley) (Team 2: Transition Zone)
		Darma Valley	10 - 12 Days of expedition mode. Two teams comprising WII researcher and 2-3 local forest staff each. (Team 1: Lasser Yaukti) (Team 2: Dawe Plains)
		Byans Valley	10 - 12 Days of expedition mode. Two teams comprising WII researcher and 2-3 local forest staff each. (Team 1: Upper Byans) (Team 1: Lower Byans)
Pindar Landscape	Kapkot range of Bageshwar FD & East Pindar range of Badrinath FD	Pindar Valley	8 – 10 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
		Sundardhunga Gaad Valley	8 – 10 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
Govind Landscape	Sankari & Supin ranges of Govind Wildlife Division	Har ki doon Valley	6 - 7 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.
		Jakhol Valley	6 - 7 Days of expedition mode. One team comprising WII researcher and 2-3 local forest staff.

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APPENDIX-I

Transect Data Sheet

Date:__/__/__ Track no._____ Observer(s) _____ Start Time__:__ __ EndTime__:__ __ Total km walked:_____ Survey Block- Start GPS (elv):_____ End GPS (elv)_____ Location (nearest village, block, dist., state) _____ Weather (sky, wind, rain/snow) today_____ previous day_____

1 Observation No	1	2	3	4	5
2 Species					
3 Time					
4 Distance Walked					
5 GPS (elv)					
6 Sign Type					
7 Sign age/visibility					
8 Substrate Type					
9 Feature Marked					
10 Sign measurement					
11 Distance to animal					
12 Sighting Angle					
13 Total animals					
14 Age & Sex composition					
15 coat color & body condition					
16 Activity					
17 Aspect					
18 Slope					
19 Rangeland Use					
20Habitat/vegetation					
21 Landform Ruggedness					
22 Dominant topography					
23 Type (distance) to Human habitation					

Comments

Instructions for Transect Data sheet

Track No.: Track route must be saved in GPS device with the same no. If more than one forms are filled on same track, Track no should follow alphabetic numbering. E.g., Track no. 2, 2b, 2c….
Survey block: Study area is gridded into 15x15 km blocks. Survey blocks bear prefixed numbers and your data sheets bears the numbers.

Weather condition: Since sign visibility depends on previous day weather, weather condition should be recorded for the previous day also if possible.

Row No.	Item		Description
2	Species	Carnivores	
		Wolf	Sign/Sighting of Wolf
		Red Fox	Sign/Sighting of Red Fox
		Snow Leopard	Sign/Sighting of Snow Leopard
		Brown /Black Bear	Sign/Sighting of Brown Bear
		Stoat/Weasel/Marten/Otter	Sign/Sighting of Stoat/Weasel/Marten/Otter
		Other Carnivores	Sign/Sighting of Other Carnivore
		Ungulates	Sightings Blue sheep, Goral, Ibex, Serow, Musk deer, Thar etc. including Livestock
3	Time		Time of finding sign/direct sighting
4	Distance Walked		Distance from the transect beginning point (take from trip record of GPS)
5	GPS (elv)		Take Northing, Easting and Elevation from GPS. Take GPS point of the location itself if sign is recorded. If direct sighting, take the GPS of your location from where you first sighted the animal
Indirect sign records (Only for carnivores)			
6	Sign Type	Scat (non-relic)	Usually only one scat (no evidence of repeated use)
		Scat (relic)	Usually numerous (3-10) scats of different age
		Pugmark	Only a few impressions of footprint
		Pugmark trail	track (record different track or individuals separately)
		Scrape/Scratch (non-relic)	non-relic Scrape by felid or scratch by canid
		Scrape/Scratch (relic)	relic Scrape by felid or scratch by canid
		Urine/Scent spray	Urination mark or Scent mark
		Hair	Hair stuck at boulder/den opening
		Den/Rendezvous Site	Site is used as Den/Rendezvous
		Kill	A kill made by carnivore, Write the possible predation species in row 2 (Species) *Scats, hair and tissue from kills are to be collected*
7	Sign age/visibility	**Scat**	
		Old	Scat is mottled and cracked, with a hard, dull surface and dry interior (several weeks to months of age).
		Fresh	Scat is odoriferous and fresh-looking, with a glossy, sheen inside (more than 2 days but less than 10 days of age).
		Very Fresh	Scat is still wet outside and moist inside (no older than 2 days)
		Pugmark/trail	
		Old	Pugmark is very poorly defined, with weathered appearance (more than 2 weeks old).
		Fresh	Pugmark has sharply defined edges and shape (several days, but less than one week old).
		Very Fresh	Pugmark is very fresh, showing fine surface details and having a very sharp edge (less than 24 hours previously)
		Scrape/Scratch	
		Old	Extensive to moderate weathering, scrape/scratch features poorly defined (several months old)

	Fresh	Slight weathering, scrape/scratch well-defined and easily recognizable (1 to 4 weeks old)
	Very Fresh	Little or no weathering, no vegetation on the mark. Often with other ephemeral signs- scat, urine, pugmark (less than 1 week old)
	Urine/ Scent spray	
	None or Slight	No detectable odor
	Moderate	Odor is readily detectable
	Strong	Odor is unmistaken and detected from a distance
	Hair	
	Old	Weathering affected
	New	Hair texture and shine is fresh
	Den/Rendezvous Site	
	In Use	Site is currently in use or was used till last season
	Abandoned	Site is not used for several years
	Kill	
	Old	Kill is disintegrating
	Fresh	Kill is made within 24 hours
8 Substrate Type	Rock	Ground consists largely of rock
	Sandy soil	Sand (particles of less than 2 mm diameter)
	Gravelly soil	Mixture of small pebbles and soil
	Fine soil	Soil consists of fine particle (clay, silt and dust)
	Snow	Sign is left on snow
	Vegetation	Sign is left on vegetation
9 Feature marked		
	Cliff (base or crest)	Steep rock face
	Boulder	Large rock
	Promontory	Peak of land that juts out over a hillside, offering a good view of the land below
	Knoll	Hillock or rounded protuberance on a hillside or ridge
	Pass	A narrow passage across a mountain top
	Bush or Tree	If possible record or photograph the species also,
	Grass	if possible record or photographs the species
	Saddle	A low spot along a ridgeline
10 Sign Measurement	**Scat (non-relic)**	*No measurement is to be marked on data sheet, but the whole scat sample should be collected without breaking*
	Scat (relic)	*Same as above*
	Relic use no.	Number of scats differentiable by age
	Pugmark/trail	*Refer to Figure 5 for description*
		Greatest length
		Greatest width
		Heel pad length
	Scrape/Scratch	*Refer to Figure 6 for description*
		Greatest length
		Greatest width
		Placement
	Urine/Scent spray	*Refer to Figure 7 for description*
		Greatest height
	Hair	*Sample must be collected. Collect only if visible follicle*
	Height from the ground	Record the height of sign from the ground
		General description of hair Color, condition
	Den/Rendezvous Site	
	Den Opening size and shape	Length and width of the opening and general shape

	Den/Rendezvous site size	Length, width & height of the site (if possible)
	Den opening height	Den opening height from the ground
	Kill	*Sample of the issue from bite must be collected.*
	Killed species& age class	Specify the killed species and age
	Eating pattern	Comment on the eating pattern of the carnivore
Direct sightings		
11 Distance to animal observer.		Approx. distance of first sighting of animal from the Take distance to the center of the group
12 Sighting Angle compass.		Angle of first sight of animal from north, using Take the angle to the center of the group
13 Total animals		Number of the animals sighted
14 Age & Sex composition		
Age categories		
	Pup	Born recently
	Young	Animal is able to walk
	Sub-adult	Sub-ordinate in a pack/group
	Adult	Full grown animal
	Sex categories	Male/Female/Undefines
15 Coat color & body condition		Comment on the physical appearance of the animal
16 Activity	Feeding	Animal is foraging
	Staking	Animal is staking for attack
	Chasing	Animal is chasing a prey
	Walking	Animal is walking normally
	Running	Animal is running with normal pace
	Galloping	Animal is running fast
	Resting	Animal is lying and resting
Habitat Features		Habitat characteristics should be recorded for sign and direct sightings
19 Aspect		Aspect of the sight should be taken from north, using compass. *Refer to Figure 8*
20 Slope		Slope of the sight should be recorded using clinometer. *Refer to Figure 8*
21 Rangeland Use	None	Area receives no human use
	Seasonal grazing	Area grazed seasonally by livestock
	Year-round grazing	Area grazed throughout the year by livestock
	Other	Other type of land-use (please specify and describe)
22 Habitat/vegetation		
	Barren	Less than 10% vegetation on ground
	Grassland	Dominant vegetation is grassland (if possible, dominant species should be recorded)
	Shrubland	Dominant vegetation is shrubs (if possible, record dominant shrub species)
	Woodland	Dominated by open trees and savanna
	Other	Other types such as agriculture fields (please specify)
23 Landform ruggedness		
	Cliff	Terrain at site is very precipitous (slope more than 50°)
	Very broken	Terrain heavily broken by cliffs, rocky outcrops, ravines, and gullies
	Moderately broken	Terrain moderately broken by irregular slopes, rocky outcrops, and gullies
	Rolling	Terrain has a relatively smooth land surface (e.g.,rolling hills or alluvial fan)
	Flat	Terrain forms a level surface (e.g., plain)

24 Dominant Topography		
	Cliff	Terrain at site is very precipitous (slope more than 50°)
	Ridgeline	Narrow crest of land sloping down on either side
	Hill-slope	Side or slope of a hill
	Valley Floor	Valley floor of adjacent slope
	Basin or Bowl	Bowl–like depression
	Stream-bed or Drainage	Site with seasonal/permanent water flowing through it
	Boulder field	Out cropping of large boulders
	Talus or Scree slope	Accumulation of rocks & pebbles at base of steep slope
	Rockfall or landslide	The mass of rocks at the base of a cliff
	Bluff	Steep slope bordering a stream or river
	Terrace	Level raised area bordering a stream or river
	Glacier	Permanent ice field
25 Type (distance) to Human Habitation		Note the type of nearest human settlement and distance in brackets
	Village	Permanently settled village
	Nomad camp	A shifting camp of nomads
	Town	Town or large settlement
	Corral	A corral of Herders

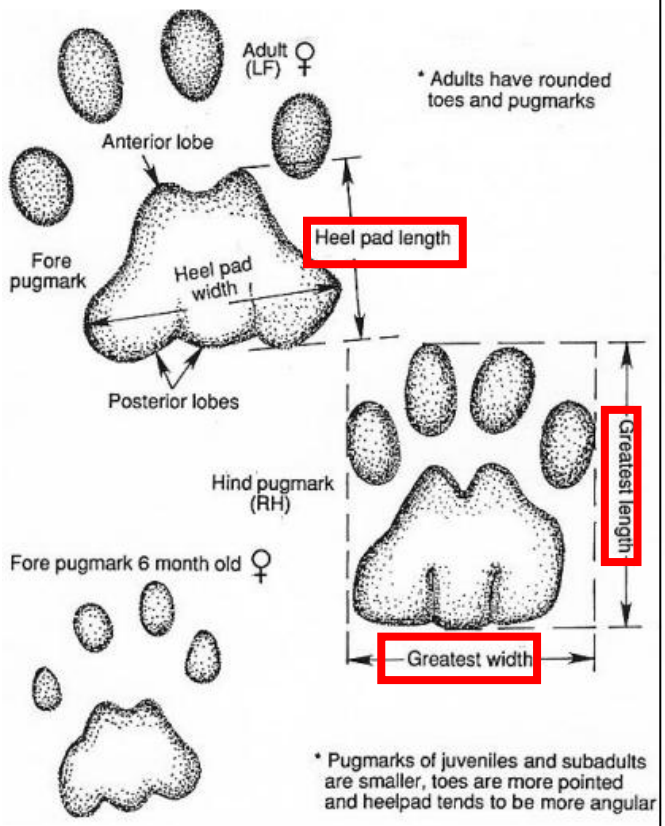

Figure 5. Measurement of Pugmark

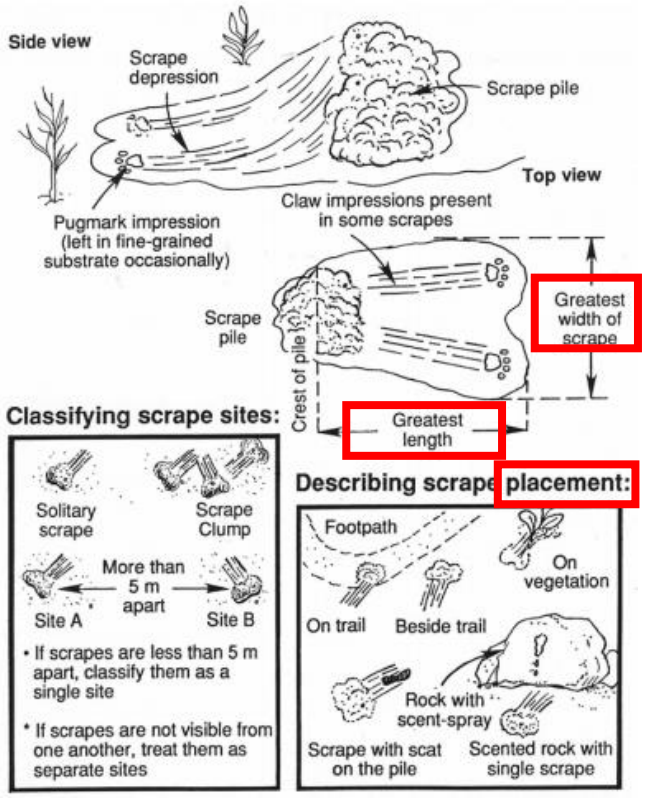

Figure 6. Measurement of Scrape/Scratch

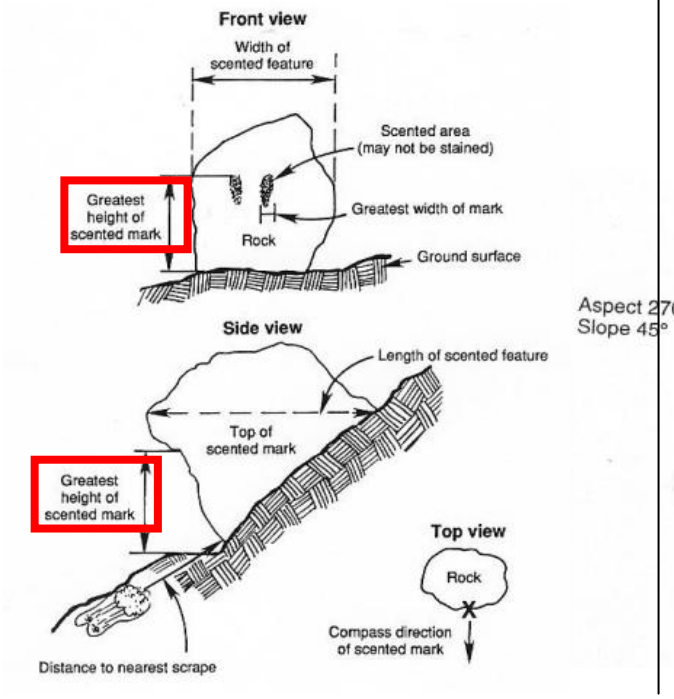

Figure 7. Measurement of Scent/Urine mark observation

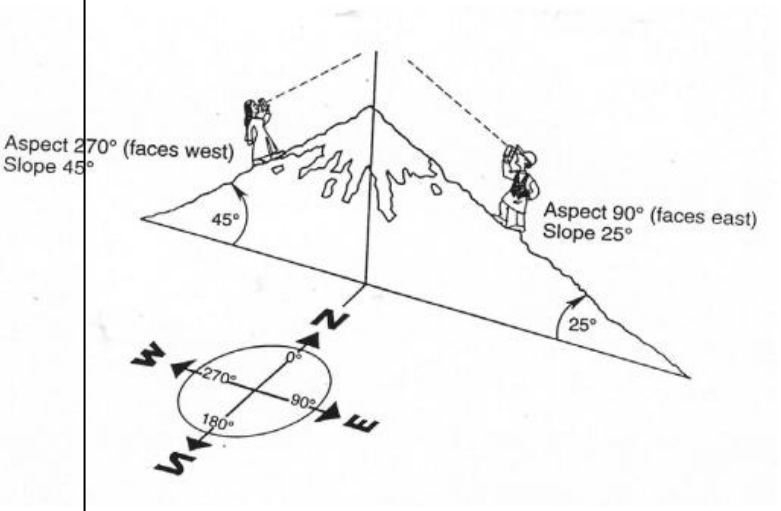

Figure 8. Measuring aspect and slope of

(Source: Jackson & Hunter 1996)

APPENDIX-II

Instructions for Collecting Scat, hair and kill tissue samples

Most of the samples are expected to be collected on transects, for which records must correspond to the transect data sheet. However, there is possibility of finding a sample out of transect. Such samples should also be collected and recorded separately. The following information must be given on the ziplock bag.

Information	Description	Items
1.Species	Mention the species which the sample belongs to	
2. Date		
3. GPS	mention the GPS location of the sample	
4 Type of Sample	Please note the type of sample (if other than mentioned, specify)	Scat, Pellet/Dung, Kill Tissue, Hair, Blood, Tissue, Other
5 Sampled Part	Mention the part of the whole sample taken	Whole (for scat), Body part of kill, Specify other cases
6 Comment	Comment on the sample for items:	age and condition of sample, killed species, Not on transect (If sample is not collected from transect), Other comments

APPENDIX-III

Prey point count Data Sheet

Date:__/__/__ Sheet no._____ Observer _____no.__

Survey Time__:__ __ GPS (elv):_____ Survey Block-

Location (nearest village, block, dist., state) _____

Weather (sky, wind, rain/snow) today_____ previous day_____

1ObservationNo	1	2	3	4	5
2 Species					
3 Distance to animal					
4 Sighting Angle					
5 Total animals					
6 Male age composition					
7Female age composition					
8 Undefined age composition					
9 Activity					
10 Position on Slope					
11 Aspect					
12 Slope					
13 Rangeland Use					
14Habitat/vegetation					
15 Landform Ruggedness					
16 Dominant topography					
17 Type (distance) to Human habitation					

Comments (rangeland use and other remarks)

Instructions for Prey point count Data Sheet

Sheet No.: For each of the 13 point surveys, 1 to 13 no. should be given. If more than 1 forms are filled on same survey, Sheet no should follow alphabetic numbering. E.g., Sheet no. 2, 2b, 2c….

Observer no.: Each observer is given specific no.

Survey block: Study area is gridded into 10 x10 or 5x5 km blocks. Survey blocks bear prefixed numbers and your data sheets bears the numbers.

Weather condition: Since sign visibility depends on previous day weather, weather condition should be recorded for the previous day also if possible.

Row No.	Item	Description
2 Species	Animal Seen	(Please note all the species separately including livestock)
	Other	(specify the species)
3 Distance to animal		Approx. distance of first sighting of animal from the observer. Take distance to the center of the group
4 Sighting Angle		Angle of first sight of animal from north, using compass. Take the angle to the center of the group
5 Total animals		Number of the animals sighted in one group
6 Male age composition		All identifiable males should be recorded per age class
	Juvenile	Born recently
	Fawn	Older than juvenile but not yet sub-adult
	Sub-adult	Grown animals but not yet mature
	Adult	Full grown animals (please classify adult males from class 1 to class 3 based on antler growth, higher class for larger antlers)
7 Female age composition		All identifiable females should be recorded as per the age classes described for male
8 Undefined age composition		All undefined sex should be recorded as per the age classes described for male
9 Activity	Feeding	Animal is foraging (grazing and/or browing)
	Resting up	Animal is standing and relatively unalert
	Resting down	Animal is lying or kneeling
	Alert	Animal is upright and alert
	Walking	Animal is walking normally
	Running	Animal is running on a slower pace
	Galloping	Animal is running fast or escaping
10 Position on slope		
	Upper third	Animal in upper portion of slope, near ridgeline
	Middle third	Animal in middle portion of slope
	Lower third	Animal near bottom of slope or in the valley
Habitat Features		Habitat characteristics should be recorded for sign and direct sightings
11 Aspect		Aspect of the sight should be taken from north, using compass. *Refer to Figure 8*
12 Slope		Slope of the sight should be recorded using clinometer. *Refer to Figure 8*
13 Rangeland Use		*Refer to Carnivore Data Sheet Instruction No. 21*
14 Habitat/vegetation		*Refer to Carnivore Data Sheet Instruction No. 22*
15 Landform ruggedness		*Refer to Carnivore Data Sheet Instruction No. 23*
16 Dominant Topography		*Refer to Carnivore Data Sheet Instruction No. 24*
17 Type (distance) to Human Habitation		*Refer to Carnivore Data Sheet Instruction No. 25*
Remark on Grazing and Livestock		Comment if the livestock grazing was supervised by grazer or unsupervised; grazing in open area or closed/bounded area; livestock was seen inside corral or grazing outside

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Principal Chief Conservator of Forest (Wildlife),
Chief Wildlife Warden
Uttarakhand Forest Department
5, Chandrabani, Mohabewla, Dehradun 248 001
Tel: 0135 – 2644691
Fax: 0135 – 2644691

Director
Wildlife Institute of India
Dehradun, Uttarakhand – 248001
Tel: 0135 – 2640111 – 2640115
Fax: 0135 – 2640117
wii@wii.gov.in