वार्षिक प्रगती प्रतिवेदन

आ. व. २०७६/७७

नेपाल सरकार

वन तथा वातावरण मन्त्रालय

राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण विभाग

मकालु वरुण राष्ट्रिय निकुञ्ज कार्यालय

संखुवासभा

२०४८

लेखन तथा सम्पादन

रामदेव चौधरी

प्रमुख संरक्षण अधिकृत

तस्वीर

चन्द्र शेखर चौधरी, प्र.सं.अ.

बद्री बिनोद दाहाल, स.सं.अ.

राम एकवाल दास, स.सं.अ.

हिमाल पाठक, रेञ्जर

मनजित बिष्ट, रेञ्जर

लकपद राई, रेञ्जर

प्रकाशक

मकालु वरुण राष्ट्रिय निकुञ्ज कार्यालय

संखुवासभा

२०० प्रति

मुद्रण

हाइडल प्रेस प्रा.लि., डिल्लीबजार, काठमाडौं

फो.नं. ०१-४२५००८६, ४२५००८७

हाम्रो भनाइ

नेपालको संविधानले आत्मसाथ गरेको ३ तहको सरकार मध्ये निकुञ्ज र वन्यजन्तु आरक्ष संघीय सरकार अन्तर्गतका निकायहरु हुन्। मकालु वरुण राष्ट्रिय निकुञ्ज र यसको मध्यवर्ती क्षेत्र प्रदेश नं. १ मा पर्ने १४ वटा जिल्लाहरु मध्ये संखुवासभा र सोलुखुम्बु जिल्लामा विस्तारित छ। यो निकुञ्जले पूर्वी नेपालको पहाड, हिमाल तथा उच्च हिमाली क्षेत्रमा पाइने वन, वन्यजन्तु, वातावरण, हावापानी र पारिस्थितकीय प्रणालीको प्रतिनिधित्व गर्दछ।

वन डढेलो, खोरिया फडानी, वन क्षेत्र अतिक्रमण, चोरीशिकार, वन पैदावार चोरीतस्करी, छाडा चरिचरन जस्ता केही मानवीय गतिविधिहरु र विनासकारी हिम पहिरो र भूक्षयका कारण खेतीयोग्य जमिन र गाउँबस्ती विस्थापित हुने केही प्राकृतिक कारणहरुले गर्दा यस भेगका जनजीविका कष्टकर र चुनौतीपूर्ण बन्दै गैरहेको छ। यद्यपि यी चुनौतीहरुलाई दीगो व्यवस्थापनका लागि निकुञ्ज कार्यालयबाट सालबसाली रुपमा संरचनात्मक, प्रचारात्मक र प्रबर्द्धनात्मक क्रियाकलापहरु सञ्चालन हुँदै आइरहेका छन्।

आन्तरिक र बाह्य पर्यटक गरी आ.व. २०७५/७६ मा जम्मा २,७६७ र आ.व. २०७६/७७ मा १७,६६ जनाले निकुञ्जको अवलोकन भ्रमण गरेको तथ्याँङ्क छ। यो दुबै तथ्याँङ्कलाई तुलना गर्दा पछिल्लो आ.व.मा पर्यटक आगमन झण्डै ५७% ले घटेको देखिन्छ। त्यस्तैगरी, आ.व. २०७५/७६ मा रु. ८२,८३,२४९ र आ.व. २०७६/७७ मा कोभिड १९ को महामारीले गर्दा नेपाल सरकारले बन्दाबन्दी घोषणा गरेको कारण जम्मा रु. ५१,८८,४४४ राजश्व संकलन भएको छ। यो दुबै आर्थिक वर्षहरुमा संकलन भएका राजश्व रकमलाई तुलना गर्दा पछिल्लो आ.व.मा झण्डै ६०% ले राजश्व संकलनमा कमि आएको छ।

मकालु वरुण राष्ट्रिय निकुञ्ज कार्यालयबाट आ.व. २०७५/७६ मा वन्यजन्तुबाट भएको मानवीय क्षति र अन्य क्षतिको राहत रकम रु. २,७९,६३९ र आ.व. २०७६/७७ मा रु. १५,८९,५७६ वितरण गरिएको छ। पछिल्लो आर्थिक वर्ष अर्थात् आ.व. २०७६/७७ मा राहत रकम भुक्तानीको दर झण्डै ८२% ले बृद्धि भएको देखिन्छ। यो आँकडा बढ्नुको सुखद पक्षको रुपमा वन्यजन्तुको संख्या बढ्नुलाई मान्न सकिन्छ भनें दुःखद पक्षको रुपमा मानव-वन्यजन्तु द्वन्द्वलाई यथोचित व्यवस्थापन गर्न नसक्नुलाई लिन सकिन्छ।

निकुञ्ज कार्यालय र मध्यवर्ती क्षेत्र उपभोक्ता समितिहरुबाट सम्पादन गरिएका सबै गतिविधिहरुलाई समेटेर सालबसाली वार्षिक प्रगती प्रतिवेदन प्रकाशन गरिन्छ। सोही अनुसार आर्थिक वर्ष २०७६/७७ मा सम्पन्न भएका गतिविधिहरु समेटर यो बार्षिक प्रगती प्रतिवेदन तयार गरिएको छ। निकुञ्ज तथा मध्यवर्ती क्षेत्रको विषयमा जानकारी राख्न इच्छुक व्यक्ति वा संघसंस्थालाई थोरै समयमा एकखालको मोटामोटी सूचनाहरु यो बार्षिक प्रगती प्रतिवेदनबाट प्राप्त गर्न सकिनेछ।

अन्तमा, बार्षिक प्रगती प्रतिवेदनको लागि सम्पादित कामहरुको तथ्य, तथ्याँक र तस्वीर उपलब्ध गराउनु हुने निकुञ्ज कार्यालयका सम्पूर्ण सहकर्मी साथीहरुलाई विशेष धन्यवाद दिन चाहन्छु। यस्तैगरी, कभर डिजाइनिङ, पेज सेटिङ र अन्य प्राविधिक सहयोग गरेर वार्षिक प्रतिवेदनलाई किताबको रुपमा प्रकाशन योग्य बनाउने हाइडल प्रेस प्रा.लि., डिल्लीबजार, काठमाण्डूका प्रेसकर्मी मित्रहरुलाई समेत धन्यवाद दिन चाहन्छु। धन्यवाद!

रामदेव चौधरी
प्रमुख संरक्षण अधिकृत

विषय सूची

रेखाचित्र (**ग्राफ**)

मकालु वरूण राष्ट्रिय निकुञ्ज तथा मध्यवर्ती क्षेत्र

१. परिचय

१.१. राष्ट्रिय निकुञ्ज

- घोषणा — बि. सं. २०४८।८।२
- क्षेत्रफल — १५०० वर्ग किलोमिटर
- औसत धरातलीय उचाइ — १००० देखि ८,४६३ मिटर
- औसत बार्षिक बर्षा — ४५७ देखि ४००० मिलिमिटर
- बायोक्लाइमेटिक जोन — सब-ट्रपिकल, अल्पाइन र नैभल
- निर्देशाङ्क — २८° १०' २६'' उ. देखि ८५° ३३' ११'' पू.
- विश्व संरक्षण संघको श्रेणी — दोस्रो

१.२. मध्यवर्ती क्षेत्र

- घोषणा — वि.सं. २०५५।१०।१५
- क्षेत्रफल — ८३० वर्ग कि.मि.
- विश्व संरक्षण संघको श्रेणी — छैठौं
- विस्तारित जिल्ला — २ वटा (संखुवासभा र सोलुखुम्बु)
- गाउँपालिका — ४ वटा (३ वटा संखुवासभा जिल्लामा-भोटखोला, मकालु, र शिलिचोङ तथा सोलुखुम्बु जिल्लामा-१, माहाकुलुङ)
- गाउँपालिकाहरुमा समावेश वडा — १६ वटा (१३ वटा संखुवासभा र ३ वटा सोलुखुम्बु)
- मध्यवर्ती क्षेत्रमा रहेका घरधूरी — ७९५७ वटा
- मध्यवर्ती क्षेत्रको जनसंख्या — ३९,६९६ जना (१९३७१ महिला, २०३२५ पूरुष)
- मध्यवर्ती क्षेत्र उपभोक्ता समिति — १२ वटा
- मध्यवर्ती क्षेत्र ब्यवस्थापन समिति — १ वटा
- म.क्षे. सा. वन उपभोक्ता समूह — ९५ वटा
- म.क्षे. सा. वनको क्षेत्रफल — २५७१६.५ हेक्टर
- सामुदायिक होमस्टे — ९ वटा

मकालु वरूण राष्ट्रिय निकुञ्जको विशेषता तथा जैविक विविधता

१. **निकुञ्ज घोषणाका विशेषताहरु**

- राष्ट्रिय निकुञ्ज र संरक्षण क्षेत्रको द्वेध अवधारणासहित घोषणा भएको राष्ट्रिय निकुञ्ज
- विश्वको सबैभन्दा गहिरो अरुण उपत्यका रहेको राष्ट्रिय निकुञ्ज
- विश्वको पाँचौ अग्लो मकालु हिमाल (८,४६३ मि.) रहेको राष्ट्रिय निकुञ्ज
- उपोष्ण देखि शितोष्ण क्षेत्रको पारिस्थितकीय प्रणालीको प्रतिधित्व गर्ने राष्ट्रिय निकुञ्ज
- विश्व वन्यजन्तु कोष इन्टरनेशनलले पहिचान गरेको २०० इकोरिजन मध्ये "इस्टर्न हिमालयन इकोरिजन" को प्रतिनिधित्व गर्ने राष्ट्रिय निकुञ्ज
- भू-परिधि स्तरको संरक्षण अवधारणा अनुसार पवित्र हिमालय भू-परिधि, Sacred Himalaya Landscape-SHL अन्तर्गत् केही वर्ष अगाडि कार्यक्रम लागू भएको निकुञ्ज
- "पवित्र हिमालय भूपरिधि" अन्तर्गत् जैविक मार्गको रुपमा रहेको राष्ट्रिय निकुञ्ज
- भोटे, राई र शेर्पा जातीको धर्म संस्कृति जगेर्ना गर्दै आएको राष्ट्रिय निकुञ्ज
- जनसहभागितामा आधारित जैविक विविधता संरक्षणको थालनी गरिएको राष्ट्रिय निकुञ्ज

२. **जैविक विविधता**

• स्तनधारी	८८	प्रजाती
• सरिसृप	४३	प्रजाती
• पंक्षी	४३३	प्रजाती
• माछा	७८	प्रजाती
• पुतली	३१५	प्रजाती
• उभयचर	१६	प्रजाती
• वन	२७	प्रकार
• फूल फुल्ने वनस्पति	३०७३	प्रकार
• गुँरास	२५	प्रजाति
• सुनाखरी	१०७	प्रजाति
• औषधिजन्य जडिबुटी	८७	प्रजाति
• दुर्लभ तथा संकटापन्न वनस्पति	५६	प्रजाति
• बाँस	१९	प्रजाति
• डालेघाँस	८६	प्रजाति

३. संरक्षित वन्यजन्तु

३.१. स्तनधारी

- हाब्रे — Red panda, *Ailurus fulgens*
- कस्तुरी मृग — Musk deer, *Moschus chrysogaster*
- हिउँ चितुवा — Snow leopard, *Uncia uncia*
- चिरु/अर्गाली — Tibetan antelope, *Pantholops hodgsonii*
- पहरे बाँदर — Assamese monkey, *Macaca assamensis*
- ब्वाँसो — Tibetan wolf, *Canis lupus*
- चरी बाघ — Leopard cat, *Felis bengalensis*
- नायन — Great Tibetan sheep, *Ovis ammon*
- सालक — Chinese pangolin, *Manis crassicaudata*
- ध्वाँसे चितुवा — Clouded leopard, *Neofelis nebulosa*

३.२. पंक्षी

- डाँफे — Himalayan Monal, *Lophophorus impejanus*
- मुनाल — Satyr Tragopan, *Tragopan satyra*
- चिर — Cheer pheasant, *Catreus wallichii*

३.३. अन्य वन्यजन्तु

- चितुवा — Common leopard, *Panthera pardus*
- रतुवा — Barking deer, *Muntiacus muntjak*
- बँदेल — Wild boar, *Sus scrofa*
- हिमाली कालो भालू — Himalayan black bear, *Selenarctos thibetanus*
- जंगली कुकुर — Wild dog, *Cuon alpinus*
- जंगली बिरालो — Jungle cat, *Felis chaus*
- बाँदर — Rhesus monkey, *Macaca mulatta*
- लँगुर बाँदर — Common langur, *Presbytis entellus*
- स्याल — Jackal, *Canis aureus*
- न्याउरीमूसो — Mongoose, *Herpestes edwardsi*
- मूसेखरायो — Himalayan mouse-hare, *Ochotona roylei*
- फ्याउमूसो — Himalayan Marmot, *Marmota himalayana*
- दुम्सी — Indian crested porcupine, *Hystrix indica*
- मलसाप्रो — Yellow-throated martin, *Martes flavigula*
- ठूलो नीरबिरालो — Large Indian Civet cat, *Viverricula indica*
- धामन सर्प — Rat snake, *Ptyas mucosa*
- माउन्टेन पिटभाइपर — Mountain pitviper, *Ovophis monticola*

मकालु वरूण राष्ट्रिय निकुञ्ज तथा मध्यवर्ती क्षेत्रको सीमाना

१. **राष्ट्रिय निकुञ्जको सीमाना**

पूर्वः-

थोप्सी भञ्याङ देखि सुरुभई ठूलो र सानो घुमठाकको श्रृङ्खलै श्रृङ्खला हुँदै हटिया गाउँको पश्चिममा पर्ने मिसेरेक र सेरेकको धारै धार भई सिमपुञ्ज गाउँको पश्चिमी किनारा हुदै अरुण वरुणको दोभान सम्म ।

पश्चिमः-

पश्चिममा मादी खर्कको पश्चिम र उत्तर पश्चिम हुँदै पाँचपोखरी (मुनीलो सम्म, पाँचपोखरीबाट चेरेम गाउँ देखि उत्तरपश्चिम इन्खु खोलासम्म, त्यहाँबाट उत्तर पश्चिम हुँदै लुक्ला माथि छतर्वु भञ्ज्याङसम्म, छतर्वुबाट कालो हिमाल र कुसुमखाङको शिखर हुँदै मन्जुखोलाको मुहानसम्म, त्यहाँबाट उत्तरतर्फ सगरमाथा राष्ट्रिय निकुञ्जको पूर्वी सिमाना हुँदै फेताञ्चे हिमालसम्म ।

उत्तरः-

पेथाङसेबाट (जहाँ सगरमाथा राष्ट्रिय निकुञ्जको उत्तर पूर्वी सिमाना टुङ्गिन्छ) पूर्वतर्फ नेपाल तिब्बत (चिनको स्वशासित क्षेत्र) बिचको अन्तर्राष्ट्रिय सिमानै सिमाना हुँदै पूर्व पोप्टी भञ्ज्याङ (४,३०० मि.) को पश्चिमपट्टीको उच्चभाग सम्म ।

दक्षिणः-

अरुण वरुण दोभानबाट उत्तर पश्चिम हुँदै हिन्जुसम्म, हिन्जुबाट वरुण खोलाको जलाधार र वाङ र नेमुखोलाको जलाधारलाई छुट्याउने डाँडाको धारहुँदै नेमुखोलाको शिरसम्म, नेमुखोलाको शिरबाट लगातार दक्षिण पूर्वको डाँडाको धार पछ्याउँदै कासुवा खोलाको करिव २,००० मि. को उचाइसम्म, कासुवा खोलाबाट यसको पश्चिमी श्रृङखला हुँदै टासीगाउँको माथिको उच्च विन्दुसम्म, त्यहाँबाट तलतिर झर्दै नुरवु गाउँको उत्तरपट्टी डसुवा खोलासम्म, नुरवु गाउँको माथीको उत्तरपट्टीको डाँडाको धारलाई पछ्याउँदै पताकारे डाँडासम्म र फेरी यो पताकारे डाँडाको शिरैशिर दक्षिणतर्फ माटे खोला (अपसुवा खोलाको शाखा खोला) को मुहानसम्म, त्यसपछि सिमाना फेरी माछेखोलालाई पछ्याउँदै अपसुवा खोलासम्म,त्यसपछी अपसुवा खोलैखोला उत्तरतर्फ दावादाक गाउँ नजीक २,००० मि. उचाइसम्म, त्यसपछि दावादाक र गोंथला गाउँदेखि उत्तरतर्फको डाँडाको श्रृङखलै श्रृङखला हुँदै साइसिम्मा (हलेङखर्क गाउँलाई भित्रपारी च्याङग्रेडाँडा (लोङलुवा खोलाको जलाधार) सम्म, च्याङग्रेबाट लगातारुपले सिमारेखा याचम्खा र सिकिदिम गाउँदेखि उत्तरतर्फ रहेको खोरिया आवादीको सिरान हुँदै संखुवा खोलापारी धर्मशाला खर्कहुँदै केन्पा खर्कको बतासेडाँडा (४,५०० मि.) सम्म, केन्पा खर्कबाट पश्चिमतर्फ झर्ने डाँडाको धार पछ्याउदै मुदीखर्क मुनीपट्टी पर्ने होङगुखोला सम्म ।

२. **मध्यवर्ती क्षेत्रको सीमाना**

उत्तरः-

मकालु वरुण राष्ट्रिय निकुञ्जको दक्षिणी सिमाना (अरुण वरुण दोभान देखि उत्तर पश्चिम हुँदै हिन्जु सम्म, हिन्जुबाट वरुण खोलाको जलाधारलाई छुट्याउने डाँडाको धारहुँदै नेमुखोलाको शिरसम्म, नेमुखोलाको शिर देखि लगातार दक्षिण पूर्वको डाँडाको धार पछ्याउँदै कासुवा खोलाको करिब २,००० मि. को उचाइसम्म, कासुवा खोलाबाटको पश्चिमी श्रृङ्खलाहुँदै टासीगाउँको माथिको उच्च बिन्दुसम्म, त्यहाँबाट तलतिर झर्दै नुरबु गाउँको उत्तरपट्टी डसुवाखोलासम्म, त्यसपछि नुरबु गाउँको माथिको उत्तरपट्टीको डाँडाको धारलाई पछ्याउँदै पताकारे डाँडासम्म र फेरी यो पताकारे डाँडाको शिरैशिर दक्षिणतर्फ माछेखोला (अपसुवा देखि खोलाको शाखा खोला) को मुहानसम्म, त्यसपछि सिमाना फेरी माछेखोलालाई पछ्याउदै अपसुवा खोलासम्म, त्यसपछी अपसुवा खोलैखोला उत्तरतर्फ हुँदै दावाताक गाउँ नजिक २,००० मि. सम्म, त्यसपछि दावाताक र गोंथला गाउँदेखि उत्तरतर्फको डाँडाको श्रृङ्खलै श्रृङ्खला हुँदै साइसिमा (हुलेङखर्क गाउँलाई बाहिर पारी च्याङग्रे डाँडा (खोङलुवा खोलाको जलाधार) सम्म, च्याङ्ग्रेबाट लगातार रुपले सिमा रेखा याचम्खा र सिकदिम गाउँदेखि उत्तरतर्फ रहेको खोरीया आवादीको शिरानै शिरान हुँदै संखुवाखोला पारी धर्मशालाखर्क हुँदै केन्पा खर्कको बतासे डाँडा (४,५०० मि.) सम्म, केन्पा खर्कबाट पश्चिमतर्फ झर्ने डाँडाको धार पछ्याउदै मुबीखर्क मुनीपट्टी पर्ने होङगु खोलासम्म ।

दक्षिणः-

संखुवा खोला र अरुण खोलाको दोभानबाट पश्चिमतर्फ साउने डाँडाको शिरैशिर बुकुर खोलाको (होङगु खोलाको शाखा) सिरानसम्म, त्यहाँबाट बुकुर खोलैखोला हुँदै होङगु र बुकुर खोलाको दोभान हुदै दक्षिण तर्फ होङगु खोलैखोला हुँदै बुङ गाउँको फेदीसम्म ।

पूर्वः-

अरुण खोलाको शिरबाट शुरुभई अरुण खोलैखोला हुँदै संखुवा खोला र अरुण खोलाको दोभानसम्म ।

पश्चिमः-

होङगु खोला (बुङ गाउँको फेदी) बाट बुङगाउँको पश्चिमपट्टीको डाँडाको धारैधार हुँदै सुर्केला सम्म,
सुर्केलाबाट चेरेम गाउँको शिरान हुँदै इङखु खोलासम्म ।

सम्पादित विकास निर्माणसम्बन्धी कामहरू

१. राष्ट्रिय निकुञ्ज कार्यालयबाट सम्पादित केही मुख्य-मुख्य कार्यक्रमहरु

आर्थिक वर्ष २०७६/७७ मा राष्ट्रिय निकुञ्ज तथा आरक्ष आयोजनाको चालु र पूँजीगत खर्च शीर्षक अन्तर्गत् अनिवार्य भुक्तानी गर्नुपर्ने दायित्व र अन्य विभिन्न विकास निर्माण कार्यका लागि संघीय सरकारबाट रु. ७,४४,३१,००० र उद्योग, पर्यटन, वन तथा वातावरण मन्त्रालय, विराटनगर, मोरङ, प्रदेश नं. १ सरकारबाट रु. १,२५,००,००० गरी कूल रु. ८,६९,३१,००० बराबरको बजेट स्वीकृत भएको देखिन्छ। तलब, स्थानीय भत्ता, पोशाक भत्ता, खाद्यान्न भत्ता र सरुवा तथा दैनिक भ्रमण भत्ता अनिवार्य भुक्तानी गर्नुपर्ने दायित्व भित्र पर्ने शीर्षकहरु हुन । यी शीर्षक बाहेकका अन्य सम्पादित मुख्य-मुख्य गतिविधिहरु तपसिलमा उल्लेख गरिएका छन्।

१.१. भवन निर्माण एवम् मर्मत

आर्थिक वर्ष २०७६/७७ मा निकुञ्जको हेदाङ्ना गढीमा सेक्टर कार्यालय र पोष्ट भवन निर्माण भएका छन्। यसका साथै उद्योग, पर्यटन, वन तथा वातावरण मन्त्रालय, बिराटनगर, मोरङ, १ नं. प्रदेशको आर्थिक सहयोगमा हेदाङ्ना गढीमा पर्यटन प्रबर्द्धनका लागि पर्यटक सूचना केन्द्रको व्यवस्थापन गरिएको छ।

१.२. पर्यटक विश्रामस्थल निर्माण

यो निकुञ्ज तथा मध्यवर्ती क्षेत्रको अवलोकन भ्रमण गर्न आउनु हुने आन्तरिक तथा वाह्य पर्यटकहरुका पर्यटकीय सुविधा उपलब्ध गराउने उद्देश्यले विभिन्न स्थानहरुमा पर्यटक विश्रामस्थलहरु निर्माण गरिएका छन् । नेहे खर्कमा १, मकालु बेसक्याम्पमा १ र सेदुवामा १ गरी जम्मा ३ वटा विश्रामस्थलहरु निर्माण भएका छन् । यी विश्रामस्थहरुले स्वदेशी तथा विदेशी पर्यटकहरुलाई भ्रमणको क्रममा थकाइ मार्न आरामस्थलको रुपमा प्रयोग हुनसक्ने देखिन्छ। यस्तैगरी, हेदाङ्ना गढीमा विश्रामस्थलको रुपमा प्रयोग गर्न सकिने गरी एउटा गोलघर निर्माण भएको हो।

१.३. भ्यु टावर (मचान) निर्माण

यस निकुञ्जको आफ्नै कार्यक्रम अन्तर्गत् हेदाङ्ना गढीमा १ वटा काठे भ्यू टावर निर्माण गरिएको छ। यो नवनिर्मित मचानबाट पर्यटकहरुले निकुञ्जमा पाइने वन्यजन्तुहरुलाई अवलोकन गर्न सहज भएको छ । यो भ्यू टावरले खासगरेर रातीको समयमा निकुञ्जका गस्ती टोलीका कर्मचारीहरुले मचानमा बास बसेर चोरी सिकारीको अनुगमन गर्न सक्ने छन्।

१.४. पदमार्ग निर्माण तथा मर्मत

उद्योग, पर्यटन, वन तथा वातावरण मन्त्रालय, बिराटनगर, मोरङ, प्रदेश नं. १, को आर्थिक सहयोगमा यस निकुञ्जमा अवस्थित शिवधारा, पार्वती गुफा हुँदै नेहेसम्म जाने पदमार्ग निर्माण गरिएको छ। यसलेगर्दा धार्मिक पर्यटकहरुलाई सुविधा पुग्नुको साथै उक्त क्षेत्रमा गस्ती कार्य गर्न निकुञ्ज प्रशासनलाई समेत वाटोको सुविधा प्राप्त भएको छ।

१.५. काठेपूल निर्माण तथा मर्मत

उद्योग, पर्यटन, वन तथा वातावरण मन्त्रालय, बिराटनगर, मोरङ, १ नं. प्रदेशको आर्थिक सहयोगमा यो निकुञ्जको मकालु बेसक्याम्पमा २ वटा, टासीगाउँको टासीखोलामा १ वटा, काली खोलामा १ वटा र उतिसे खोलामा १ वटा गरी कूल ५ वटा काठे पूलहरु निर्माण भएका छन् । ती पूलहरुको निर्माण भएपश्चात् स्थानीय मानिसहरुलाई दैनिक आवागमनमा सहजता भएको छ। यसको साथै पर्यटकहरुलाई भ्रमण गर्न सहज हुनुको साथै निकुञ्ज कार्यालयलाई जैविक विविधता संरक्षणका लागि गस्ती कार्यमा सहयोग पुग्ने अपेक्षा गरिएको छ।

१.६. डिजिटल सूचना प्रविधि तथा सूचना बोर्ड तयार र स्थापना

मकालु वरुण राष्ट्रिय निकुञ्ज, मध्यवर्ती क्षेत्र, यहाँका जैविक विविधता, संरक्षण कार्यसंग सम्बन्धित नीतिगत व्यवस्था लगायतका विविध विषयहरुलाई समेटेर सहज एवम् प्रभावकारी रुपमा आम उपभोक्ताहरु, पर्यटकहरु, कर्मचारीहरु, शिक्षकहरु लगायतका सरोकारवालाहरुलाई सुसूचित गर्न निकुञ्ज मुख्यालयमा डिजिटल सूचना प्रविधिको स्थापना गरिएको छ। यसको अतिरिक्त फिल्ड स्तरमा यिनै विषयबस्तुहरु समेटेर सूचना बोर्ड तयार गरी विभिन्न स्थानहरुमा स्थापना गरिएको हो।

१.७. डढेलो नियन्त्रण सम्बन्धि सचेतना तालिम तथा नयाँ अग्नि रेखा निर्माण

स्थानीय जनताले चौपायाका लागि कलिलो र राम्रो घाँस प्राप्त गर्नका लागि जानीजानी वन जंगलमा आगो लगाउने कार्यलाई डढेलो भनिन्छ । यसले समग्र जैविक विविधता संरक्षणमा सकारात्मक भन्दा नकारात्मक प्रभाव पर्दछ। तर, कुनै कुनै वनस्पति प्रजातिलाई नियन्त्रित रुपमा गरिने डढेलोलाई वन व्यवस्थापनको एउटा तरिका मानिएको छ। नेपालमा वन डढेलो एउटा राष्ट्रिय समस्याको रुपमा देखिएको छ। मकालु वरुण राष्ट्रिय निकुञ्जमा घाँसेमैदान भन्दा रुख प्रजाति बढी भएकोले नियन्त्रित आगली वन व्यवस्थापनको एउटा वैज्ञानिक उपाय हुन सक्दछ। खासगरे फागुन, चैत्र, बैशाख र जेष्ठ जस्ता सुख्खा महिनामा निकुञ्ज क्षेत्र

तथा मध्यवर्ती क्षेत्रको वनमा लाग्ने डढेलो नियन्त्रणका लागि विशेष सतर्कता अपनाईएको छ। मध्यवर्ती क्षेत्रका उपभोक्ताहरुलाई १ पटक र कर्मचारीहरुलाई १ पटक डढेलोको नकारात्मक प्रभावबारे सचेतना तालिमको आयोजना गरिएको थियो। त्यस्तैगरी डढेलो नियन्त्रणका लागि सूचनामूलक पम्फ्लेट्स छपाइ वितरण गरिएको थियो। स्थानीय एफ.एम.बाट समेत डढेलो नियन्त्रणबारे विज्ञापन प्रसारण गरिएको थियो। नेपाली सेना र स्थानीय प्रहरी प्रशासनको सहकार्यमा निकुञ्जको विभिन्न क्षेत्रमा डढेलो नियन्त्रण गरिएको थियो। यसको साथै डढेलो नियन्त्रणका लागि ५ किलोमिटर अग्निरेखा निर्माण गरिएको छ। नवनिर्मित अग्निरेखाले गस्ती कार्यमा आवागमनको लागि पदमार्गको सुविधा प्रदान गरेको छ। डढेलो नियन्त्रण कार्यलाई थप सशक्त र प्रभावकारी बनाउन डढेलो नियन्त्रण कार्यमा सक्रिय भूमिका निर्वाह गर्न सुराकी परिचान गरिएको थियो।

१.८. वन्यजन्तुका लागि पानी पोखरी निर्माण

वन्यजन्तुको दिगो व्यवस्थापन गर्नका लागि तिनीहरुको वासस्थान व्यवस्थापन गर्नु पहिलो र अनिवार्य काम हो। वन्यजन्तु बस्ने ओत, हिँडडुल गर्ने ठाउँ, आहारा र पानीको समग्र स्वरुपलाई वासस्थान भनिन्छ। वासस्थान विभिन्न स्वरुपका हुन्छन्, जस्तै, वन-जङ्गल, घाँसेमैदान, सिमसार, कृषि भूमि, बगर, चौर आदि। नेपालमा खासगरेर संरक्षित क्षेत्रमा रहेका प्राकृतिक वासस्थानहरु केही मानवीय र केही प्राकृतिक कारणहरुले गर्दा दिनानुदिन विनास हुँदै गैरहेको छ। वासस्थान विनास हुने प्रमुख कारणको रुपमा वन खण्डीकरण, वनको स्वरुप रुपान्तरण, मिचाहा प्रजातिको बृद्धि, वन अतिक्रमण, डढेलो, भू-क्षय, बाढी र पहिरो, भूकम्प, ठूल्ठूला राष्ट्रिय गौरवका संरचनाहरुको निर्माण (जल विद्युत, राजमार्ग, नहर, अन्तर्राष्ट्रिय विमानस्थल) आदि पर्दछन्। सिमसार जलीय वन्यजन्तुको लागि वासस्थान हो भर्नै अन्य वन्यजन्तुको लागि पानीको प्रमुख स्रोत हो। यस निकुञ्ज तथा मध्यवर्ती क्षेत्रमा रहेका साना ठूला नदी, ताल, भंगालो, झर्ना, पोखरीले जैविक विविधता संरक्षणमा अहम् भूमिका निर्वाह गरेको छ। वन्यजन्तुको जलीय वासस्थानलाई थप व्यवस्थित गर्न विभिन्न स्थानमा ५ वटा सिमसारहरु (पानी पोखरी) निर्माण गरिएका छन्।

१.९. वन्यजन्तुको अध्ययन/अनुसन्धान

यो निकुञ्ज र यसको मध्यवर्ती क्षेत्रमा ८८ प्रजातिका स्तनधारी वन्यजन्तु पाइने अभिलेख छ। यी ८८ प्रजातिका मध्ये आ.व. २०७६/७७ मा हिमाली कालो भालुको अवस्था तथा निकुञ्ज र मध्यवर्ती क्षेत्रमा अवस्थित सिमसारको अध्ययन एवम् अभिलेखीकरण बारे यसै निकुञ्ज कार्यालयका प्राविधिकहरुबाट अध्ययन/अनुसंधान गरिएको थियो। अनुसंधान प्रतिवेदन यसै बार्षिक प्रतिवेदनमा समेटिएको छ।

१.१०. वन्यजन्तुको उद्धार

मकालु वरुण राष्ट्रिय निकुञ्जमा वन्यजन्तु उद्धार केन्द्र नरहेता पनि एकजना पशु स्वास्थ्य प्राविधिक रहेको र प्रमुख संरक्षण अधिकृत, सहायक संरक्षण अधिकृत र रेञ्जरहरु वन्यजन्तु विज्ञको रुपमा रहेकाले वहाँहरुको सुपरिवेक्षणमा घाइते वन्यजन्तुलाई उपचार गरी तिनीहरुको प्राकृतिक वासस्थानमा उद्धार गर्ने गरिएको छ। यस वर्ष उद्धार गरिएका वन्यजन्तुहरुको विस्तृत विवरण तल तालिकामा दिइएको छ।

क्र.सं.	प्रजातिको नाम	फेला परेको स्थान	संख्या	लिङ	फेला पर्दाको अवस्था	कारण
१	चरीबाघ	वरुण महिला मध्यवर्ती सामू. वन	१	?	घाइते	थाहा हून नसकेको
२	रतूवा	एकूवा मध्यवर्ती सामू. वन	१	?	घाइते	थाहा हून नसकेको
३	डाँफे	कोथे पोष्ट	१	भाले	घाइते	थाहा हून नसकेको
४	ब्वाँसो	कोथे पोष्ट	१	?	मृत्त	थाहा हून नसकेको
५	चरीबाघ	चिसापानी मध्यवर्ती सामू. वन	१	?	मृत्त	थाहा हून नसकेको
६	चरीबाघ	वरुण महिला मध्यवर्ती सामू. वन	१	?	घाइते	थाहा हून नसकेको
७	रतूवा	पूकूवादोभान पोष्ट	२	?	मृत्त	थाहा हून नसकेको
८	रतूवा	सिमा गाउ	६	?	घाइते	थाहा हून नसकेको
९	चरीबाघ	हेदाङ्ना गढी	१	?	मृत्त	कूकूरको टोकाइ

१.११. मानव वन्यजन्तु द्वन्द्व व्यवस्थापन

मकालु वरुण राष्ट्रिय निकुञ्जमा वन्यजन्तुको संख्या दिनानुदिन बृद्धि हुनु, निकुञ्जको वरिपरि र कोर क्षेत्रमा समेत गाउँबस्ती र कृषिभूमि हुनु, आदि इत्यादि कारणले गर्दा खासगरेर हिमाली कालो भालु र चितुवाले मानवीय क्षति र पशुधनको क्षति गर्ने गरेका छन्। पछिल्लो समयमा हिमाली कालो भालु र चितुवाको आक्रमण बढ्दो क्रममा रहेको देखिन्छ। यस आर्थिक वर्षमा संखुवासभा, सोलुखुम्बु, ओखलढुङा र खोटाङ जिल्लाका ११ जना नागरिकहरुले हिमाली कालो भालुको आक्रमण भेल्नु परेको थियो। त्यस्तैगरी यी ४ वटै जिल्लाहरुमा खासगरेर चितुवाले खसी, भेडा र गाईगोरु मारेर ८७ वटा पशुधनको क्षति गरेको तथ्याँङ्क छ। मकालु वरुण राष्ट्रिय निकुञ्ज कार्यालयबाट आ.व. २०७५/७६ मा वन्यजन्तुबाट भएको मानवीय क्षति र अन्य क्षतिको राहत रकम रु. २,७९,६३९ र आ.व. २०७६/७७ मा रु. १५,८९,५७६ वितरण गरिएको छ। पछिल्लो आर्थिक वर्ष अर्थात् आ.व. २०७६/७७ मा राहत रकम भुक्तानीको दर झण्डै ८२% ले बृद्धि भएको देखिन्छ। मानवीय क्षति र पशुधनको क्षतिको अवस्था तपसिलमा दिईएको छ।

क्र.सं.	जिल्ला	क्षतिगर्ने वन्यजन्तू	मानवीय क्षति				पशूधन क्षति		
			मृत्यु	सख्त घाइते	सामान्य घाइते	जम्मा	खसी, भेडा	गाई, गोरु	जम्मा
१	संखुवासभा	हिमाली कालो भालु	०	२	२	४	०	०	०
२	संखुवासभा	चितुवा	०	०	०	०	१८	१	१९
३	सोलुखुम्बु	हिमाली कालो भालु	०	१	१	२	०	०	०
४	सोलुखुम्बु	चितुवा	०	०	०	०	३३	६	३९
५	ओखलढुङा	हिमाली कालो भालु	०	०	४	४	०	०	०
६	ओखलढुङा	चितुवा	०	०	०	०	२८	१	२९
७	खोटाङ	हिमाली कालो भालु	०	१	०	१	०	०	०
जम्मा			**०**	**४**	**७**	**११**	**७९**	**८**	**८७**

मानव वन्यजन्तु द्वन्द्व मकालु वरुण राष्ट्रिय निकुञ्जको एकल संरक्षणको चुनौती नभएर राष्ट्रव्यापि रुपमा अझै विश्वव्यापि रुपमा एउटा साझा चुनौती जस्तै देखिएको छ। यसको दिगो व्यवस्थापनका लागि स्थानीय स्तरमा निकुञ्ज कार्यालय, निकुञ्जमा तैनाथ नेपाली सेना, मध्यवर्ती क्षेत्र व्यवस्थापन समिति, उपभोक्ता समिति/समूह, स्थानीय तह, प्रदेश सरकार, नागरिक समाजका अगुवाहरु, सञ्चारकर्मीहरु सबैले आ-आफ्नो स्थानबाट सकरात्मक एवम् रचनात्मक सहयोग गर्नुपर्ने देखिन्छ। साथै, नेपाल सरकारले वन्यजन्तुबाट पीडित परिवारलाई राहत मार्फत् मानव वन्यजन्तु द्वन्द्व व्यवस्थापन गर्ने नीतिगत व्यवस्था गरेको छ। जसअनुसार निकुञ्ज कार्यालयबाट आ.व. २०७६/७७ मा मानवीय क्षति वापत् राहत रु. ६,६५,५७६ र पशुधन क्षति वापत् राहत रु ९,२४,००० गरी कूल रु. १५,८९,५७६ वितरण भएको देखिन्छ।

क्र.सं.	क्षतिको किसिम	राहत पाउने जिल्लाहरु				जम्मा रु.
		खोटाङ	ओखलढुङा	संखुवासभा	सोलुखुम्बु	
१	मानवी क्षति	१०४४८८	१३१६४	३४२५५४	२०५३७०	६६५५७६
२	पशुधन क्षति	०	२८००००	१६९०००	४७५०००	९२४०००
	जम्मा रु.	**१०४४८८**	**२९३१६४**	**५११५५४**	**६८०३७०**	**१५८९५७६**

२. मध्यवर्ती क्षेत्र उपभोक्ता समितिहरुवाट संचालन गरिएका कार्यक्रमहरु

आ.व. २०७६/७७ को लागि मकालु वरुण राष्ट्रिय निकुञ्जको मध्यवर्ती क्षेत्रतर्फ प्राकृतिक स्रोत व्यवस्थापन तथा सामुदायिक विकासका लागि मूलतः पाँच वटा शीर्षकहरुमा कूल रु. ६५,०८,००० बजेट स्वीकृत भएको थियो। स्वीकृत भएका ती कार्यक्रमहरु सम्पन्न गरी शिलशिलेवार रुपमा तपसिल बमोजिम वर्णन गरिएको छ।

(१) **संरक्षण कार्यक्रम** (३०%)

मध्यवर्ती क्षेत्र व्यवस्थापन निर्देशिका २०५६ बमोजिम मध्यवर्ती क्षेत्रतर्फ प्रस्ताव गरिने वार्षिक विकास कार्यक्रमहरु मध्ये ३०% कार्यक्रम संरक्षण कार्यक्रम अन्तर्गत समेट्नु पर्ने हुन्छ । सोही बमोजिम आ.व. २०७६/७७ को लागि संरक्षण कार्यक्रम अन्तर्गत चोरीशिकार नियन्त्रण यूवा परिचालन-१२ पटक, मध्यवर्ती क्षेत्र उपभोक्ता समितिका पदाधिकारीहरुलाई स्वदेशीय अध्ययन अवलोकन भ्रमण-१ पटक, यार्सागुम्बा संकलन व्यवस्थापन अनुगमन-१ पटक, मध्यवर्ती क्षेत्र सामुदायिक वन समूहको विधान र वन कार्ययोजना नवीकरण-१० वटा, धार्मिक वनको विधान र वन कार्ययोजना तयार तथा हस्तान्तरण-२ वटा, गैह्रकाष्ठ वनपैदावर कार्ययोजना तयार-१ वटा र सामुदायिक वन व्यवस्थापन तालिम-३० पटक जस्ता कार्यक्रमहरु स्वीकृत भई आएकोमा यी सम्पूर्ण कार्यक्रमहरु पूर्णरुपमा प्राविधिक प्रकृतिका भएकाले निकुञ्ज कार्यालय मार्फत् सम्पन्न गरिएको थियो ।

(२) **सामुदायिक विकास कार्यक्रम** (३०%)

आ.व. २०७६/७७ को लागि सामुदायिक विकास कार्यक्रम अन्तर्गत् समितिको भवन मर्मत-१ वटा, खानेपानी निर्माण तथा मर्मत-४ वटा, विश्रामस्थल निर्माण-३ वटा र बाख्राको लागि सुधारिएको खोर निर्माण-३ वटा जस्ता कार्यक्रमहरु स्वीकृत भई आएकोमा यी कार्यक्रमहरु सम्पन्न गर्न प्राविधिक ज्ञानको खासै आवश्यकता नपर्ने देखिएकोले ती सबै कार्यक्रमहरु मध्यवर्ती उपभोक्ता समितिहरु मार्फत् सम्पन्न गरिएको थियो ।

(३) **आयआर्जन तथा सीप विकास कार्यक्रम** (२०%)

आ.व. २०७६/७७ को लागि आयआर्जन तथा सीप विकास कार्यक्रम अन्तर्गत् प्लाष्टिकको टनेलमा बेमौसमी तरकारी खेती, सामुदायिक सहभागितात्मक वन व्यवस्थापन तालिम र पर्यापर्यटन प्रबर्द्धन, व्यस्थापन तथा सचेतना तालिम जस्ता कार्यक्रमहरु स्वीकृत भई आएकोमा यी कार्यक्रमहरु मध्यवर्ती उपभोक्ता समितिहरु मार्फत् सम्पन्न गरिएको थियो ।

(४) **संरक्षण शिक्षा कार्यक्रम** (१०%)

आ.व. २०७६/७७ को लागि संरक्षण शिक्षा कार्यक्रम अन्तर्गत् संरक्षण सम्बन्धी विद्यालय कार्यक्रम-४ पटक, इकोक्लब गठन-५ वटा, संरक्षणसम्बन्धी प्रचारप्रसार सामग्री उत्पादन तथा वितरण-१ पटक, वन्यजन्तुबाट हुने क्षतिको राहत सहयोग निर्देशिका २०७५ सम्बन्धी अन्तरक्रिया-६ पटक र विधान र कार्ययोजना कार्यन्वयन बारे उपभोक्ता समूहहरुलाई तालिम-६ पटक जस्ता कार्यक्रमहरु स्वीकृत भएको र ती कार्यक्रमहरु पूर्णरुपन प्राविधिक प्रकृतिका भएकाले निकुञ्ज कार्यालय मार्फत् सम्पन्न गरिएको थियो ।

पर्यटन तथा राजश्व

१. पर्यटन प्रबर्द्धन

मकालु वरुण राष्ट्रिय निकुञ्ज पूर्वी नेपालको पर्यटन विकासको केन्द्र (Hub) को रुपमा परिचित भएता पनि यस वर्ष कोभिड-१९ को महामारीको कारण आन्तरिक तथा बाह्य पर्यटकहरु कमै मात्रामा भ्रमण गरेको देखिन्छ । निकुञ्जको अभिलेखबाट आ.व. २०७५/७६ को चैत्र मसान्तसम्म नेपाली, सार्क र विदेशी गरी २,७६७ जना पर्यटकहरु निकुञ्ज अवलोकन गर्न आएको देखिन्छ । र, आ.व.२०७६/७७ को सोही अवधिसम्म १७६६ जना पर्यटकहरुले मात्र मकालु वरुण राष्ट्रिय निकुञ्जमा भ्रमण गरेको तथ्याँङ्क छ । यी दुबै तथ्याँङ्कहरुलाई तुलनागर्दा यस वर्ष सोही अवधिसम्म झण्डै ५७% ले पर्यटक आगमनमा कमि आएको हो । २०७६ साल श्रावणदेखि २०७७ साल अषाढ महिनासम्मको पर्यटक विवरण तपसिलमा दिईएको छ ।

महिना	इकाइ	नेपाली			सार्क			विदेशी			कूल जम्मा
		महिला	पूरुष	जम्मा	महिला	पूरुष	जम्मा	महिला	पूरुष	जम्मा	
श्रावण	जना	११	८	१९	०	०	०	२	४	६	२५
भदौ	जना	०	३	३	१	२	३	१	१९	२०	२६
असोज	जना	११६	५६	१७२	२३	१	२४	१८०	६३	२४३	४३९
कात्तिक	जना	०	१२५	१२५	२०	३	२३	२६७	६४०	९०७	१०५५
मंसिर	जना	६	१६	२२	०	१	१	४७	१११	१५८	१८१
पौष	जना	०	०	०	०	१	१	८	३	११	१२
माघ	जना	०	०	०	०	०	०	०	०	०	०
फागुन	जना	०	०	०	०	०	०	२	५	७	७
चैत्र	जना	०	०	०	०	०	०	७	१४	२१	२१
बैशाख	जना	०	०	०	०	०	०	०	०	०	०
जेष्ठ	जना	०	०	०	०	०	०	०	०	०	०
आषाढ	जना	०	०	०	०	०	०	०	०	०	०
जम्मा		**१३३**	**२०८**	**३४१**	**४४**	**८**	**५२**	**५१४**	**८५९**	**१३७३**	**१७६६**

२. राजश्व आम्दानी

मकालु वरुण राष्ट्रिय निकुञ्ज कार्यालयको प्रमुख जिम्मेवारी जैविक विविधता संरक्षण गर्नु नै हो । यसको अतिरिक्त पर्यापर्यटन प्रबर्द्धन मार्फत् राजश्व आम्दानी गरेर स्थानीय स्तरमा रोजगार सृजना गर्नु निकुञ्जको अर्को उद्देश्य पनि हो । यसका लागि निकुञ्ज कार्यालयबाट निकुञ्ज प्रवेश शुल्क, वन पैदावार निकासी शुल्क, पथ प्रदर्शक शुल्क, हेलिकप्टर अवतरण शुल्क, बेरुजु फछ्र्योट, न्यायिक दण्डजरिवाना, अन्य प्रशासनिक शुल्क जस्ता विविध शीर्षकहरुमा नियम कानून बमोजिम राजश्व संकलन हुने गर्दछ । विश्वव्यापि कोभिड १९ को संक्रमणले गर्दा यस वर्ष राजश्व संकलनमा समेत नकारात्मक असर परेको छ । आ.व. ०७५/७६ मा रु. ८२,८३,२४९ र आ.व. ०७६/७७ मा रु. ५१,८८,४४४ राजश्व रकम संकलन भएको देखिन्छ । पछिल्लो आर्थिक वर्षको राजश्व संकलनमा झण्डै ६०% ले कमि आएको छ । २०७६ साल श्रावणदेखि २०७७ साल अषाढ महिनासम्मको राजश्व विवरण तपसिलमा दिईएको छ ।

क्र.सं.	विवरण	रकम रु.	भ्याट रु.	जम्मा रु.	कैफियत
१	वन रोयल्टी (३३१५१)	१०४२२६	०	१०४२२६	
२	अन्य प्रशासनिक सेवा शुल्क (१४२२९)	२७००००	०	२७००००	
३	बेरुजु फछ्र्योट (१५१११)	७०७८४	०	७०७८४	
४	वन क्षेत्रको रोयल्टी (३३३६१)	४७४३४३४.१	०	४७४३४३४.१	
	जम्मा रु			**५१८८४४४.१**	

अध्ययन/अनुसंधान

१. मकालु वरुण राष्ट्रिय निकुञ्ज र मध्यवर्ती क्षेत्रमा हिमाली कालो भालूको अवस्था बारे सर्वेक्षण

Executive Summary

A general synopsis of status of Himalayan black bear, *Selenarctos thibetanus* is presented in this partial report based upon 120 days (17 November 2019 to 13 March 2020) surveying conducted by the park wildlife technicians. The major objective to launch this project in Makalu Barun National Park (MBNP) and its Buffer Zone (BZ) is to study national system of conservation status of Himalayan black bear, to record conservation threats and to record damages (human, livestock and agricrop) caused by Himalayan black bear. Buffer Zone Community Forests (BZCFs) and adjoining park's Forests were selected for the study area. Direct and indirect both methods were executed to acquire necessary information. Existing wildlife conservation policies were reviewed and found legal status of the Himalayan black bear. National Park and Wildlife Conservation Act 1973 has granted legal protection to this species as protected wildlife of Nepal. The depicted image in official letterhead of MBNP is Himalayan black bear, which undoubtedly signifies national system of its status. Observers photographed some incidents in the field as evidences of presence of the Himalayan black bear. Likewise, they also recorded snares, camping sites, poaching suspected sites as conservation threats to this species. Local farmers, teachers and herders were consulted and collected livelihood issues raised by the Himalayan black bear. Altogether 1364 households of 15 villages were surveyed and recorded human casualties, cattle and agricrops damages. There are 4 human injuries, 17 cattle damages, 10928 Pathi maize, 434 Pathi millet and 198 Pathi wheat destroyed by the Himalayan black bear. Out of 15 villages, 5 villages viz. Hatiya, Chyamtang, Dangok, Syakshila and Lingam recognized as the hotspots for agricrop damages. To deal with these livelihood issues and to ensure sustainable survival of the Himalayan black bear in the study area, a precautionary and legal measures could be essential options. A regular wildlife monitoring, animal scaring devices, awareness about escaping techniques, crop protect strategy (fencing), pre-warning, sms texting, seasonal damage calendar, broadcasting, local level dialogoue, crop pattern change, business diversification, encroachment control could be some precautionary measures. Relief fund mobilization, insurance (life, cattle, agriculture etc.) mechanism, rescueing and transportation system, local government level coordination committee could be powerful legal measures to cope with these issues.

Keywords:

Wildlife, Habitat, Livelihood, Livestock, Crop damage, Shifting cultivation, Slash and burn.

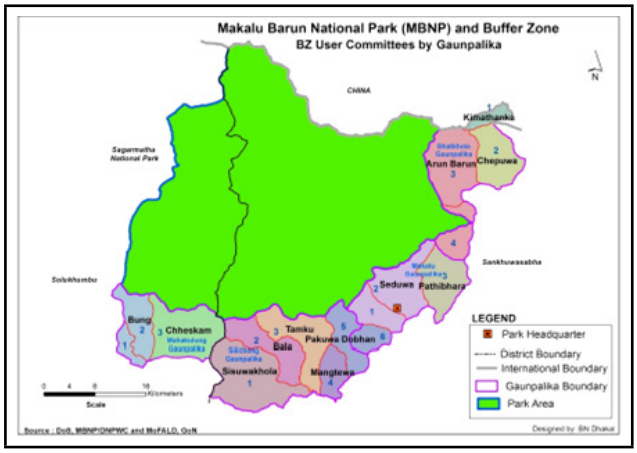
1. Introduction

1.1 Makalu Barun National Park

Makalu Barun National Park (MBNP) is bounded by Sagarmatha National Park (SNP) in the west, Arun River by South, Arun and Kimathanka in the East and China (Tibet) in the North. It is the only protected area in the country to host proposed pristine strict nature reserve Saldima valley with lustrous green vegetation containing floral hotspot. It spreads over parts of Bhot Khola rural municipality, Makalu rural municipality, fully encompasses Silichong rural municipality in Sankhuwasbha district and parts of Maha Kulung rural municipality in Solukhumbu district.

In 18 Novebber, 1991 by covering some 1500 Km^2 landmasses, it was announced as the MBNP. Later on, Buffer Zone (BZ) of Makalu Barun National Park was declared on 10 February 1999 by covering some 800 Km^2 areas.

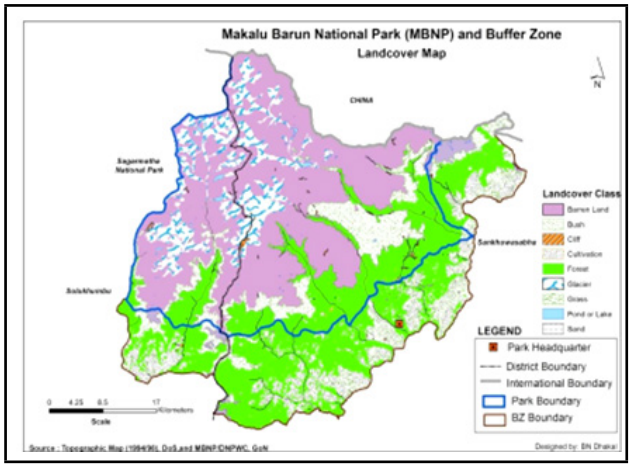
The main objective of Makalu Barun National Park and its Buffer Zone management is to enhance biodiversity of the park, promote eco-tourism and regulate it to maintain balance between conservation and tourism and also support livelihoods of local Community through effective management of natural and cultural heritage.



1.2. Biodiversity

The park hosts 3073 species of vascular plants, 78 species of lichen, 128 species of pteridophytes, 88 species of mammals, 433 species of birds, 43 species of reptiles, 16 species of amphibians, 14 species of herpetofauna, 13 species of fish, 315 species of butterfly and 20 species of bat (Chaudhary and Vetaas 2002). The invasive species commonly occurring are *Eupatorium odoratum*, *E. adenophorum*, and *Lantana camara* which were found dominant on the slash and burn sites. The 11 species of mammals and 3 species of birds found in MBNP which are protected by NPWC Act 1973. Some of the protected

mammals are Musk deer, *Moschus crysogaster*; Red panda, *Ailurus fulgens*; Leopard cat, *Felis bengalensis*; Pangolin, *Manis crassicaudata*; Assamese macaque, *Macaca mulatta*, etc.



1.3 Conservation Issues or Rationale of the Study

Besides poaching within the MBNP and its Buffer Zone, crop depredation by Himalayan black bear, monkey and barking deer is prime concern of local people. Livestock depredation by Himalayan black bear is also reported by the locals. Moreover, encounters of people with Himalayan black bear have increased causing hindrance to the harmonious relationship with local people.

The Himalayan black bear is nationally endangered species (Jnawali et. al. 2011) and Vulnerable at IUCN Red list. Makalu Barun National Park possess about many species of mammals. Among them, the Himalayan black bear, *Selenarctos thibetanus* is the iconic species of MBNP. Concept of Makalu Barun as protected area was developed when researcher started to study about Himalayan black bear. This species is the authentic logo of MBNP.

Focusing on Himalayan black bear, management plan of MBNP (2076/77-2080/81) illustrate 15 actions to carry out. These proposed actions are as follows.

- Carry out the studies on Himalayan black bear occupancy, population status, distribution and habitat suitability.
- Study Himalayan black bear's ecology and behavior through cutting-edge technology (Satellite/radio collaring, camera trapping etc.).
- Conduct Himalayan black bear population survey based on genetic analysis (or any other appropriate techniques).
- Establish and maintain a database on Himalayan black bear information.
- Study climate change impact on the Himalayan black bear and its habitat.
- Himalayan black bear conservation zoning and habitat management.
- Conduct researches on poaching and illicit trade of Himalayan black bear.

1.4 Objectives of the study

General objective

The general objective of this project is to study national system of conservation status of Himalayan black bear in Nepalese context referring Makalu Barun National Park along with livelihood issues of local people especially in the Buffer Zone.

Specific Objective

- To study national system of conservation status regarding Himalayan black bear in Nepal.
- To record conservation threats to Himalayan black bear.
- To record damages (human, livestock, agricrops etc.) caused by Himalayan black bear.

1.5 Limitations of the Study

To conduct this study, several trips to local villages and Forest were organized however because of the continuous and heavy snowfall in field, we unable to visit the Forest area extensively. COVID19 pandemic also negatively impacted to gather local experts to elicit detail information regarding Himalayan black bear. 2. **Methodology**

2.1 Study Area

To ensure sustainable conservation of biological diversity of Makalu Barun National Park and its Buffer Zone, the entire area was divided into 4 larger sectors. Bung sector lies in Solukhumbu and Hatiya, Seduwa and Tamku sectors in Sankhuwasabha district. In the Buffer Zone of Makalu Barun National Park, there are altogether 95 Buffer Zone Community Forests lying at both districts. Altogether, 17 Buffer Zone Community Forests e.g. 5 from Bung, 5 from Hatiya, 5 from Seduwa, and 2 from Tamku sector and adjoining park's Forest were chosen for the survey.

Park staff and some Buffer Zone people were trained by providing training on "Wildlife Surveying and Recording Techniques". The trained observers went in the field with previously developed data sheet.

Himalayan black bear most often feeds diurnally. However, their nocturnal activity increases through autumn. This occurs because the bear must increase their food intake in order to store body fat for insulation and caloric needs for use during harsh winters and hibernation. Himalayan black bear seems to be able to shift their circadian rhythm

in order to obtain desired foods; for example, when raiding crops, they are more likely to do so at night in order to avoid contact with humans.

2.2 Data Collection

2.2.1 Literature Review

This report is prepared on the basis of field experiences; however we consult few literatures about Makalu Barun National Park and Himalayan black beer.

Aspects of wildlife protection and utilization in the Makalu Barun Conservation Area (Jackson et. al, 1990) mentioned about the hunting policies in MBNP. Much of the hunting activity is directed toward the control of animals which threaten crops of livestock, like bears, deer, wild dogs or leopards. Local people have developed a diverse array of homemade traps to supplement their crude muzzle loaders, ranging from leg snares to pitfall and dead "stone fall" traps constructed of bamboo, lumber and rocks.

According to author, hunting should be permitted under special conditions and by permit only. People suffering from proven crop damage or living in high risk areas should be allowed to set traps (traditional types only) during the period that the crops are ripening. No permits should be issued to take threatened or rare species. Persons breaking hunting regulations should be firmly prosecuted and fined according to the law. While the authorities can "turn a blind eye" to persons killing the occasional animal for meat, attempts to hunt economically valuable protected species like musk deer and even black bear (without a valid crop depredation permit) should be strongly discouraged. He also recommends that no hunting whatsoever be permitted within the core area.

In this report, author recommends control of locally over abundant Wildlife Species. Concern has been expressed that there could be a great numerical increase of some wildlife species if park protection measures are implemented. For example, hunting and poaching, a significant limiting factor on the numbers of Himalayan black bear, and wild pig, would decline. Such increases could exacerbate the conflict between wildlife and the local people.

About crop damage, this report mentioned that about thirty per cent of the annual crop is lost by monkeys, wild pig or Himalayan black bear. Losses are greatest in the higher and more remote villages of Yaphu, Makalu, Hatiya and in areas near forests where slash and burning agriculture is practiced. The cutting of pristine forest, followed by the planting of grain crops, creates ideal conditions for wildlife adapted to successional or disturbed habitats. In the same context, he claimed that crop losses will continue to occur as long as suitable habitat exists for these animals nearby to settlements. However, only those individuals whose home range encompasses fields actually do the damage. Thus the more the slash-and-burn fields intrude upon the Forest, the greater the amount of damage. In the most susceptible places, people have to mount a 24-hour guard to chase off diurnal pests (monkeys and birds) as well as nocturnal animals (bear, pig and deer).

Crop depredation by wild animals in Forest-Agriculture Landscape in Buffer Zone of Makalu Barun National Park (Regmi 2008), mentioned that enormous damage of crops in Buffer Zone of MBNP caused by Himalayan black bear in Apsuwa valley and Hongue valley. The damage of maize is most severe followed by millet and potato. Due to depredation by Himalayan black bear nearly 40 percent annual grain loss in Yanden village of Lowever Apsuwa Valley. There were 32 households in Yanden. Unfortunately, repetitive crop failure baffled to several households, 21 dismal households abandoned the area and migrated to Chulachuli of Ilam and other places. The remaining households thrived changing the cropping pattern at the vicinity of Forests and introduced cardamom which has less damaged or unscathed by Himalayan black bear.

Similarly, about 31 bear victims were recorded in Buffer Zone of MBNP from 1980 to 2007 (28 years period) and most of mauling and killing activities by Himalayan black bear Himalayan occurred in August to October. This is the season that jaded black bear intrudes the crop field for raiding maize. In December, January, and Feb. There was no single record of such incident this was probably due to hibernation time of Himalayan black bear. Most victims were recorded as male as compared to female. Male are usually share the work of guarding crop field, collecting fuel wood and cattle grazing. One suspects that male goes for retaliatory killing of black bear and frequently attacked by bear but they hesitated to share. Most black bear attack occurred when the victim was guarding the crop field, followed by cattle grazing walking in the forest, Non-Timber Forest product (NTFP) collection, fuel wood collection and timber collection. In Buffer Zone of MBNP, the most black bear mauling/killing activities occurred in Yafu followed by Chheskam, Sisuwa, Makalu, Tamku, Bala, Hatiya and Bung.

It is recommended to change the cropping pattern particularly to hinterlands with narrow Georges, heavy forested landscape with interspersion of agriculture field from maize/millet cropping to cardamom plantation as the most pragmatic and imminent option since it is less vulnerable to wildlife damage in large scale or unscathed by Himalayan black bear being compensation of crop

damage is overwhelmingly large in the Buffer Zone of MBNP. In cardamom plantation, local people maintain the fostering plantation of alder, *Alnus nepalenesis* which is more compatible and monochromatic to adjoining landscape in the Buffer Zone.

Threatened wildlife, crop and wildlife depredation and grazing in the Makalu Barun Conservation Area (Jackson, 1990), mentioned that high densities of bear are reported from Syaksila, Simpung, and Hatiya village of Buffer Zone area. It is estimated by local people that at Syaksila, there are20 - 25 bears in the area. On one early October night, grain was consumed at 10 sites and livestock killed in another 7 places.

About species, in his report he mentioned that local people insist that there are two species of bear, tree and ground bears (Rukh and Bhui bhalus respectively). According to these people, the ground bear has never been seen to climb a tree. Ground bears are said to be far more destructive of corn fields, and because of their larger size pose a much greater threat to human life. Most encounters resulting in injury seem to occur in the Forest or along the trails, rather than in fields.

Management Plan of Makalu Barun National Park and its Buffer Zone and The World Conservation Union (IUCN) were reviewed to prepare this report.

2.2.2 Consultation/Interaction with Local People

Formal and informal consultations were made with local people and key informants. Highly affected areas by Himalayan black bear were selected and interaction programs organized. Consultations with victims by Himalayan black bear were made personally from Chheskam to Hatiya. During interaction program, Issues related Himalayan black bear and its ecological behavior were discussed. How it raid crops, what precaution measures it applied to escape from human, what crops it preferred to raid, which season it preferred to enter into the crop field, how it react when people obstruct to raid crops, what measures should apply to deter it from crop field are the main queries during interaction program. In addition, we also discussed with local people and herder where it stay during winter and rainy season.

Interation Program at Bala

2.2.3 Field Observation

In the study area, field observations of crop damage by Himalayan black bear was seen. The team observed several spots where incidents of human injured were occurred and crop field as well. Similarly, potential sites of Himalayan black bear were also identified in consultation with local people and field observation. Almost 87 sites within Buffer Zone and core zone of MBNP are identified the potential site.

2.3 Data Analysis

Available data was analyzed by using general statiscal tools like mean, median, mode and average. The final report was published in descriptive way containing with tables, graphs and photographs.

3. Evaluating and Managing Crop Damage Due to Wildlife

3.1 Introduction

Farmers in Buffer Zone of Makalu Barun National Park blamed that Himalayan black bear, rhesus and langur, barking deer and other wildlife are agricultural pests because of their tendency to raid fields and consume crops. Furthermore, bears pose a potentially serious threat to persons attempting to defend their fields or to gather fuel-wood and other resources in the Forest. The extent of such loss or depredation and threat to human life has not been investigated, but "hotspots" are known to exist. For example, grain losses to bears, monkeys and deer in Syaksila and other villages of Bhotkhola region are substantial. Relatively high number of people injured at Seduwa area and tends to substantiate the reports of high incidence of crop damage due to the Himalayan black bear. The most severe problems seem to occur in areas with Community Forest and agriculture land situated in close proximity to extensive tracts of forest, ideal habitat for Himalayan black bear.

Conversely, wildlife is a potential asset if such effects could be eliminated or at least minimized. Tourists, for example, may welcome the chance to see deer or bears; some bear concentration areas are located along key tourist routes, thus providing opportunities to view wildlife. However, local support for wildlife conservation programs within the study area ultimately depends upon satisfactorily addressing the villager's real (or perceived) concern.

Although, we do have limited information on the distribution and extent of agricultural damage due to wildlife. The upper Arun is a food-deficient zone, and many residents lack sufficient food for as long as two to four months of each year. They are presently unable to compensate for their losses because of fewer options to earn. The problem is better tackled in other ways. However, preventive or remedial measures will only succeed if these actions are sensitive to the natural history of the particular pest species involved.

Little quantitative information on crop loss or damage is available for the study area. The main depredators appear to be bear, deer, wild boar, monkeys and a variety of birds. The clusters in which crop losses appear to be significant and/or widespread include Hatiya, Chepuwa (mainly bears), Makalu (deer, bear, porcupine, goral and tahr) and Yaphu (monkey and bear). As a matter of fact many local people indicated that if wild animals could somehow be controlled, annual crop production could increase by nearly 20 - 25% in some areas.

3.2 Factors Influencing Susceptibility to Crop Depredation

Agricultural fields present some wildlife at the right time of year- with an abundance of food. It is not hard to see why animals are attracted to areas with grain or other crops. Ripening maize (corn) is richer in protein and carbohydrates as well as some mineral nutrients than most of the natural plants available in adjacent forests or shrub-lands.

Agricultural crops occur in relatively large, concentrated stands. Thus, animals feeding upon such items do not have to expend as much energy searching: instead they can satisfy their hunger quickly and efficiently.

Crops are only available for a short time each year in the mountains, but this period may coincide with the time that many species are "fattening-up" in preparation for winter, or when females are nursing and therefore have significantly greater energy demands.

Toward the end of summer, bears have only a month or two before they hibernate for the winter. The female give birth in a winter den. Their newborn young are very small, thus requiring large amounts of milk, which must be provided without the mother having access to food, at least for the first month or so of life. It is hardly surprising that maize fields are so attractive to the Himalayan black bear. Furthermore, it is conceivable that survival rates of cubs during their first few months of life are improved if the mother has access to crops in late summer and early fall.

Not all individuals of a particular species raid agricultural fields. Only those animals with home ranges that encompass plan can do so. Since most adult mammals have strong attachments to their "home area", they are not likely to visit sites outside their normal Zone of use or to shift their home ranges in response to ripening fields or quickly changing cultivation patterns. Sub-adults or juveniles, by contrast, can become significant pests after they are forced from maternal ranges by their parents or dominant conspecifics. As they disperse in search of a home range of their own and encounter already-occupied sites, there may be increased pressure for them to settle in or near lands settled by people. Also, juveniles are less experienced in locating or catching food, and may thus take those items which are most abundant and readily available, irrespective of the risks involved.

Crop losses are probably most substantial in the upper subtropical and lower temperate ecological zones (1,500 - 2,500m), along the edge between continuous Forest and dense human habitation. Most of the pest animals are species which are associated with succession or "disturbed habitats". They are thus benefitted by human actions which promote secondary Forest succession, i.e., selective thinning and opening up of dense Forest by tree cutting, livestock grazing or burning. Thus, slash-and-burn activity may actually enhance habitat conditions for bears or barking deer, by creating grassy open glades within the Forest, by increasing the availability of some foods (including maize and other grain crops), or simply by encouraging succession shrub-land that provides more browse or fruit shrubs and trees.

The carrying capacity of old-growth forests is usually much lower than that of succession forests, because of a paucity of fruit or protein rich undergrowth foliage. Any increase in the amount of edge between forest, shrub-land, grassland and agricultural field improves foraging opportunities for generalized species like bear, langur or rhesus and barking deer.

Population increases cannot be sustained indefinitely, and crop losses are not likely to be uniform, or even inevitable. The most severe impacts will occur in areas known as "hotspots", or sites that provide ideal habitat conditions for

pest wildlife species. Management is essential to minimize the development of "hotspots" within areas dedicated to community development, to replace grain crops with cash crops unattractive to wildlife, or to compensate owners for their crop losses under specified circumstances.

3.3 Natural History of Selected Pest Species

The following species are selected economically important wildlife pest species, indicating their natural history and distribution within the project area.

3.3.1 Monkeys

The common, grey or Hanuman langur, *Presbytis entellus* and rhesus macaque, *Macaca mulatta* are two primate species which raid agricultural fields regularly throughout the Himalayan region. Common langurs occur between 1,000 and 3,000 meters, within the subtropical to temperate ecological zones. Although more arboreal than macaques, they are the most terrestrial of the "leaf-eating" monkeys. Their diet consists of fruits, flowers, buds, shoots and leaves, and they are known to consume items avoided by even insects. While they raid crops, they do so less often than macaques. Langurs are diurnal. They inhabit fairly open Forests and shrub-land, showing a tendency to roost on cliffs.

Troops range in size from six to as many as seventy animals. Most breeding troops contain only a single adult male. Male takeovers have resulted in infanticide. Young males and other adult males are nomadic, wandering between the various female-young groups in all-male nomadic troops. Such groups cover much larger ranges and may therefore be more damaging to crops than localized female groups unless they happen to be located immediately next to fields.

From the viewpoint of depredation, the rhesus macaque is a far greater agricultural pest than the langur. This primate lives in Forests (including oak, rhododendron and fir cover types) between elevations of about 500 and about 3,000 meters in the study area.

While the rhesus macaque sleeps in trees, it spends most of the day on the ground, eating the leaves and roots of herbaceous plants. Fruit is the most common item in summer and fall. Mating usually occurs in fall, with the young being born in spring. Females generally remain in their natal group throughout life, while males emigrate at adolescence, living alone, in male groups, or with other female groups for varying periods of time. A female group may include several adult males. Troop or band size depends upon climate, the availability of food, openness of the habitat, and the time of year, but as many as seventy monkeys may be seen in a single foraging group-making them potentially very destructive to crops.

The Assamese macaque, the other primate found in the study area, rarely enters fields, as it is strongly arboreal and prefers dense Forests of Sal, *Schima castanopsis* and *Castanopsis* between elevations of 1,000 to 2,000 meters. Its diet consists of fruit, insects, young leaves, crops and small animals. Since this species prefers dense Forest, it is much less of a pest than the rhesus macaque.

3.3.2 Wild Boar

It is not very widespread in the study area. Its preferred habitat is Forest and thick scrubland with open meadows, fields and moist grasslands. Wild boars are omnivorous, and may cause much damage by rooting for tubers, as they turn the soil over in large areas. While some ecologists believe such rooting aids in soil aeration, others consider it to promote erosion, and thus be more detrimental than beneficial. Other items in their diet include fungi, ferns, grasses, leaves, fruits, insect larvae, earthworms, small vertebrates and crops. Acorns and chestnuts, *Castanopsis* nuts are probably important autumn foods in the study area. Pigs forage in family. The main social units are solitary boars, bachelor groups and matriarchal sounders comprising one or more adult sows with young of various ages. Wild pigs appear to be non-territorial, with overlapping home ranges of about ten to twenty square kilometers in other parts of their range. Often aggressive, they are usually crepuscular or nocturnal, spending the daytime lying up in wooded ravines or dense shrub thickets. Thus crop fields are almost always raided during the evening, night or early morning.

3.3.3 Barking Deer

Barking deer is very selective feeders, browsing on leaves, buds, flowers and fruits from shrubs, saplings, grasses and herbaceous plants. They are especially attracted by ripe, fallen fruits of wild fig trees. Occupying rather small home ranges, they seem to depend upon thinly-scattered foods. Being true ruminants, they spend the daytime lying up and chewing cud. They tend to be most diurnal where least harassed by people. Barking deer rut in early winter and give birth in early spring. Besides man, the species' main enemies are Forest leopards and jackals. It is one of the major species that raid crops and conflict is arising with human settlement.

3.3.4 Himalayan Black Bear

The Himalayan black bear largely inhabits the temperate zone, between elevations of about 2,000 and 3,000 meters. The best populations probably occur in areas with mixed deciduous broad-leafed and oak Forests having glades or open patches and supporting sites under various stages of

woodland succession. This habitat and ecological zone is primarily located outside the existing core park boundary, in the Buffer Zone Community Forest.

The black bear is nocturnal or crepuscular, and spends the winter (December to April) in hibernation, although fresh tracks and dung have been found in cultivated land in February. Den consists of caves or large crevices in cliffs or rockpiles. Bears mate in late autumn; the young are born in late winter and raised in the maternal den. Females are said to stay with their young for two years. A good climber, the black bear is said to rest on tree platforms made of branches broken while feeding.

The Himalayan black bear is omnivorous, requiring relatively nutrient rich food sources, such as grass, buds and blossoms, acorns, fruits and berries, tubers and roots, new bamboo shoots, and crops. They may also feed upon animal remains, some insects, bird's eggs, etc. Bear consumes maize and mulberries in June and August, with grass forming their spring diet. While no studies have been undertaken to determine their diet in the study area, they are known to kill sheep and goats, and to consume substantial amounts of corn raided from fields or storage areas. Crop depredation and injury to humans is most severe in late autumn or fall.

High densities of bear are reported from parts of the Arum, including the villages of Syaksila, Simpung, Robesha, Lumdimsa, and Chheskam. Local people at Syaksila, for example, felt there were twenty to thirty-five bears in the area. On one early October night, grain was consumed at ten sites and livestock killed in another seven places. Two people attempting to guard their fields were mauled.. The major crop affected, by far, is maize. The damage occurs at night in August/September when the maize ripens. The available evidence suggests that damage is heaviest in fields near forest, and in slash-and-burn areas.

Local people insist that there are two species of bear, tree and ground bears (Rukh and Bhui Bhalu respectively). According to these people, the ground bear has never been seen to climb a tree. Ground bears are said to be far more destructive of corn fields, and because of their larger size pose a much greater threat to human life. Most encounters resulting in injury seem to occur in the Forest or along the trails, rather than in fields.

So far, till now, has not definitively confirmed whether the two bears belong to the same or to an entirely different species, largely for lack of taxonomic, morphological, behavioral and ecological data. It may be that the two represent individuals of different age or sex classes (i.e., adults versus juveniles, or large males versus smaller females/sub adults). Villager observations that the tree and ground bear have distinctly different behavioral and feeding strategies are reasonable, but it needs confirmation in the form of field observations.

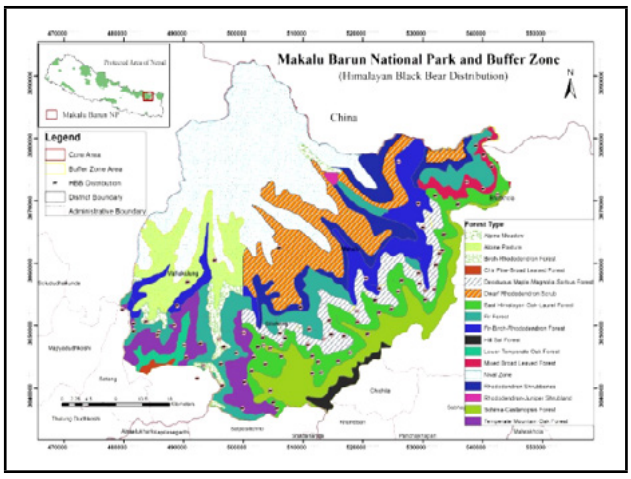
4. Distribution of Himalayan Black Bear at MBNP and Its BZ

Distribution of the Himalayan black bear was classified according to the people's knowledge, habitat type, literature review and direct field survey. We discussed with local people extensively about its existence, major places of crop raid, livestock killing sites. Similarly, we talked to the local herder of high altitude about this species movement at high altitude. We collect the GPS point of every site where it occurred.

Distribution pattern of Himalayan black bear are as follows.

4.1 On the Basis of Forest Type

On the basis of forest type, Himalayan black bear is mostly found East Himalayan Oak-Laurel Forest (32%) within Makalu Barun National Park followed by Deciduous Maple-Magnolia-Sorbus Forest (21%). In the Bhotkhola region, it is mostly found in Mixed Broad Leaved Forest (9%). In the Shishuwa khola and Bung area, it is marked in Temperate Mountain Oak Forest (11%) and Birch- Rhododendron Forest (7%). Very few were found at Lower Temperate Oak- Forest (5%), Fir-Birch-Rhododendron Forest (7%) and Alpine Pasture (3%), Schima-Castanopsis Forest (2%), Fir Forest (1%) and Dwarf Rhododendron Scrub (1%)



Distribution of Himalayan black bear based on Forest Types

East Himalayan Oak-Laurel Forest includes pure stand of *Quercus lamellosa* with dense understory and tree covered with mosses, ferns and epiphytes. It is the Forest with moist clouds and permanent source of perrenial river system. Other few species are of this forest are *Persia* spp. *Magnolia campbellii, Acer campbellii, Prunus sp., Alnus nepalensis, Ilex sikkimensis, Betula alnoides, Acer sterculiaceum, A. sikkimensis, Michelia, Lithocarpus*

spicata, Tetracentron sinense, Evodia fraxinifolia, Lyonia ovalifolia, Rhus succedanea, Rhododendron arboreum, Helwingia himalaica, Viburnum erubescens, Daphne bholua etc. (TMI, IUCN, 1995).

Maple-Magnolia-Sorbus Forest includes *Acer canpbellii, Magnolia campbellii, Tetracentron sinense, Osmanthus suavis, Ilex dipyrena, Corylus ferox. Rhododendron arboreum, R. barbatum, R. hodgsonii, Lyonia villosa, Acer pectinatum, Sorbus foliolosa, Viburnum nervosum* etc.

Mixed Broad Leaved Forest constitutes *Rhododendron arboreum, Lyonia ovalifolia, Castanopsis hystrix, Lithocarpus spicata, Alnus nepalensis, Onerous glance* etc. Because of dense cover with high nutrient grasses and tubers, Himalayan black bear preferred the habitat.

Temperate Mountain Oak Forest constitutes *Quercus* spp, *Castanopsis* spp, *Acer* spp, *Magnolia* spp. etc.

Birch-rdodendron Forest includes *Betula utilis, Sorbus cuspidata, Rhododendron arboreum, R. barbatum, R. hodgsonii, Lyonia villosa, Acer pectinatum, Sorbus foliolosa* etc.

Alpine Pasture constitutes *Anemone* spp, *Caltha* spp, *Arisaema griffithii*, *Fragaria* spp, *Anaphalis* spp, *Potentilla microphylla*, *Meconopsis grandis*, *Primula obliqua*, *Bergenia purpurescens*, *Fritillaria chirrosa* etc.

Schima-Castanopsis Forest includes *Castanopsis tribuloides, Lithocarpus spp, Alnus nepalensis, Malotus nepalensis, Lyonia ovalifolia* etc.

Fir Forest includes Mixed Coniferous Forest. The species are *Abies spectabilis, Tsuga dumosa, Rhododendron spp, Acer campbeli, Betula utilis, Sorbus microphylla, Juniperus recurva, Prunus rufa* etc.

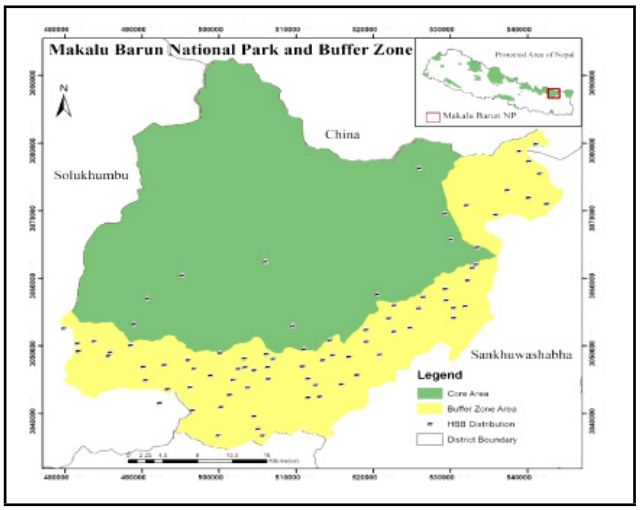
Dwarf Rhododendron Forest includes *Rhododendron campanulatum, R campylocarpum, R. cinnabarinum, R. fulgens, Juniperus recurva, Berberis scrub. Berberis erythroclada* etc.

It is observed that Himalayan black bear preferred Broad Leaved Forest in compared with coniferous. In the same altitude, Himalayan black bear preferred to reside in evergreen/deciduous broadleaved Forest.

4.2 On the Basis of Utility Zone

Most of the habitat of Himalayan black bear is found within the Buffer Zone area of MBNP. It is assumed that because of the shifting cultivation practice and Evergreen Broadleaved Forest, habitat of Himalayan black bear is getting better rather than other zone. Easily available high nutrient food at crop field is another probably the convincing reason that preferred Buffer Zone for few months.

Before the declaration of Makalu Barun National Park, this species was killed by poachers for commercial purposes and to deter from crop lands but nowadays, trend of poaching is decreased and impact of Himalayan black bear is increasing within Buffer Zone.

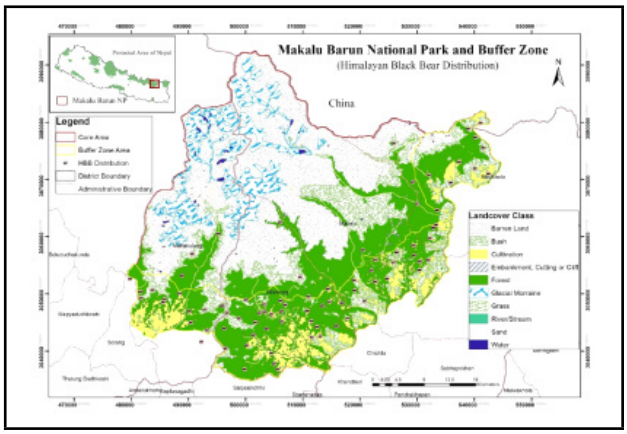


Distribution of Himalayan black bear based on Utility Zone

Himalayan black bear spends nearly 88% time in Buffer Zone Community Forest and Buffer Zone Forest for its survival. However, it frequently visits park area during rainy season.

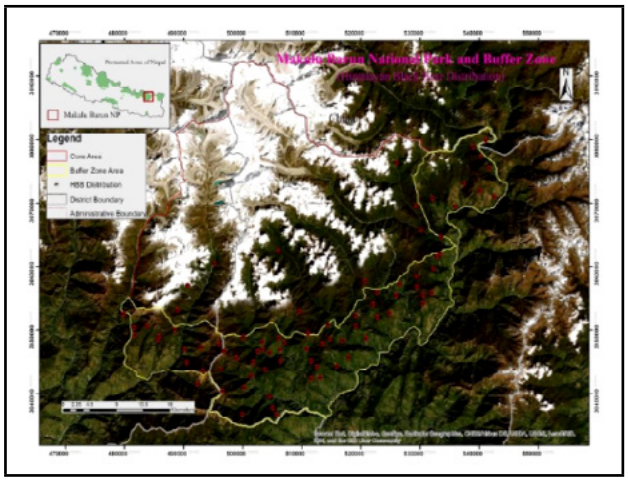
4.3 On The Basis of Land Cover

Most of the Himalayan black bear are found within MBNP/BZ are at forest area (78%) followed by bush cover (11%). It is also marked in nearby to cultivation area (11%) which denotes the conflict with local people. It's not marked at barren land.



Distribution of Himalayan black bear based on Land Cover

4.4 On The Basis of Altitude



Distribution of Himalayan black bear based on Altitude

The distribution of Himalayan black bear on the basis of altitude is as follows. This illustrate that 2000-2500m (39%) is highly preferred altitude and most of Himalayan black bear is residing at this altitude followed by 2500-3000m (20%), few available at 4000m (1%) upwards. After snowfall, it is marked that Himalayan black bear goes down and at rainy season, it goes upwards.

Altitude (m)	Existence (%)
< 1000 m	0
1000 - 1500 m	3
1500 - 2000 m	16
2000 - 2500 m	39
2500 - 3000 m	20
3000 - 3500 m	11
3500 - 4000 m	10
> 4000 m	1

5. Crop Damage/Human Injury

5.1 Introduction

The success of conserving biological resources in any protected area depends on the extent of support and positive attitudes and perceptions of local people have towards such establishments. Ignoring the dependence of the local people for their subsistence needs on resources of such areas leads local people and consequential conflicts between protected area managers and the local inhabitants. Human-wildlife interactions play an important role in shaping perceptions and conservation paradigms and the livelihoods in villages neighboring protected areas. These interactions also determine the future survival of the wildlife in the face of increasing pressure due to high human population growth. Most rural people in Makalu Barun area are agro-pastoral, combining small scale farming with animal husbandry, who relies on natural resources for sustenance.

The negative impacts from wildlife to humans may include crop damage, attacking and killing livestock and humans. Humans may affect wildlife through a wide range of lethal methods such as shooting, poisoning, trapping or snaring, habitat modification and encroachment.

Illegal hunting using traditional weapons is wide spread in communities. The main factors contributing to poaching wild animals are local availability, easy catch-ability (wire snares, traps), affordability. Retaliation killing is also rampant in the area.

In the study areas the black bear has been constantly reported by the villagers. High densities of black bears are reported from Seduwa, Chepuwa, Lumdumsa, Yafu, Yangsima, Lingam, Chheskam, Syaksila, Simbung etc.

During crop raiding season (mid-August/mid-September at lower altitude and mid-September to mid-October at higher altitude), most or all of the crop raider bears reside in the heavily or moderately broken terrain interspersed by boulders and rocks with succession Forest or shrub-lands near the agricultural field. The bear during raiding period always raids the maize at night and rests during day on the sunny broken terrain. It rests on the sheltered boulder in the sun. Bears raid the fields singly but there are maybe two or three occasionally. It is still doubtful that bear only raid those fields which are adjacent to the jungles or select those maize fields which ripen

first irrespective of their location. Bear often attack at dusk as the guarding people reluctant to sleep during this time due to exhaustion as a result of guarding the fields throughout the night.

Bears are prone to damage more maize during initial stage of maize ripening than when the maize is fully ripened. It is assumed that in this stage it damages more than it eats, while selecting the right cobs and also due to its habit of sucking the milky juice only during this stage. So, more milky cobs are required in this stage more than well ripped cobs in order to satisfy its hunger.

But the frequency of raiding increases slowly and gets maximum at the peak when maize ripens fully and then decreases progressively. Local people say bear enters in the field very quietly and after selecting a crop field, sits in the manner of a "dog" and grabs the cob one by one within its reach. During this process mostly the stems of the plant individuals get broken. About 10-12 plants got damaged in one such place. It shifts the place when all the adjacent plants within its range got consumed or damaged.

5.2 Guarding Practice

Local people build "Yaksha" in their cropland to deter bear and other problematic animal. It is a kind of small open house with a roof and a strong elevated platform wholly made up of *Arundinaria* spp. Number of "Yaksha" in cropland or Khorea, locally called "Bhasme" depends upon the size of the field and labour available. People construct a new Yaksha every year. In the Sherpa village which is often located at higher elevation, Yaksha construction begins after the mid-September whereas in Rai villages which are located comparatively at lower elevations, construction begins right after mid-August or even earlier depending on when the maize starts ripening. People start guarding their field once the bear attack begins. One male individual (or two or more female individuals) stay in the Yaksha awake throughout the night producing whatever noise or sound they can make (e.g. biting up the tins). At frequent interval the guard goes around the field with burning faggot. Guarding is made very difficult especially when it rains. Every family member guards their fields. However, it is not possible for people to guard all their lands due to the shortage of man power and their reluctance to stand guard alone at night.

It is comparatively difficult to guard the Khorea as too steep slope hinders going up and down (with burning faggot) and it is often too large. Guarding becomes more effective in a large village than in a small village as in a large village "Yaksha" belonging to different households tend to be more and closer enough to harass the bear. The combined sound produced by different guards tends to be louder enough to chase the bear.

Local people in the study area besides Yaksha construction, have also developed another indigenous system deterring the' wild animals. This system is more popular in lower most Rai community, where the damage caused by other wild animals (e.g. monkey, porcupine, birds etc) is more pronounced. In this system two sticks made up of Arundinaria spp. (which have been cut horizontally) tied up with another strong stick at the centre. On the centre, stick a bell like structure made out of old tin and iron piece is hung and strong rope (made up of Arundinaria spp.) is, fixed in the same stick where bell is hung. Another end of the rope is connected to the house so as to control the system from the house without going out in the field. When the end of the rope is drawn or shaken from the house the bell automatically produces sound (Shrestha, K., Ale, S. 1993).

5.3 Crop Depredation

Wild animals such as black bear and few others are responsible for crop damage in study area. Some farmers lose as much as 30% of their crop to wildlife which is substantial loss. The situation is worst in the slash-and-burn areas than in the permanent agricultural land.

Existence of such wildlife problem has a long history and people use various control measures including hunting of the problematic animals. However, with the designation of the area as a protected area such control measures have become illegal and people may be prosecuted for doing so. In the absence of management techniques to alleviate this problem, it is hard to gain support from the local people in conservation and management.

The setup of the agricultural lands in MBNP, particularly, the slash-and-burn areas, surrounded by Forest make crops susceptible to wildlife damage. Most of the animals responsible or crop damage are associated with succession or "disturbed habits". Secondary Forest resulting from tree cutting, livestock grazing and burning, slash-and-burn agricultural practice provide them with foods such as browse, fruits, and crops.

Not all individuals of a particular species raid agricultural fields. Only those animals with home ranges that encompass agricultural lands do so. During the poor fruiting year in the Forest, home range of wild animals may overlap in search of food. Sub-adults can become a pest after they are forced out from their maternal ranges by their parents. Such individuals are likely to settle in forests near human habitations failing to find an unoccupied range and thus, may raid crops or any food items that are abundant and readily available, irrespective of the risks involved. Maize is the main crop in the study area. Ripening of maize coincides with the high energy demand period of bears in the fall for the "fattening-up" in preparation for winter hibernation. Therefore, maize fields become the most attractive foraging site for black bears in the study area.

5.3.1 Crop Depredation by Himalayan Black Bear in Different Villages of Buffer Zone

Generally, Himalayan black bear raid crops (maize) during autumn season. It is also observed that Himalayan black bear raid wheat and barley in late winter but it occurred rarely. Every year, Himalayan black bear damage crops in significant amount around Buffer Zone. Villages adjoin to Forestland and shifting cultivation is very sensitive in terms of crop raid. Few of them villages are as follows where Himalayan black bear raid crops regularly.

1. Yangsima

This village is situated in the remote north of Shishuwa Khola at 1,800 m. This village is adjoining to CommunityForest. People frequently use this Forest to collect fuel-wood and fodder. There are about 125 households. Major crop pattern of this village is maize, potato, and wheat/barley. Since this decade, people started cultivating cardamom as cash crop. In 2019, nearly 169 Pathi of maize and 198 Pathi wheat/barley were damaged by Himalayan black bear alone. Equivalent to NRs. 1,03,340 were lost by Himalayan black bear at Yangsimma village. Yangsimma is only one such village where Himalayan black bear raid crops in winter and in late autumn.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Uddit Keshar Rai	Pathi	18	21	260	300	4680	6300	10980
2	Mr. Aaitaram Rai	Pathi	20	13	260	300	5200	3900	9100
3	Mr. Sukhan Rai	Pathi	20	19	260	300	5200	5700	10900
4	Mr. Shubha Prasad Rai	Pathi	15	21	260	300	3900	6300	10200
5	Mr. Dilman Rai	Pathi	15	16	260	300	3900	4800	8700
6	Mr. Krishna Prasad Rai	Pathi	13	17	260	300	3380	5100	8480
7	Mr. Alag Bahadur Rai	Pathi	11	18	260	300	2860	5400	8260
8	Mr. Bhim Kubir Rai	Pathi	11	20	260	300	2860	6000	8860
9	Mr. Bal Kubir Rai	Pathi	12	16	260	300	3120	4800	7920
10	Mr. Paran Bahadur Rai	Pathi	20	17	260	300	5200	5100	10300
11	Mr. Kubir Rai	Pathi	14	20	260	300	3640	6000	9640
	Total	**Pathi**	**169**	**198**	**0**	**0**	**0**	**0**	**103340**

2. Tashigoan

This village is situated along the way to Makalu base camp and it is the last village of this route. Most of the people of this village are depend on agriculture and livestock. Few of them are involved in tourism business. This village is adjoining to Community forest. People frequently use this Forest to collect fuel-wood and fodder. There are about 65 households. Major crop pattern of this village is maize, potato, wheat/ barley. Many people are also planting Cardamom in the lower height. In 2019, nearly 520 Pathi maize were damaged by Himalayan black bear worth of NRs. 1, 35,200 at Tashigoan village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Ngima Dorche Sherpa	Pathi	120	0	260	0	31200	0	31200
2	Mr. Doktok Sherpa	Pathi	60	0	260	0	15600	0	15600
3	Mr. Ngima Wongjuk Sherpa	Pathi	60	0	260	0	15600	0	15600
4	Mr. Tenjing Sherpa	Pathi	80	0	260	0	20800	0	20800
5	Mr. Wong Nurbu Sherpa	Pathi	80	0	260	0	20800	0	20800
6	Mr. Dawa Sanje Sherpa	Pathi	120	0	260	0	31200	0	31200
Total		Pathi	**520**	**0**	**0**	**0**	**0**	**0**	**135200**

3. Robesha

This village is situated along the way to Makalu Base camp and just below the Tashigoan, Most of the people of this village are depending on agriculture and livestock. Few of them are involved in tourism business. There are about 68 households. This village is adjoining to community forest. People frequently use this Forest to collect fuel-wood and fodder. Major crop pattern of this village is maize, potato, wheat/ barley. Many people are also planting Cardamom in the lower height. It is highly affected village by Himalayan black bear. This year, 2 persons were injured by Himalayan black bear. In 2019, about 240 Pathi maize were damaged by Himalayan black bear worth of NRs. 62400 at Robesha village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Khangdu Babu Sherpa	Pathi	120	0	260	0	31200	0	31200
2	Mr. Dorchee Sherpa	Pathi	60	0	260	0	15600	0	15600
3	Mr. Pasang Dawa Sherpa	Pathi	60	0	260	0	15600	0	15600
Total		Pathi	**240**	**0**	**0**	**0**	**0**	**0**	**62400**

4. Lingam/Mangkhim

This village is situated nearby to Gola bazar of Hatiya sector. This village is highly affected village by Himalayan black bear from long time. Shifting cultivation practice is still occurred here and encounter rate of Himalayan black bear with local people is very high. Most of the people of this village are depend on agriculture and livestock. There are about 52 households. This village is adjoining to community forest. People frequently use this Forest to collect fuelwood and fodder. Because of active shifting cultivation practice and adjoin to Forest land, it is believed that many bears are residing here for whole year. It's difficult to chase bear from this village because of rugged topography. Major crop pattern of this village is maize, potato, millet, and wheat/barley. Many people are also planting Cardamom in the lower height. In 2019, nearly 1040 Pathi maize were damaged by Himalayan black bear worth of NRs. 2,60,000 at Lingam/Mangkhim village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Panch Bdr Rai	Pathi	200	0	250	0	50000	0	50000
2	Mr. Dipendra Rai	Pathi	180	0	250	0	45000	0	45000
3	Mr. Bam Bdr Gurung	Pathi	120	0	250	0	30000	0	30000
4	Mr. Bodharaj Rai	Pathi	120	0	250	0	30000	0	30000
5	Mr. Nipudhwoj Gurung	Pathi	140	0	250	0	35000	0	35000
6	Mr. Prem Gurung	Pathi	140	0	250	0	35000	0	35000
7	Mr. Ghale Sherpa	Pathi	140	0	250	0	35000	0	35000
Total		**Pathi**	**1040**	**0**	**0**	**0**	**0**	**0**	**260000**

5. Simbung

It is one of the highly affected villages by Himalayan black bear from long time. This village is densely populated village Shifting cultivation practice is still exist. Every year, local people are threatened by Himalayan black bear and raid crops. Most of the people of this village are depend on agriculture and livestock. There are about 56 households. This village is adjoining to community forest. People frequently use this forest to collect fuelwood and fodder. Major crop pattern of this village is maize, potato, millet, and wheat/barley. Many people are also planting Cardamom in the lower altitude. In 2019, nearly 660 Pathi maize were damaged by Himalayan black bear worth of NRs. 165,000 at Simbung village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Thilen Bhote	Pathi	40	0	250	0	10000	0	10000
2	Mr. Chhembi Lama	Pathi	80	0	250	0	20000	0	20000
3	Mr. Tensum Bhote	Pathi	20	0	250	0	5000	0	5000
4	Mr. Ngima Dorchee Bhote	Pathi	20	0	250	0	5000	0	5000
5	Mr. Namja Bhote	Pathi	100	0	250	0	25000	0	25000
6	Mr. Phurpu Ridar Bhote	Pathi	80	0	250	0	20000	0	20000
7	Mr. Chhangjuk Bhote	Pathi	80	0	250	0	20000	0	20000
8	Mr. Ngima Lenduk Bhote	Pathi	40	0	250	0	10000	0	10000
9	Mr. Dawa Bhutik	Pathi	40	0	250	0	10000	0	10000
10	Mr. Ngima Mimje Bhote	Pathi	60	0	250	0	15000	0	15000
11	Mr. Ngeruk Bhote	Pathi	100	0	250	0	25000	0	25000
Total		**Pathi**	**660**	0	**0**	0	**0**	0	**165000**

6. Syakshila

This village is situated nearby to Barun/Arun tributary. Most of the people of this village are depend on agriculture and livestock. There are about 128 households. Major crop pattern of this village is maize, potato, millet, wheat/ barley. Many people are also planting Cardamom in the lower height. It is one of the most affected villages by Himalayan black bear. Because of heavy shifting cultivation practice from long time, it is assumed that habitat of Himalayan black bear is getting better and residing for long time. In 2019, nearly 1800 Pathi maize were damaged by Himalayan black bear worth of NRs. 4,50,000 at Sykshila village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Mingma Tenjing Bhote	Pathi	40	0	250	0	10000	0	10000
2	Mr. Semduk Bhote	Pathi	160	0	250	0	40000	0	40000
3	Mr. Ridar Bhote	Pathi	100	0	250	0	25000	0	25000
4	Mr. Chhechaja Bhote	Pathi	60	0	250	0	15000	0	15000
5	Mr. Tamrik Lama	Pathi	100	0	250	0	25000	0	25000
6	Mr. Sengi Bhote	Pathi	80	0	250	0	20000	0	20000
7	Mr. Kunga Bhote	Pathi	40	0	250	0	10000	0	10000
8	Mr. Chhaba Bhote	Pathi	60	0	250	0	15000	0	15000
9	Mr. Chhiring Sonam Bhote	Pathi	40	0	250	0	10000	0	10000
10	Mr. Karma Bhote	Pathi	60	0	250	0	15000	0	15000
11	Mr. Aangdawa Bhote	Pathi	120	0	250	0	30000	0	30000
12	Mr. Kanden Bhote	Pathi	80	0	250	0	20000	0	20000
13	Mr. Dorchee Bhote	Pathi	20	0	250	0	5000	0	5000
14	Mr. Miyang Bhote	Pathi	80	0	250	0	20000	0	20000
15	Mr. Temba Chhiring Bhote	Pathi	60	0	250	0	15000	0	15000
16	Mr. Chhinjeb Bhote	Pathi	60	0	250	0	15000	0	15000
17	Mr. Kingsang Bhote	Pathi	80	0	250	0	20000	0	20000
18	Mr. Ngima Ridar Bhote	Pathi	120	0	250	0	30000	0	30000
19	Mr. Chuksum Bhote	Pathi	80	0	250	0	20000	0	20000
20	Mr. Churu Bhote	Pathi	40	0	250	0	10000	0	10000
21	Mr. Thukten Bhote	Pathi	40	0	250	0	10000	0	10000
22	Mr. Dendi Bhote	Pathi	60	0	250	0	15000	0	15000
23	Mr. Wanga Bhote	Pathi	40	0	250	0	10000	0	10000
24	Mr. Pemu Bhote	Pathi	80	0	250	0	20000	0	20000
25	Mr. Chhecha Bhote	Pathi	100	0	250	0	25000	0	25000
Total		**Pathi**	**1800**	**0**	**0**	**0**	**0**	**0**	**450000**

7. Sisne

This village is adjoining with community forest. Shifting cultivation practice is extensive and thus creating favorable habitat for the Himalayan black bear. Most of the people of this village are depend on agriculture and livestock. There are 36 households in Sisne village. Major crop pattern of this village are maize, potato, millet, wheat/barley. Many people are also planting cardamom in the lower height. Seven farmers severely affected by crop depredation. In 2019, nearly 340 Pathi maize were damaged by Himalayan black bear worth of NRs. 68,000 at Sisne village.

SN	Name of Victim	Unit	Damaged Agricrops		Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Maize	Wheat	Maize	Wheat	
1	Mr. Kumar Gurung	Pathi	40	0	200	0	8000	0	8000
2	Mr. Kalu Sherpa	Pathi	40	0	200	0	8000	0	8000
3	Mr. Phurinje Sherpa	Pathi	30	0	200	0	6000	0	6000
4	Mr. Latte Sherpa	Pathi	40	0	200	0	8000	0	8000
5	Mr. Bam Bdr Gurung	Pathi	40	0	200	0	8000	0	8000
6	Mr. Uttam Gurung	Pathi	100	0	200	0	20000	0	20000
7	Mr. Jagdhan Rai	Pathi	50	0	200	0	10000	0	10000
Total		**Pathi**	**340**	**0**	**0**	**0**	**0**	**0**	**68000**

8. Yangden

Most of the people of this village are depend on agriculture and livestock. There are about 44 households. About 2 decades ago, this village was highly affected by Himalayan black bear but nowadays, the rate of crop depredation is decreasing. Major crop pattern of this village is maize, potato, millet, wheat/ barley. Many people are also planting cardamom in the lower altitude. In 1920, nearly 192 Pathi maize were damaged and 6 cattle were killed by Himalayan black bear. Farmers have detrimented an economic loss equivalent to NRs. 98,400 at Yangden village.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Nain Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
2	Mr. Chandra Bdr Rai	Pathi	25	0	0	200	0	5000	0	5000
3	Mr. Duti Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
4	Mr. Bal Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
5	Mr. Aash Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
6	Mr. Pritimaya Rai	Pathi	22	0	0	200	0	4400	0	4400
7	Mr. Devraj Rai	Pathi	25	0	0	200	0	5000	0	5000
8	Mr. Ganga Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
9	Mr. Achmma Bdr Rai	Pathi	20	0	0	200	0	4000	0	4000
10	Mr. Chhiring Dorje Sherpa	No	1	0	Cow	0	0	0	0	10000
11	Mr. Aangnorbu Sherpa	No	1	0	Cow	0	0	0	0	10000
12	Mr. Lakpatemba Sherpa	No	1	0	Cow	0	0	0	0	10000
13	Mr. Pemnorbu Sherpa	No	1	0	Cow	0	0	0	0	10000
14	Mr. Sonamchhedar Sherpa	No	1	0	Cow	0	0	0	0	10000
15	Mr. Dawatashi Sherpa	No	1	0	Cow	0	0	0	0	10000
16	Mr. Chhiring Dorje Sherpa	Person	1	0	Man	0	0	0	0	Injury
17	Mr. Pasangphuti Sherpa	Person	1	0	Man	0	0	0	0	Injury
Total		**Pathi**	**200**	**0**	**0**	**0**	**0**	**0**	**0**	**98400**

9. Dangok

Most of the people in this village are depend on agriculture for livelihood. Wildlife e.g. bear, deer and monkey damage agricrops. There are 50 households and most of them are highly affected by Himalayan black bear. Nearby settlement, there is Pejung danda Buffer Zone Community Forest and it is the best habitat for Himalayan black bear. In this village, villagers grow maize, millet and wheat. Villagers have detrimented an economic loss equivalent to NRs. 2,29,000 in 1920.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Lakpa Chhiring Bhote	Pathi	80	0	0	200	0	16000	0	16000
2	Mr. Nawa Chhiring Bhote	Pathi	40	0	0	250	0	10000	0	10000
3	Mr. Kanden Bhote	Pathi	40	0	0	200	0	8000	0	8000
4	Mr. Nikma Bhote	No	1	0	cow	0	0	0	0	10000
		Pathi	20	0	0	250	0	5000	0	5000
5	Mr. Putuk Bhote	Pathi	60	0	0	250	0	15000	0	15000
6	Mr. Namja Lama	No	1	0	goat	0	0	0	0	5000
		Pathi	60	0	0	200	0	12000	0	12000
7	Mr. Hima Anjuk Bhote	Pathi	50	0	0	200	0	10000	0	10000
8	Mr. Teka Bhote	Pathi	6	0	0	200	0	1200	0	1200
9	Mr. Kingjawa Bhote	Pathi	40	0	0	250	0	10000	0	10000
10	Mr. Matuk Bhote	Pathi	40	0	0	200	0	8000	0	8000
11	Mr. Ngajam Bhote	Pathi	80	0	0	200	0	16000	0	16000
12	Mr. Thunang Bhote	Pathi	6	0	0	200	0	1200	0	1200
13	Mr. Chhimbi Bhote	Pathi	40	0	0	250	0	10000	0	10000
14	Mr. Pasang Bhote	Pathi	60	0	0	200	0	12000	0	12000
15	Mr. Chhedar Bhote	Pathi	16	0	0	200	0	3200	0	3200
16	Mr. Dukpa Bhote	Pathi	40	0	0	200	0	8000	0	8000
17	Mr. Temba Lama	Pathi	12	0	0	200	0	2400	0	2400
18	Mr. Nadar Bhote	Pathi	40	0	0	200	0	8000	0	8000
19	Mr. Thilen Bhote	Pathi	40	0	0	200	0	8000	0	8000
20	Mr. Kanchha Tare Bhote	Pathi	24	0	0	200	0	4800	0	4800
21	Mr. Jyajok Bhote	Pathi	40	0	0	250	0	10000	0	10000
22	Mr. Pimba Bhote	Pathi	40	0	0	200	0	8000	0	8000
23	Mr. Sanga Tenji Bhote	Pathi	80	0	0	200	0	16000	0	16000
24	Mr. Ridar Bhote	Pathi	16	0	0	200	0	3200	0	3200
25	Mr. Patuk Bhote	Pathi	40	0	0	200	0	8000	0	8000
Total		**Pathi**	**1010**	**0**	**0**	**0**	**0**	**0**	**0**	**229000**

10. Hungung

This village is situated at Bhotkhola-3, Sankhuvasabha. These are 250 households. The main income source of this village is agriculture. Like nearby to village of Dangok, this village is also highly affected by bear, deer and other wildlife. In 1920, villagers losses their agricrops equivalent to NRs. 2,11,600.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Nima Dorchi Bhote	Pathi	60	0	0	200	0	12000	0	12000
2	Mr. Temba Bhote	Pathi	40	0	0	200	0	8000	0	8000
3	Mr. Pimba Chhodar Bhote	Pathi	60	0	0	200	0	12000	0	12000
4	Mr.Thukpa Bhote	Pathi	40	0	0	250	0	10000	0	10000
5	Mr. Chhamjek Bhoteni	Pathi	40	0	0	200	0	8000	0	8000
		No	1	0	Goat	200	0	0	0	5000
6	Mr. Pasang Bhote	Pathi	60	0	0	200	0	12000	0	12000
7	Mr. Dorchi Bhote	Pathi	40	0	0	250	0	10000	0	10000
8	Mr. Kachung Bhote	Pathi	24	0	0	200	0	4800	0	4800
9	Mr. Mayan Bhote	Pathi	40	0	0	200	0	8000	0	8000

10	Mr. Lakpa Raten Bhote	Pathi	60	0	0	200	0	12000	0	12000
11	Mr. Rapten Lama	Pathi	40	0	0	200	0	8000	0	8000
12	Mr. Pasang Nurpu Bhote	Pathi	20	0	0	200	0	4000	0	4000
13	Mr. Dan Dorchi Bhote	Pathi	40	0	0	200	0	8000	0	8000
14	Mr. Palden Khamba Bhote	Pathi	40	0	0	200	0	8000	0	8000
15	Mr. Samba Chhiring Bhote	Pathi	60	0	0	200	0	12000	0	12000
16	Mr. Lenduk Bhote	Pathi	24	0	0	200	0	4800	0	4800
17	Mr. Dojung Bhote	Pathi	60	0	0	200	0	12000	0	12000
		No	1	0	Sheep	0	0	0	0	5000
18	Mr. Sangbu Khamba Bhote	Pathi	20	0	0	200	0	4000	0	4000
19	Mr. Phupu Temba Bhote	Pathi	40	0	0	200	0	8000	0	8000
20	Mr. Tashi Bhote	Pathi	40	0	0	250	0	10000	0	10000
		No	1	0	Cow	0	0	0	0	10000
21	Mr. Thab Bhote	Pathi	40	0	0	200	0	8000	0	8000
22	Mr. Lakpa Phutik Bhote	Pathi	40	0	0	200	0	8000	0	8000
Total			**928**	**0**	**0**	**0**	**0**	**0**	**0**	**211600**

11. Chyamtang

Most of the people in this village are depend on agriculture. Wildlife e.g. bear, deer and Kalij pheasants damage their agricrops. Local people also blamed Goral, *Naemorhedus goral* for their crop raid. There are 130 households and few of them are affected by Himalayan black bear. Nearby settlement, there is Damdangma Buffer Zone Community Forest where reside different kinds of wildlife including Himalayan black bear. In this village, maize, millet, wheat and sometimes paddy were damage and few cattle were also killed. Farmer losses their agricrops equivalent to NRs. 2,68,700 in 1920.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Nomyang Lama	Pathi	40	0	0	200	0	8000	0	8000
2	Mr. Kasang Bhote	Pathi	16	0	0	200	0	3200	0	3200
3	Mr. Pasang Bhote	Pathi	60	0	0	200	0	12000	0	12000
4	Mr.Thau Bhote	Pathi	100	0	0	250	0	25000	0	25000
5	Mr. Sokpa Bhote	Pathi	40	0	0	150	0	6000	0	6000
6	Mr. Nosang Bhote	Pathi	24	0	0	200	0	4800	0	4800
7	Mr. Bhutik Bhote	Pathi	5	0	0	250	0	1250	0	1250
8	Mr. Thongmik Bhote	Pathi	40	0	0	200	0	8000	0	8000
9	Mr. Kami Rijek	Pathi	40	0	0	200	0	8000	0	8000
10	Mr. Dawa Rigjin Bhote	Pathi	40	0	0	200	0	8000	0	8000
11	Mr. Mikma Temba Bhote	Pathi	40	0	0	200	0	8000	0	8000
12	Mr. Chhyang Temba Bhote	Pathi	20	0	0	250	0	5000	0	5000
13	Mr. Chhipang Bhote	Pathi	40	0	0	250	0	10000	0	10000
14	Mr. Sine Bhote	Pathi	20	0	0	200	0	4000	0	4000
		No	1	0	Goat	0	0	0	0	5000
15	Mr. Ridar Dendi Bhote	Pathi	40	0	0	250	0	10000	0	10000
16	Mr. Temba Bhote	Pathi	20	0	0	200	0	4000	0	4000

17	Mr. Phurwapu Bhote	Pathi	40	0	0	200	0	8000	0	8000
18	Mr. Lachhin Bhote	Pathi	40	0	0	150	0	6000	0	6000
19	Mr. Chyaruk Bhote	Pathi	16	0	0	200	0	3200	0	3200
20	Mr. Sangbo Bhote	Pathi	5	0	0	250	0	1250	0	1250
21	Mr. Chhiri Phutik Bhote	Pathi	44	0	0	250	0	11000	0	11000
22	Mr. Sangak Bhote	Pathi	40	0	0	250	0	10000	0	10000
23	Mr. Chhiring Chhembi Bhote	Pathi	20	0	0	150	0	3000	0	3000
24	Mr. Kiran Bhote	Pathi	6	0	0	250	0	1500	0	1500
25	Mr. Jomma Bhote	Pathi	40	0	0	250	0	10000	0	10000
26	Mr. Phumu Bhote	Pathi	20	0	0	150	0	3000	0	3000
27	Mr. Lakpa Bhutik Bhote	Pathi	60	0	0	150	0	9000	0	9000
28	Mr. Chenga Bhote	Pathi	20	0	0	250	0	5000	0	5000
29	Mr. Chenga Bhote	Pathi	40	0	0	150	0	6000	0	6000
30	Mr. Nganrinjin Bhote	Pathi	40	0	0	250	0	10000	0	10000
31	Mr. Sagjik Bhote	Pathi	6	0	0	250	0	1500	0	1500
32	Mr. Namatu	Pathi	20	0	0	150	0	3000	0	3000
33	Mr. Pimma Bhote	Pathi	40	0	0	250	0	10000	0	10000
34	Mr. Tesi Bhote	Pathi	40	0	0	250	0	10000	0	10000
35	Mr. Uchhen Thile Bhote	Pathi	40	0	0	200	0	8000	0	8000
36	Mr. Jyabu Bhote	Pathi	5	0	0	200	0	1000	0	1000
37	Mr. Mibmar Bhote	Pathi	40	0	0	200	0	8000	0	8000
38	Mr. Temba Chhiring Bhote	Pathi	40	0	0	250	0	10000	0	10000
Total			**1247**	**0**	**0**	**0**	**0**	**0**	**0**	**268700**

12. Lingam

Most of the people in this village are depend on agriculture. Wildlife e.g. bears and deer damage agricrop and leopard their cattle. There are 40 households and few of them are affected by Himalayan black bear. Nearby settlement, there is Pejung danda Buffer Zone Community Forest which is the best habitat for Himalayan black bear and common leopard, *Panthera pardus*. In this village, maize, millet, wheat were damage mainly Himalayan black bear. A few cattle were also killed in 1920. An estimation of economic losses for crop and cattle per annum is NRs. 60,200.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Nimja Bhote	Pathi	20	0	0	200	0	4000	0	4000
2	Mr. Kale Bhote	Pathi	10	0	0	200	0	2000	0	2000
		No	1	0	Goat	0	0	0	0	5000
3	Mr. Sangram Lama	Pathi	5	0	0	200	0	1000	0	1000
4	Mr.Chholchik Bhoteni	Pathi	10	0	0	200	0	2000	0	2000
5	Mr. Thamu Bhote	Pathi	15	0	0	200	0	3000	0	3000
6	Mr. Dawa Chhiring Bhote	Pathi	10	0	0	200	0	2000	0	2000
7	Mr. Karok Lama	Pathi	15	0	0	200	0	3000	0	3000
8	Mr. Thongmik Bhote	Pathi	7	0	0	200	0	1400	0	1400
9	Mr. Jamling Bhote	Pathi	6	0	0	200	0	1200	0	1200
10	Mr. Jenjen Bhote	Pathi	9	0	0	200	0	1800	0	1800

11	Mr. Wangdak Bhote	No	1	0	Goat	0	0	0	0	5000
12	Mr. Gindin Bhote	Pathi	12	0	0	250	0	3000	0	3000
13	Mr. Gindin Bhote	Pathi	11	0	0	200	0	2200	0	2200
14	Mr. Guru Bhote	Pathi	13	0	0	200	0	2600	0	2600
		No	1	0	Goat	0	0	0	0	5000
15	Mr. Kanchha Thilen Bhote	Pathi	80	0	0	200	0	16000	0	16000
Total			**224**	**0**	**0**	**0**	**0**	**0**	**0**	**60200**

13. Chhumsur

Most of the people in this village are depend on agriculture. There are 20 households and few of them are affected by Himalayan black bear. Nearby settlement, there is Guimkharka Buffer Zone Community Forest. In this village, millet, wheat and barley damage by Himalayan black bear. An estimation of economic losses for crop and cattle per annum is NRs. 108500.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Millet	Wheat	Other	Millet	Wheat	Millet	Wheat	
1	Mr. Lachpa Bhote	Pathi	24	0	0	250	0	6000	0	6000
2	Mr. Chhedar Pejawa	Pathi	20	0	0	250	0	5000	0	5000
3	Mr.Biahal Pejawa	Pathi	20	0	0	250	0	5000	0	5000
4	Mr. Langchik Bhoteni	Pathi	40	0	0	250	0	10000	0	10000
5	Mr. Phuda Chawa	Pathi	60	0	0	250	0	15000	0	15000
6	Mr. Dharche Nawa	Pathi	60	0	0	250	0	15000	0	15000
7	Mr. Sirap Bhote	Pathi	60	0	0	250	0	15000	0	15000
8	Mr. Om Lama	Pathi	40	0	0	250	0	10000	0	10000
9	Mr. Wangja Bhote	Pathi	10	0	0	250	0	2500	0	2500
10	Mr. Wangja Bhote	Pathi	40	0	0	250	0	10000	0	10000
11	Mr. Dendi Bhote	Pathi	60	0	0	250	0	15000	0	15000
Total			**434**	**0**	**0**	**0**	**0**	**0**	**0**	**108500**

14. Chepuwa

Most of the people in this village are depend on agriculture. There are 150 households and few of them are affected by Himalayan black bear. In this village, maize and wheat damage by Himalayan black bear and a few cattle were also killed in 1920. An estimation of economic losses for crop and cattle per annum is NRs. 108,600.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Sanadema Bhote	Pathi	12	0	0	200	0	2400	0	2400
2	Mr. Lakpa Bhote	Pathi	7	0	0	200	0	1400	0	1400
		No	1	0	0	0	0	0	0	5000
3	Mr. Sitik Bhote	Pathi	8	0	0	200	0	1600	0	1600
4	Mr. Chhiring Anjuk Bhote	Pathi	10	0	0	200	0	2000	0	2000
5	Mr. Nangang Bhote	Pathi	11	0	0	200	0	2200	0	2200
6	Mr. Dorchi Bhote	Pathi	12	0	0	200	0	2400	0	2400
7	Mr. Mingma Lamu Bhote	Pathi	11	0	0	200	0	2200	0	2200
8	Mr. Chhiring Temba Bhote	Pathi	8	0	0	200	0	1600	0	1600

9	Mr. Lakpa Denduk Bhote	Pathi	15	0	0	200	0	3000	0	3000
		No	1	0	Goat	0	0	0	0	5000
10	Mr. Mukhiya Bhote	No	1	0	Goat	0	0	0	0	5000
11	Mr. Deni Bhote	Pathi	6	0	0	200	0	1200	0	1200
12	Mr. Dawa Lama	Pathi	20	0	0	200	0	4000	0	4000
13	Mr. Chhiring Chhedar Bhote	Pathi	12	0	0	200	0	2400	0	2400
14	Mr. Phunjung Bhote	Pathi	8	0	0	200	0	1600	0	1600
15	Mr. Juma Bhote	Pathi	5	0	0	200	0	1000	0	1000
16	Mr. Jeba Bhote	Pathi	11	0	0	200	0	2200	0	2200
17	Mr. Dorchi Bhote	Pathi	12	0	0	200	0	2400	0	2400
18	Mr. Chhyangwa Bhote	Pathi	15	0	0	200	0	3000	0	3000
19	Mr. Phurpu Bhote	Pathi	13	0	0	200	0	2600	0	2600
20	Mr. Sangbu Bhote	Pathi	15	0	0	200	0	3000	0	3000
21	Mr. Chapar Bhote	Pathi	10	0	0	200	0	2000	0	2000
22	Mr. Jenjen Bhote	Pathi	20	0	0	200	0	4000	0	4000
23	Mr. Lakpa Pache Bhote	Pathi	18	0	0	200	0	3600	0	3600
24	Mr. Ridar Bhote	Pathi	21	0	0	200	0	4200	0	4200
25	Mr. Anjur Bhote	Pathi	19	0	0	200	0	3800	0	3800
26	Mr. Rinjin Bhote	Pathi	20	0	0	200	0	4000	0	4000
27	Mr. Kami Bhote	Pathi	13	0	0	200	0	2600	0	2600
28	Mr. Namja Bhote	Pathi	15	0	0	200	0	3000	0	3000
29	Mr. Aakpa Bhote	Pathi	18	0	0	200	0	3600	0	3600
30	Mr. Chhechhiring Bhote	Pathi	14	0	0	200	0	2800	0	2800
31	Mr. Jumik Bhote	Pathi	16	0	0	200	0	3200	0	3200
32	Mr. Kija Bhote	Pathi	19	0	0	200	0	3800	0	3800
33	Mr. Sanje Bhote	Pathi	11	0	0	200	0	2200	0	2200
34	Mr. Tapchen Bhote	Pathi	18	0	0	200	0	3600	0	3600
35	Mr. Genda Rinjin Bhote	Pathi	15	0	0	200	0	3000	0	3000
36	Mr. Pimba Bhote	Pathi	10	0	0	200	0	2000	0	2000
Total		Pathi	**468**	**0**	**0**	**0**	**0**	**0**	**0**	**108600**

15. Hatiya

Most of the people in this village are depend on agriculture for subsistence. There are 150 households and few of them are affected by Himalayan black bear. In this village, maize was raid and few cattle were also killed. An estimation of economic losses for crop and cattle per annum is NRs. 4,23,000.

SN	Name of Victim	Unit	Damaged Agricrops			Unit Cost		Total Amount		Grand Total Rs.
			Maize	Wheat	Other	Maize	Wheat	Maize	Wheat	
1	Mr. Sona Basek Bhote	Pathi	40	0	0	200	0	8000	0	8000
2	Mr. Chheldar Bhote	Pathi	24	0	0	200	0	4800	0	4800
3	Mr. Tenjing Bhote	Pathi	24	0	0	200	0	4800	0	4800
4	Mr. Mingma Jenjen Bhote	Pathi	44	0	0	200	0	8800	0	8800
5	Mr. Yeisa Jumik Bhote	Pathi	32	0	0	200	0	6400	0	6400
6	Mr. Chhecha Bhote	Pathi	9	0	0	200	0	1800	0	1800
7	Mr. Dawa Nurbu Bhote	Pathi	12	0	0	200	0	2400	0	2400
8	Mr. Lakpa Ridar Bhote	Pathi	60	0	0	200	0	12000	0	12000
9	Mr. Ngeruk Bhote	Pathi	80	0	0	200	0	16000	0	16000
10	Mr. Furup Bhote	Pathi	52	0	0	200	0	10400	0	10400
11	Mr. Mikma Dorchi Bhote	Pathi	40	0	0	200	0	8000	0	8000

12	Mr. Ngimma Ridar Bhote	Pathi	40	0	0	200	0	8000	0	8000
13	Mr. Wanga Bhote	Pathi	12	0	0	200	0	2400	0	2400
14	Mr. Menang Chhiring Bhote	Pathi	60	0	0	200	0	12000	0	12000
15	Mr. Samden Bhote	Pathi	24	0	0	200	0	4800	0	4800
16	Mr. Pekma Aandik Bhote	Pathi	40	0	0	200	0	8000	0	8000
17	Mr. Ngatemba Bhote	Pathi	32	0	0	200	0	6400	0	6400
		No	1	0	0	0	0	0	0	5000
18	Mr. Lakpa Chhiring Bhote	Pathi	5	0	0	200	0	1000	0	1000
19	Mr. Pimba Relok Bhote	Pathi	60	0	0	200	0	12000	0	12000
20	Mr. Nurpu Bhote	Pathi	40	0	0	200	0	8000	0	8000
21	Mr. Karma Khamba	Pathi	40	0	0	200	0	8000	0	8000
22	Mr. Phurpu Bhote	Pathi	80	0	0	200	0	16000	0	16000
23	Mr. Ridar Khamba	Pathi	40	0	0	200	0	8000	0	8000
24	Mr. Laptuk Chhiring Bhote	Pathi	48	0	0	200	0	9600	0	9600
25	Mr. Andik Bhote	Pathi	40	0	0	200	0	8000	0	8000
26	Mr. Lakpa Anjuk Bhote	Pathi	100	0	0	200	0	20000	0	20000
27	Mr. Chektuk Bhote	Pathi	80	0	0	200	0	16000	0	16000
28	Mr. Kanchha Bhote	Pathi	24	0	0	200	0	4800	0	4800
29	Mr. Gatukpa Bhote	Pathi	60	0	0	200	0	12000	0	12000
30	Mr. Chhiyang Chhedar Bhote	Pathi	80	0	0	200	0	16000	0	16000
31	Mr. Sangje Bhote	Pathi	40	0	0	200	0	8000	0	8000
32	Mr. Guru Bhote	Pathi	80	0	0	200	0	16000	0	16000
33	Mr. Pasang Dharche Bhote	Pathi	9	0	0	200	0	1800	0	1800
34	Mr. Tsmring Shibo Bhote	Pathi	32	0	0	200	0	6400	0	6400
35	Mr. Minjur Chhiring Bhote	Pathi	60	0	0	200	0	12000	0	12000
36	Mr. Ngimma Anjuk Bhote	Pathi	60	0	0	200	0	12000	0	12000
37	Mr. Sanga Ridar Bhote	Pathi	80	0	0	200	0	16000	0	16000
38	Mr. Dendi Lama	Pathi	24	0	0	200	0	4800	0	4800
39	Mr. Ngimma Chhiring Bhote	Pathi	32	0	0	200	0	6400	0	6400
40	Mr. Pimba Danen Bhote	Pathi	40	0	0	200	0	8000	0	8000
41	Mr. Pasa Rinjin Bhote	Pathi	60	0	0	200	0	12000	0	12000
42	Mr. Tensom Bhote	Pathi	40	0	0	200	0	8000	0	8000
43	Mr. Rinjin Dorchi Bhote	Pathi	32	0	0	200	0	6400	0	6400
44	Mr. Dhanang Bhote	Pathi	20	0	0	200	0	4000	0	4000
45	Mr. Tenjin Pasang Bhote	Pathi	40	0	0	200	0	8000	0	8000
46	Mr. Kami Bhote	Pathi	80	0	0	200	0	16000	0	16000
47	Mr. Dorchi Bhote	Pathi	7	0	0	200	0	1400	0	1400
48	Mr. Jamling Bhote	Pathi	32	0	0	200	0	6400	0	6400
Total		Pathi	**2090**	**0**	**0**	**0**	**0**	**0**	**0**	**423000**

5.3.2 Cardamom as Cash Crop

Changing the crop pattern is the most pragmatic and imminent option particularly to Buffer Zone, heavy f orested landscape with interspersion of agriculture field from maize/millet cropping to cardamom plantation. Since it was said that less vulnerable to wildlife damage and highly valuable. In cardamom plantation, local people maintain the fostering plantation of Alder, *Alnus nepalnesis* which is more compatible in adjoining landscape in the Buffer Zone. This species also support to minimize shifting cultivation practice in entire Buffer Zone of MBNP.

But these days, this cash crop is being damaged by monkeys and seedlings of this species are being rotten by several diseases. Thousands of hectares of this species plantation are getting worst. People started changing this species. Thus, the time has come to intervention the cropping pattern; need to search other new suitable species as cash crop for local people.

5.4 Human Injury

The incidences of human injuries are mostly related to Himalayan black bear and very few by Common leopard. Most of mauling and killing activities by Himalayan black bear occurred in August to October. This is the season that black bear intrudes the crop field for raiding maize. Most of the human injuries from bears were as a result of accidental confrontations. Frequency of sudden encounters between bears and farmers are likely to be high because farmers frequently used to go to the crop field which is nearby to Forest. Bears might take such action of the farmer as provocation. Incidences of attacks also occurred when the victim driving away the bear from the crop field, carcass of livestock, collecting fodder, livestock herding, etc.

From 2080 to 2020, more than 70 people were injured by Himalayan black bear within MBNP and its Buffer Zone. The rates of encounter with Himalayan black bear are increasing rapidly in these past five years. List of human casualties by Himalayan black bear is given below:

SN	Date	Site	Victim's Name	Address	Injury	Amount Rs
1	11/4/2069	Bung	Bhim Pd Rai	Bung-7, Solukhumbu	Serious	0
2	25/7/2069	Chheskam	Shubhamani Rai	Chheskam-4, Solu.	Serious	0
3	25/7/2069	Chheskam	Purna Dhani Rai	Chheskam-4, Solu.	Serious	40000
4	25/7/2069	Chheskam	Sunita Kulung	Chheskam-5, Solu.	Serious	40000
5	25/7/2069	Chheskam	Nirmala Kulung	Chheskam-5, Solu.	Serious	40000
6	11/5/2071	Bung	Hira Pd Rai	Chheskam-7, Sol.	Death	300000
7	27/1/2072	Yaphu	Pasang Phuti Sherpa	Yamphu-1, Sankhu.	Serious	32500
8	9/5/2072	Shisuwa	Kuber Rai	Shisuwa-8, Sankhu.	Serious	0
9	19/5/2072	Shisuwa	Jay Bahadur Rai	Shisuwa-8, Sankhu.	Serious	10000
10	19/5/2072	Shisuwa	Samar Bdr Rai	Shisuwa-4, Sankhu.	Serious	100000
11	12/6/2072	Tamku	Prem Kumar Rai	Tamku-9, Sankhu.	Minor	10000
12	15/6/2072	Tamku	Suk Bdr Rai	Tamku-9, Sankhu.	Serious	40000
13	6/3/2073	Shisuwa	Dharchi Phuti Sherpa	Shisuwa-9, Sankhu.	Minor	10000
14	14/4/2073	Chheskam	Lakpa Dhiki Sherpa	Chheskam-3, Solu.	Minor	0
15	8/5/2073	Yaphu	Ngima Temba Sherpa	Yamphu-9, Sankhu.	-	0
16	7/1/2074	Chheskam	Tilaraj Rai	Chheskam-3, Solu.	Serious	0
17	31/1/2074	Shisuwa	Uttar Rai	Shisuwa-8, Sankhu.	Serious	0
18	12/4/2074	Makalu	Chandra Gurung	Makalu-2, Sankhu.	Serious	60335
19	12/4/2074	Makalu	Tula Bahadur Bista	Makalu-2, Sankhu.	Serious	87131
20	17/6/2075	Bung	Gobardhan Rai	Mahakulung-1, Solu.	Minor	0
21	5/9/2075	Pelmang	Uttar Kumar Rai	Mahakulung-2, Solu.	Minor	5370
22	19/4/2076	Chheskam	Sujan Kulung	Mahakulung-3, Solu.	Serious	200000
23	5/6/2076	Seduwa	Dawa Nurbu Sherpa	Makalu-2, Sankhu.	Serious	28764
24	17/7/2076	Limdumsa	Dawa Nupu Sherpa	Makalu-2, Sankhu.	Serious	128328
25	10/8/2076	Hunggunh	Mrs. Chhamje Bhote	Bhotkhola-3, Sankhu.	Serious	148053
	Total Rs					**1280481**

Injured Chandra Gurung

Injured Sujan Kulung by HBB

Injured Dawa Nupu Sherpa after treatment

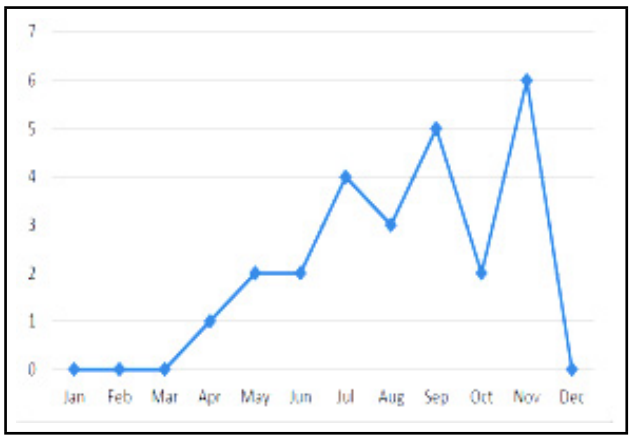
Injured Dawa Nurbu Sherpa

Injured Utra Kumar Rai by HBB

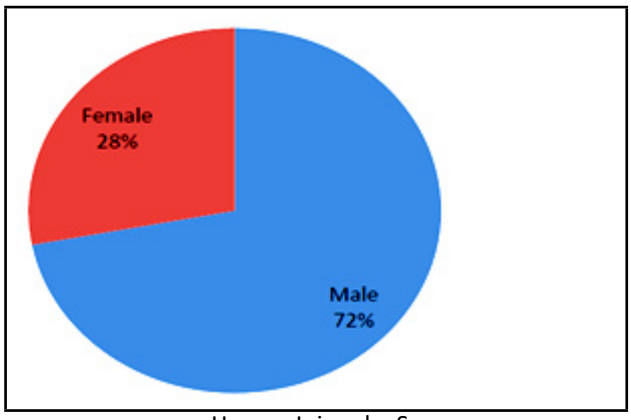
Injured Chhamje Bhote

5.4.9 Human Injury by Month and by Sex

On the basis of six years human injury record, 28% of people were female and rest is male. Among male, one people were killed by Himalayan black bear. Similarly, in recent six years period, November is the highest month of human injury by Himalayan black bear, followed by September and July. It is also marked that from December to March, there is no any single attack to human.



Human Injury by Months



Human Injury by Sex

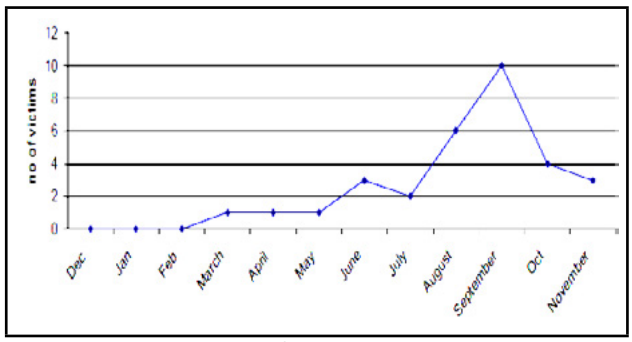
5.4.10 Human Injury from 1980-2007

Makalu Barun National Park published a report in 2008 named Crop Depredation by Wild animals in Forest-Agriculture Landscape in Buffer Zone of Makalu Barun National Park: With focus on human casualties by Himalayan black bear stated that about 31 bear victims were recorded in Buffer Zone area of Makalu Barun National Park from 1980 to 2007 (27 years period). Among them, most of mauling and killing activities by Himalayan black bear occurred in August to Oct. This is the season that black bear intrudes the crop field for raiding maize. In December, January, and Feb, there was no single record of such incidents this may be probably due to hibernation time of Himalayan black bear.

Human Injury by Season

According to this report, most victims were recorded as male (94%) as compared to female (6%). it might happen because male usually share the work of guarding crop field, collecting fuel wood and grazing cattle. It is probable that male goes for retaliation killing of black bear and frequently attacked by bear.

In these days, Himalayan black bear attack occurred to whom guarding the crop field (39%), followed by cattle grazing (29%), walking (13%), NTFPs collection (10%), fuel wood collection (6%) and timber collection (3%).



Season

6. Conclusion/Recommendations

On the basis of taken action research within Makalu Barun National Park and its Buffer Zone about Himalayan black bear and its conservation issue, following conclusions and recommendations are made.

6.1 Conclusion

A. The large scale of crop damage is being caused by Himalayan black bear in every sector repeatedly every year. The damage of maize is most severe followed by wheat/ barley. It is noted that the most severe condition of crop depredation is at Syaksila village followed by Lingam village. Other villages are also in danger. More than NRs. 450,000.00 of crops depredated by the Himalayan black bear in monetary terms this year at Syaksila. Similarly, In Yangden village, 6 cattle were killed by Himalayan black bear in this year. More than Nrs. 40, 00,000 are being lost generally every year by crop raiding and killing cattle by Himalayan black bear within MBNP and its Buffer Zone.

B. Himalayan black bear normally used to stay in hibernation in winter. In wheat crop field, it is observed in 2-3 numbers of Himalayan black bear during winter at Yangsima village this year. But it is marked that it raid crops in winter also. The reason of not having hibernation is the matter of research.

C. At the end of summer, bears have only a month or two before they hibernate for the winter. The female give birth in a winter den. Their newborn young are very small, thus requiring large amounts of milk, which must be provided without the mother having access to food, at least for the first month or so of life. In this case, maize fields are only the better option to care their offspring. It is concluded that maize fields/wheat fields are the better source to decrease the infant mortality rate of cubs.

D. Human injury by Himalayan black bear is common phenomenon. Within 40 years, more than 70 people were injured and few of them were killed. The rate of injury by Himalayan black bear is increasing rapidly in these five years. This year alone, 5 people were severely injured and one of them was woman. Most of the incidents were occurred from August to October and most of the attacks occurred when the victim was working or guarding the crop field followed by cattle grazing, fuel-wood/ timber collection and NTFP collection.

E. Himalayan black bear is only the wild animal that raid crops, killed cattle's and attack human. Wildlife Damage

Relief Guideline, 2069, in case of Himalayan black bear, made compensatory measures only for human attack. This situation creates havoc to the people and human- wildlife conflict is taking shape among communities. It, consequently, increases the probability of retaliatory killing.

F. The most havoc created by Himalayan black bear is at Seduwa sector followed by Bung and Hatiya sector. The least impact is observed at Tamku sector recently but the existence and distribution of Himalayan black bear is more or less equal in every sector.

G. Human wildlife conflict is increasing within Buffer Zone of MBNP. The major problematic wildlife is Himalayan black bear followed by rhesus monkey, common leopard, barking deer and porcupine. These animals raid crops and killed cattle.

H. Most of the Himalayan black bears are residing in fringe areas among Community Forest and settlements. Traditional shifting cultivation practice made better habitat for Himalayan black bear at fringe area. Likewise, policy on banned to kill wildlife helps the protection of Himalayan black bear in this area.

I. The most favourable habitat for Himalayan black bear is East Himalayan Oak-Laurel Forest followed by Decidious Maple-Magnolia-Sorbus Forest. In the Bhotkhola region, it is mostly found in Mixed Broadleaved Forest. It favors 1500 m to 3000 m altitude most. During rainy season, it might climb little bit high altitude.

6.2 Recommendations

Following recommendations were made on the basis of conclusion of report.

A. Hotspot Delineation

1. Each year, crop raiding and killing livestock is common. Livestock are killed normally at park area where herders graze their cattle's during rainy season. On the basis of crop raiding and human injury record, highly affected settlements are identified. These are as follows:

SN	Settlements	BZ Communtiy Forest	BZ User Committee	Sector
1	Chumsur	Guimkharka	Chepuwa	Hatiya
2	Lingam	Thulo Chandane	Arun Barun	
3	Honggong	Popti Bhanjyang		
4	Syakshila	Lomba Tembang		
5	Simbung	Tutin		
6	Sisne	Devinath	Pathibhara	Seduwa
7	Yangden	Khempalung	Pukhuva Dobhan	
8	Robesha	Makalu	Seduwa	
9	Limdumsa	Laligurans		
10	Nurbuchaur	Aakhedhunga		
11	Sikdim	Sapdokhola Kharukham	Tamku	Tamku
12	Yangsima	Bukurchong	Shishuwakhola	
13	Cherem	Cherem	Bung	Bung
14	Pelmang	Pelmang		
15	Chheskam 1	Belpaudo	Chheskam	
16	Chheskam 2	Hungachamlang		
17	Mamerku	Mamerku		

These villages are situated at the top of the settlements within Buffer Zone and adjoin with forest which is the habitat of Himalayan black bear. The time has come to do action research focussed to deter Himalayan black bear from crop field. We need to explore better practical techniques to deter Himalayan black bear and other wildlife in co-ordination with local people.

2. Alternatives to Crop

Encourage the planting of non-wildlife food, such as cash crops, in or near areas where bears are active. This option seeks to develop, support and sustain a cash-based agricultural economy producing crops giving much higher economic returns than maize or barley. Examples of possible crops include cardamom and other spices, Allo (Nettle plant), Lokta, *Daphne bholua*, bamboo etc. The species might be chosen as per market demand or own skill and capacity of investment.

Farmers who make special efforts to protect their crops from wildlife damage should be offered incentives, such as loans, extension training in activities which provide greater potential for income generation and preferential treatment in the event of continued crop damage. For example, incentives would only be offered to farmers who best protected their fields from monkey, deer, bird or other pests, using officially sanctioned procedures.

3. Improved Deterrents

The options for restricting or deterring wildlife access or movement into crop fields include noise-making bamboo or other locally identified techniques. The time has come to introduce "high-tech" options, which may work, include barbed wire fences and solar-powered electric fences. Improved means of guarding fields at night are urgently needed to deter bear in defined settlements at the beginning.

A. Species of Himalayan black bear is still unknown at Makalu Barun National Park. However, from its establishment, Himalayan black bear is highly prioritized species at MBNP, we don't know, how many types of bears are exist here. Local people claimed 3 species of bear within MBNP and they are: (i) Large black bear which cannot climb tree and usually used to stay in heart of the Forest. It seldom raid crops but killed cattle's, (ii) Small black bear, which raid crops and climb tree. It also attacks human, (iii) Small sized brown color bear. It is found in the heart of the jungle above 2000 m especially at Bhotkhola area.

Likewise, biology of Himalayan black bear is still unknown at Makalu Barun National Park. It is assumed that bears used to go to hibernation during winter but local people are being attacked and it also raid crops in the mid- winter.

To resolve these issues, a high level study is required to identify the species and peculiar biological characteristics. Similarly, MBNP need to develop a permanent team led by Assistant Conservation Officer to collect and analyze the data regularly and to co-ordinate with local people for better conservation measures. To distinguish it from other activities, MBNP should develop Bear Research and Conservation Center cell at headquarter. Terms of Reference of this cell will be prepared and directed by Chief Warden.

B. It is observed that to raid crop is very important for Himalayan black bear. It helps to restore high energy during their hibernation and to feed large amounts of milk to their young cubs.

Wildlife Damage Relief Guideline, 2069 do not provide compensation if farmer lose their crop by Himalayan black bear. Thus, following two actions need to be done immediately to protect Himalayan black bear and to provide relief to farmer.

(i) Bear Research and Conservation Center need to collect data regularly of crop depredation/livestock killing and human injury. As per analyzed data, concerned Users Committee (UC) need to co-ordinate with concerned Community Forest User Groups to compensate farmers immediately. UC need to develop fund. The source of fund would be from CFUGs, UC and rural municipality. CFUGs need to increase their fund by searching potentialities and they need to allocate their budget for compensation of crops damaged by Himalayan black bear instead of Community development.

(ii) MBNP need to suggest concerned authorities to amend Wildlife Damage Relief Guideline, 2069 to provide compensation if bear raid crops and killed cattle's. Amendment in this guideline would be a great tool to protect Himalayan black bear in the long run.

D. Increasing trend of human injury by Himalayan black bear is great concern of MBNP. To minimize the risk, local people of 17 villages need to be aware regularly. Member of CFUGs and Communitybased Anti-Poaching Units (CBAPU) need to be trained to handle the Himalayan black bear.

E. Regular conservation based workshop is crucial to change the perception of local people towards Himalayan black bear esp. in targeted villages. CBAPU, CFUGs, UC needs to be institutionalized to protect it from retaliatory killings. Similarly strong damage relief system needs to be set up with strong law enforcement to protect Himalayan black bear.

F. Because of shifting cultivation practice, new habitat for Himalayan black bear created. The carrying capacity of old-growth forests is usually much lower than that of successional forests, because of a paucity of fruit or protein rich undergrowth foliage. Shifting cultivation practice increase in the amount of edge between Forest, shrub land, grassland and agricultural field improves foraging opportunities for Bear, Langur or Rhesus and Barking deer (Jackson, R. 1990). Abundant food crops and new vegetation made it better habitat. To avoid Himalayan black bear from fringe area or from nearby to settlement area, following activities are recommended.

(i) It is strongly recommended that the right of the local people to indiscriminately cut old growth forest

and thereby create more slash and-burn areas should be terminated as soon as possible esp in Hatiya sector.

(ii) Micro study on habitat of Himalayan black bear is required. Park land need to be managed accordingly focuses on Himalayan black bear to reduce the damage.

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२. मकालु वरुण राष्ट्रिय निकुञ्ज र मध्यवर्ती क्षेत्रमा रहेका सिमसारहरुको अध्ययन तथा अभिलेखीकरण

Executive Summary

Makalu Barun National Park and its Buffer Zone is comprising a vast amount of water in the form of snow, ice, glacier, lake and frost. It possess major two sub- basin of Koshi basin with numerous lakes and important 8 river systems of Nepal. Barun River is recognized as one of the sacred river of Nepal because of consisting the water from Shivadhara. It is the river which originates from Makalu Barun area and ends also at Makalu Barun area which runs about 48.75 Km. About 121 glacial wetlands exist at MBNP and cover almost 16.35 km^2. We found more than 60 glacial and other lakes from Popti to Naulekh.

To study about the status of wetlands at Makalu Barun National Park, we organize several informal meetings and sharing with local people. Extensive field surveys were organized from Popti to Kothe by different groups. Literatures regarding wetlands were collected from different sources.

In Arun Sub-basin, there are major five river systems. These are Barun, Kasuwa, Ishuwa, Apsuwa and Sankhuwa. These rivers cover almost 1332.8 Km^2. Similarly, in Dudh koshi Sub-basin, there are major three river systems and they are Hongu, Inkhu and Dudh koshi. There rivers cover almost 2602.81 Km^2.

Most of the lakes are found at 4000-5000m altitude. These glacial lakes are changing their size from time to time. The cause of changing size of glacial lakes is retreating glaciers, outburst, rock fall, avalanche etc. Similarly, lower elevations lakes are also changing their features. Lower lakes are ecologically and socially important for livelihood of local people of downstream.

Among lakes, 3 Lakes are highly prioritized and focussed to make it nationally important lakes. These are Thulo Pokhari and associate lakes, Barun Pokhari and associate wetlands and Panch Pokhari. Special report has been prepared of these lakes.

- GLOFs are common phenomenon at Makalu Barun National Park. Tama Pokhari flood were occurred in 1998 followed by Langmale flood at 2017. Several other glacial floods were also occurred but their date is not known yet. Lower Barun and west Chamlang glacial lakes are critical and a potentiality of outbreak is high. These lakes need to be monitored regularly.
- Detail study is required to assess the real amount of water, released by the river systems of MBNP. The time has come to develop Barun river catchment as sacred site. Similarly, a detail Succession process needs to be studied of Langmale GLOF, Tama GLOF and other small floods.

1. Introduction

1.1 Wetlands in Nepal

Wetlands denote perennial water bodies that originate from underground sources of water or rains. It means swampy areas with flowing or stagnant fresh or salt water that are natural or man-made, or permanent or temporary. Wetlands also mean marshy lands, riverine floodplains, lakes, ponds, water storage areas and paddy fields (Nepal Wetland Policy, 2003).

Wetlands are fertile lands for agriculture and rich from the point of view of biological diversity. These wetlands provide habitat for several species of wildlife and lie within various ecosystems of high-mountain and lowland plains.

Wetlands are home to several species of flora and fauna and play an important role in plant and animal diversity. Wetlands are also crucial in maintaining various sources of underground water, preventing landslides and controlling the loss of nutrients. These wetlands also provide ample opportunities for sustainable livelihood options.

Wetlands occupy approximately 5% (743,756 ha) of total area of Nepal, ranging from high altitude glacial lakes to hot springs, ponds, oxbow lakes, river flood plains, swamps and marshes. Wetlands have great significance on various aspects such as biodiversity, livelihood and on the purification of water sources. Ramsar secretariat has declared 10 Ramsar Sites in different ecological zones of Nepal. Of these, 4 are in high altitude.

These wetlands functions as water resources and are thus have become an increasingly significant global issue in recent years. Very limited studies and research have been carried out focusing on high mountain wetlands. In 1998, IUCN (The World Conservation Union)-Nepal made invent of 163 wetlands in the Terai region of Nepal and 78 wetlands listed from mid hills and high mountains. An inventory was carried out by ICIMOD (International centre for Integrated Mountain Development) and UNEP (United Nations Environmental Programme) in 2002, which listed 2,323 Glacial Lakes above 3500m in Nepal covering an area of 75.70 Km^2.

National Wetland Conservation and Development Committee have been identified 5358 wetlands in Nepal. Among them, 2712 (51%) are at lowlands (upto 500m), 419 (8%) are at mid hill and lower temperate zone (up to 3000m). Remaining 227 (42%) are in high altitude (above 3000m). Department of Agriculture Development mentioned that there are about 5000 natural lakes/ pond and more than 5000 are artificial ponds in Nepal.

Wetlands are considered as biological supermarket. It is estimated that about 200 avian species are depends in wetland for their survival. These wetlands provide habitat for several species of wildlife and lie within various ecosystems of high-mountain and lowland plains. The wetlands of the country's lowlands alone support 32 species of mammals, 185 species of fish, 36 species of amphibians, 80 species of reptiles. Similarly wetland supports almost 25% plant in Nepal. Five native paddy species are still found in wetlands of Nepal which is ultimate genetic source.

1.2 Wetlands of Makalu Barun National Park

Numerous lakes and ponds exist as snow, glacial ice and water in the upper elevations of the Makalu Barun National Park (MBNP) and its Buffer Zone. Released continuously, the water pours southward, forming eight major river tributaries which pour into the Arun and Dudh Koshi riverssub-basin. It is assumed that Solukhumbu and Sankhuwasabha districts hold 579 glacial lakes which covers an area of 3.31 Km^2 and 13.03 Km^2 respectively. Altogether 121 glacial lakes lie inside MBNP (Karki 2002). Groups of alpine, sub-alpine lakes exist in the upper elevations of Park area of Sankhuwasabha and Solukhumbu districts.

1.3 Issues of Wetland in MBNP

Management Plan of MBNP (2076/77-2080/81) mentions the following issues of wetland.

- Inadequate information about present wetlands status
- Inadequate scientific studies about current status, vulnerability and threats towetlands
- Glacial Lake Outburst Floods (GLOFs), pollution, overgrazing, unsustainable harvesting of resources are the pronounced threats to wetlands
- Impact of climate change in high altitude wetlands and
- Pollution in high altitude wetlands due to religious and tourism activities.

1.4 Objective of the Study

The general objective of this study is to identify the lakes/wetlands of Makalu Barun National Park and its Buffer Zone. The specific objectives of this study are as follows.

1. Identify the lakes/ ponds/ wetlands and their geographic position as well as river system of MBNP.
2. Identify the most valuable (natural, biological and cultural amenities) lakes and prepare scientific report.
3. Identify the major GLOF prone glacial lakes, history of GLOF in MBNP.

1.5 Limitations of the Study

To conduct this study, several trip to wetlands were organized however because of the continuous snowfall, we unable to visit the high altitude glacial lakes extensively. Similarly, because of the spread of pandemic of COVID19 (Corona virus) around the world, we unable to gather people to discuss about the cultural assets of wetlands as desired.

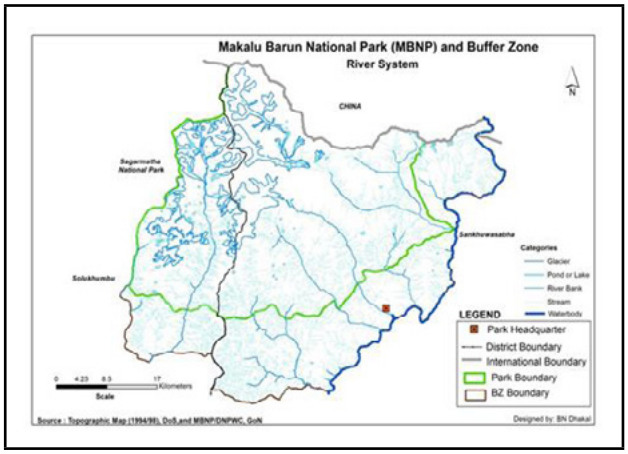
2. Methodology

2.1 Study Area

Makalu Barun National Park, 1500 Km^2 and Buffer Zone, 830 Km^2 is bounded by Sagarmatha National Park (SNP) in the west, Arun River by South, Kimathanka in the East and China (Tibet) in the North. It is the only protected area in the country to host pristine proposed strict nature reserve Saldima valley with lustrous green vegetation containing floral hotspot. It spreads parts of Bhotkhola rural municipality, Makalu rural municipality, fully encompasses Siluchung rural municipality in Sankhuwasbha district and parts of Maha-Kulung rural municipality in Solukhumbu district.

It has very wide altitudinal variation from 435-8463m. The Arun is the largest trans-Himalayan river passing through Nepal and also has the greatest snow and ice-covered area of any Nepalese River basin. Park has 6 Himalayan Peaks higher than 6000m such as Makalu (8,463m asl), Baruntse (7,129m), Chamlang (7,319m), Himchuli (6, 424m), Naulekh (6,358m) and Mera Peak (6,654m). Seven major watershed tributaries forming river valleys to the south are Barun, Kasuwa, Isuwa, Apsuwa and Sankhuwa rivers draining into the Arun river and Hongu and Inkhu draining into Dudh Koshi river. The park area is also famous for many stagnant water bodies (lakes/ponds) such as Panch Pokhari, Barun Pokhari, Tama Pokhari, Dudh Pokhari, Tin Pokhari and Thulo Pokhari. Solukhumbu and Sankhuwasabha districts hold 579 glacial lakes which covers an area of 3.31 Km^2 and 13.03 Km^2 respectively. Altogether, 121 glacial lakes exists inside MBNP (Karki 2002).

Makalu Barun National Park and its Buffer Zone is the study area. It includes different type of water bodies (lakes/ ponds. river system, glacial lakes).



2.2 Data Collection/Analysis

2.2.1 Consultation with Local People

Informal consultations were made with local people and key informants. Herders, ritual leaders and community members were selected and interaction programs organized. Consultations with victims by GLOF (Glacial lake Outburst Flood) were made personally.

During interaction program, Issues related glacier and lakes and its ecological aspects were discussed. The values of glaciers, glacial lakes, reservoir, stream, river system were discussed extensively and issues were raised. Cultural values of lakes/ rivers were also discussed.

2.2.2 Field Survey

In the study area, field surveys of different identified and non- identified lakes were done and basic data were collected from Hatiya sector to Bung sector. Lakes and glacial lakes were included in this survey including river system.

Similarly, using Google map, few high altitude lakes were also identified where we unable to reach because of ice. In this survey, we identified almost 46 glacial and other lakes within Makalu Barun National Park and its Buffer Zone.

2.2.3 Data Analysis

In this report, data were analysed using computer software program esp. Excel. Similarly, maps were prepared using Global Positioning System (GPS) technology. Similarly, literature review and local knowledge were also analysed to derive the conclusions.

3. Wetlands of MBNP/Buffer Zone

3.1 Watersheds

Of the seven major sub watershed of the Koshi system, only the Arun and Dudh Koshi lie within the study area. The study area consist eight watersheds of considerable size. These include the Barun, Kasuwa, Isuwa, Apsuwa and Sankhuwa in the Arun Basin and the Hongu, Inkhu and Dudh Koshi in the Dudh Koshi Basin.

Major Watersheds of MBNP

Arun Basin						
SN	River	Total area	Length	Width	Lowest alt (m)	Highest
		KM^2	KM	KM		alt (m)
1	Barun	475.78	48.75	9.76	1097	8463
2	Kasuwa	112.5	16.13	6.97	758	4385
3	Isuwa	169.48	35.38	4.79	678	6800
4	Apsuwa	218	29.75	7.33	601	6292
5	Sankhuwa	357.04	33.88	10.54	397	6100
Dudh Koshi Basin						
6	Hongu	600.78	55	10.92	880	7129
7	Inkhu	315	45.38	6.94	920	6767
8	Dudh Koshi	1687.03	76.25	22.12	920	8848

Source: District map 1:25000 prepared by Topographical Survey branch

The table indicates that the total area of these watersheds ranges from 112.5 Km^2 to more than 1,687 Km^2 Dudh Koshi is the largest and Kasuwa is the smallest watershed in terms of size. Dudh Koshi basin lies within and beyond MBNP.

The Hongu is the second largest watershed with an area of 600.78 Km^2. The Barun has an area of 475.78 Km^2 whereas the areas of Sankhuwa, Inkhu, Isuwa and Apsuwa are 357, 315, 169.48 and 218 Km^2 respectively. The length of these watersheds ranges from 16.13 Km (Kasuwa) to more than 76 Km (Dudh Koshi). Similarly, the width ranges from 4.79 Km (Isuwa) to more than 22 Km (Dudh Koshi).

These watersheds can be grouped into three categories on the basis of land distribution.

1. Watersheds with the highest percentage of land between 5,000 and 6,000m: Dudh Koshi, Inkhu and Barun.
2. Watersheds with the highest percentage of land between 4,000 and 5,000m: Apsuwa and Isuwa.
3. Watersheds with highest percentage of land between 2,000 and 3,000: Kasuwa, Sankhuwa and Hongu.

River System Distribution (%) by Altitude

SN	Altitudinal range (m)	Arun Basin					Dudhkoshi Basin		
		Barun	Kasuwa	Isuwa	Apsuwa	Sankhuwa	Hongu	Inkhu	Dudhkoshi
1	<1000m	-	0.9	0.6	0.8	4.5	0.3	0.2	0.05
2	1000 -2000m	1.6	25.9	7.8	9.4	25	12.2	9.2	4.3
3	2000- 3000m	7.6	48.2	19.2	21.3	34	24.8	14.9	9.9
4	3000- 4000m	18.3	21.8	24.6	29	22.6	22.1	13	11.02
5	4000-5000m	28.4	3.2	30.3	36.8	11.2	13.4	27.8	25.6
6	5000-6000m	29.5	-	14.3	2.6	2.7	23.3	30.2	40.58
7	6000-7000m	13.4	-	3.2	0.1	-	3.9	4.7	6.56
8	7000-8000m	1.1	-	-	-	-	-	-	1.82
9	>8000m	0.1	-	-	-	-	-	-	0.17
		100	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source : Study of Geo-hydrology, Land use and Population of Makalu Barun Conservation Area 1992 (MBNP publication)

These watersheds can be grouped into three categories on the basis of land distribution.

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2. Watersheds with the highest percentage of land between 4,000 and 5,000m: Apsuwa and Isuwa.
3. Watersheds with highest percentage of land between 2,000 and 3,000m: Kasuwa, Sankhuwa and Hongu.

3.2 Lakes/ Ponds/ Glaciers (Wetland)

High Altitude Wetlands is areas of swamp, marsh, meadow, fen, peat land, or water located at an altitude above 3,000m, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or saline and is generally located at altitude between continuous natural forest border and the permanent snow (Chatterjee et al. 2010). It includes lakes, ponds, rivers, glaciers, and glacial lakes.

Nepal is blessed with the numerous highest peaks and these tall mountains are the source of glaciers and lakes in the high altitude regions across the country and acting as a fresh water reservoir to the major river basins. (Gujja, 2005).

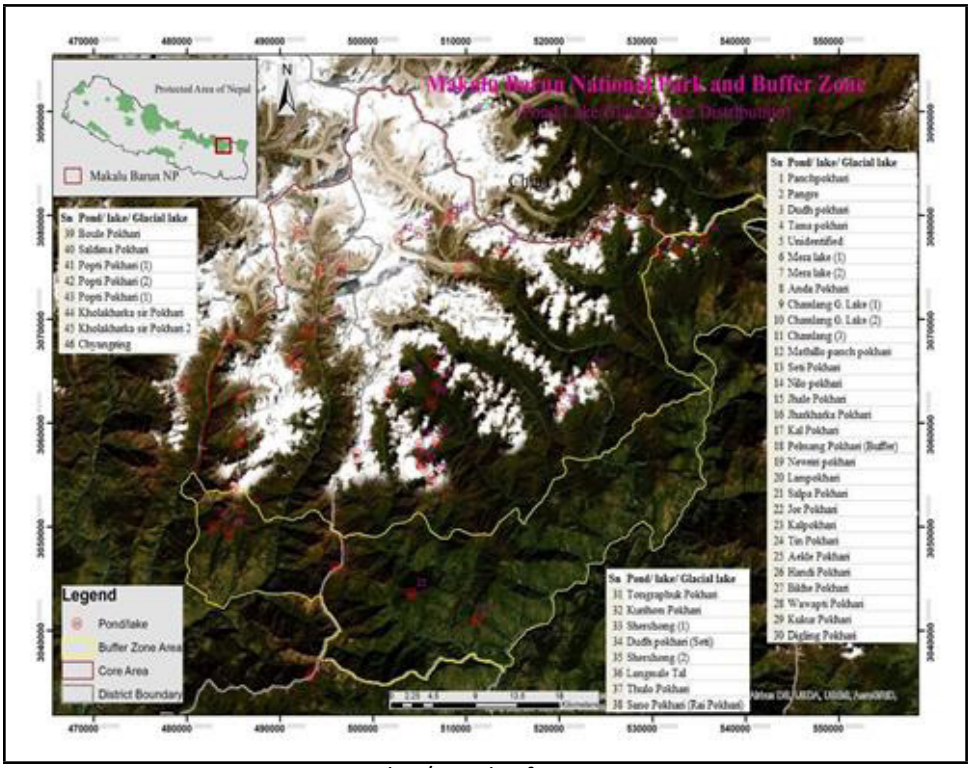
Glacial lake and ponds in the upper elevations of the Makalu Barun area released continuously to the downstream river channels. These rivers are feed continuously by these lakes/glaciers.

Beside these major rivers, these lakes/glaciers form numerous streams. The land is evolved as one of the significant water towers of the world which produce huge amount of fresh water to feed the world.

Some of the important lakes/ pond of the MBNP are as follows.

SN	Pond/Lake/Glacial Lake	X	Y	Altitude, m	Remarks
1	Panchpokhari	485064.84	3053859.7	4332	Core Zone
2	Pangre	485600.41	3058194.07	4367	Core Zone
3	Dudh pokhari	485853.26	3062535.8	4770	Core Zone
4	Tama pokhari	484685.12	3068546.36	4445	Core Zone
5	Unidentified	479488.11	3063534.74	4962	Core Zone
6	Mera lake (1)	491148.62	3066068.2	4999	Core Zone
7	Mera lake (2)	491751.53	3065449.24	5114	Core Zone
8	Anda Pokhari	493079.77	3068727.59	4816	Core Zone
9	Chamlang G. Lake (1)	495601.64	3070008.67	4961	Core Zone
10	Chamlang G. Lake (2)	495601.29	3073234.18	5212	Core Zone
11	Chamlang (3)	496645.77	3075046.24	5415	Core Zone
12	Mathillo panch pokhari	492043.15	3078402.78	5372	Core Zone
13	Seti Pokhari	494337.3	3074687.00	5060	Core Zone
14	Nilo pokhari	493867.49	3881341.54	5489	Core Zone
15	Jhale Pokhari	498315.37	3056947.66	4739	Core Zone
16	Jharkharka Pokhari	482863.61	3049966.81	3362	Buffer Zone
17	Kal Pokhari	495912.19	3046143.12	3919	Core Zone
18	Pelmang Pokhari (Buffer)	484508.37	3049420.81	3050	Core Zone
19	Newriri pokhari	503713.84	3843832.87	2743	Buffer Zone
20	Lampokhari	511137.55	3040965.62	1986	Buffer Zone
21	Salpa Pokhari	493478.48	3035787.81	3457	Outside BZ
22	Jor Pokhari	504184.01	3043499.44	2883	Buffer Zone
23	Kalpokhari	505035.06	3056152.82	4189	Core Zone
24	Tin Pokhari	505497.29	3055697.47	4306	Core Zone

25	Aekle Pokhari	506343.29	3054695.51	4327	Core Zone
26	Handi Pokhari	505011.8	3057945.95	4376	Core Zone
27	Bikhe Pokhari	506867.3	3058122.68	4178	Core Zone
28	Wawapti Pokhari	506282.32	3062031.87	3787	Core Zone
29	Kukur Pokhari	501737.24	3063022.05	4479	Core Zone
30	Digling Pokhari	503758.06	3064069.53	4419	Core Zone
31	Tongraphuk Pokhari	506475.93	3065759.98	4013	Core Zone
32	Kurihom Pokhari	506837.65	3063683.45	3780	Core Zone
33	Shershong (1)	509198.55	3074772.4	4566	Core Zone
34	Dudh pokhari (Seti)	507941.39	3079746.03	4847	M base camp
35	Shershong (2)	504932.97	3078284.81	5230	Core Zone
36	Langmale Tal	513840.93	3076539.89	4818	Core Zone
37	Thulo Pokhari	520331.16	3062934.1	4066	Core Zone
38	Sano Pokhari (Rai Pokhari)	520303.63	3061293.85	4041	Core Zone
39	Boule Pokhari	523312.87	3064819.17	4110	Core Zone
40	Saldima Pokhari	524010.8	3077977.9	4037	Buffer Zone
41	Popti Pokhari (1)	532844.62	3076614.09	3948	Buffer Zone
42	Popti Pokhari (2)	502723.07	3077757.34	4160	Buffer Zone
43	Popti Pokhari (1)	530539.58	3076402.26	3903	Buffer Zone
44	Kholakharka sir Pokhari 1	529717.39	307996.55	4179	Buffer Zone
45	Kholakharka sir Pokhari 2	508743.55	3079713.13	4470	Buffer Zone
46	Chyangring	535590.01	3077712.42	3911	Core Zone



Lakes/ ponds of MBNP

3.2.1 Distribution of Lakes by Altitude

Altitude (m)	No. of lakes	%
>2000m	1	2
2000m -2500m	0	
2500- 3000m	2	4
3000- 3500m	3	7
3500- 4000m	6	13
4000- 4500m	18	39
4500- 5000m	9	20
5000- 5500m	7	15
<5500m	0	0
Total	**46**	**100**

The table illustrates that most of the lakes/ ponds are exist between 4000-5000m. It covers almost 60% of the lakes. Remaining is above 5000m (15%), 3500-4000m (13%). Above 2500-3500 m is also luxuriant for lakes (11%). One pond is available below 2000m which is culturally important ponds.

4. Major Wetlands of MBNP

4.1 Introduction

Wetlands within MBNP are numerous and few of them are Tin Pokhari, Panch Pokhari, Barun Pokhari, Lower Barun Pokhari, Tama Pokhari, Thulo Pokhari and Sano Pokhari etc.

Within Buffer Zone, there are about 10 lakes. Most of them are at Bhotkhola area. These are series of Popti pokhari and Kholakharka shir Pokhari. Similarly other lakes are Jorpokhari, Lampokhari, Newriri Pokhari, Jharkharka Pokhari etc. Adjoin to MBNP; one of the ecologically and culturally important lakes is Salpa Pokhari. Each year, more than 30000 people visit this Lake for ritual purpose.

Salpa Pokhari

4.2 Major Wetlands of MBNP

Within MBNP, from its establishment, three lakes are highly prioritized because of its ecological and cultural importance. Moreover, these lakes represent the two major blocks of MBNP. About 10 years ago, Buffer Zone Management Committee, proposed 2 lakes to develop as Ramsar Sites. These 2 lakes are Thulo Pokhari and Panch Pokhari. In this report, we focused to prepare Resource Information Sheet (RIS) of these 2 lakes to proceed it for national/international level wetlands.

4.2.1 Thulo Pokhari and Associated Lakes

Thulo Pokhari is the headwater of Ishuwa Khola, one of the tributary of the Arun River. The other important lakes of the Thulo Pokhari series are Bhale Pokhari, Sano Pokhari, and Shreeti Pokhari. At present, there is no sign of glacier nearby but the Thulo Pokhari and other associated wetlands are glacial originated alpine fresh water lake and are oligotrophic in nutrient content. The total area of associate lake is 16.163 ha and the biggest one is Thulo Pokhari.

Lake	Area (Ha)	Elevation (m)	Latitude	Longitude
Thulo Pokhari	14.890	4069	27° 41' 29"	87° 12' 24"
Bhale Pokhari	0.403	4080	27° 41' 29"	87° 12' 24"
Sano Pokhari	0.600	4020	27° 41' 06"	87° 12' 25"
Shreeti Pokhari	0.270	4350	27° 42' 24"	87° 13' 15"
Total	**16.163**			

These lakes and catchment lie in between 27° 41’ 06”- 27° 42’ 24” Latitude and 87° 13’ 15”- 87° 13’ 05” Longitude. The altitude ranges between 3,900m to 4,210m in Himalayan Zone. These lakes are surrounded by Keke hill on the North, Sipton hill on the south, south east flank of Sipton and ridges on the east and on the west there is narrow pass without let which joins with Ishuwa Khola.

Access

It takes 45-50 minutes by plane from Kathmandu to Tumlingtar. Then, 4 hours drive to Num. Num is a small market where we could buy several food and other items to go to Thulo Pokhari. It takes about 4 camps from Num to Thulo Pokhari. The first camp would be Seduwa. A small village with lodging/restaurant facilities. The second camp would be at Tashigaun, the last settlement of this route, where we could find grocery shops/ hotel/ fancy restaurants. The next camp would be Khogma. It is national park area. The next day, we will be at Thulo Pokhari.

Geology, Geomorphology and Topography

The secondary study shows that the Thulo Pokhari lies in the higher crystalline group. The Main Central Thrust (MCT) separates lesser Himalaya with higher crystalline rocks of this Nappe are separated from the underlying

garnet-biotite grade metamorphic rocks of the lesser Himalayan tectonic unit by the main central thrust. The rocks of the catchment including lake are predominantly of gneiss followed by mica schist, calc-silicate gneiss, migmatite, marble and quartzite.

Thulo Pokhari during winter

Thulo Pokhari during summer

Geographically, this zone is colluvial and morinal deposited surface, composed of various kinds of gneisses that forms the basement of the Tibetan-Tethys-Sedimentary sequence and consists of high-grade metamorphic rocks that include various kinds of gneisses, schists and migmatites. Although, traditionally these rock units were thought to be very old rocks of the Indian shield forming the basement for the Tethyan as well as lesser Himalayan rocks, recent studies have shown that they are much younger rocks of the Neoproterozoic age, about 800 to 500 million years old (Karki, J.; Adhikari, K.,2018).

Soil Type

One sample of soil was taken each from Thulo and Sano Pokhari. The texture of the soil of Thulo Pokhari is sandy loam (68.7% sand, 33.6% Loam and 7.7% clay). The p^H is 4.9, Organic matter content 0.801%, Nitrogen content is 0.057%, Phosphorus (P205 kg/ha) is 128.2 and Potash (k20 kg/ha) is 93.8 (Karki, J.; Adhikari, K., 2018).

The texture of the soil of Sano Pokhari is sandy (91.7% sand, 1.6% Loam and 7.7% clay). The pH is 4.9, Organic matter content 1.758 %, Nitrogen content is 0.117%, Phosphorus (P205 kg/ha) is 682.2 and Potash (k20 kg/ha) is 80.6 (Karki, J.; Adhikari, K., 2018).

Origin

The Lakes around Thulo Pokhari series are glacial in origin from the Sipton Peak and Keke Peak, which are the main source of water. But there is no sign of glacier at present.

Down-Stream Area

The downstream area of the Thulo Pokhari lies inside the Makalu Barun National Park and its Buffer Zone. One of the sources of Ishuwa Khola is discharge from Thulo Pokhari. The sources of water come from the Keke hill which forms Thulo Pokhari. Water from the two other hills in eastern and southern Sipton hill also feed Thulo Pokhari. Before meeting with the Ishuwa Khola, the water from the Thulo Pokhari passes through steep hills. Discharged water from the Bhale Pokhari and other one Shreeti lake joins with the small stream formed by Thulo Pokhari. Later Ishuwa Khola mixes with Arun at Ishuwa Dovan. The water is mainly used for domestic purposes like washing, drinking in the downstream. Thus the clean, unpolluted and regular supply of water downstream from Thulo Pokhari has high significance not only for the local communities of nearby villages but also to the downstream people.

General Climate

The general climate is prominent winter with about sub–zero temperature. The Lakes are frozen for about 3-5 months in winter. The summer is mild with pronounced rain from June to September. The rest of the months are mild cold and are ideal for grazing, tourism and conservation activities.

Land Tenure, Ownership and Jurisdiction

The area falls under the ownership of Makalu Barun National Park. The Ministry of Forest and Environment, Government of Nepal, is the legal authority. The park is governed by the National Parks and Wildlife Conservation Act 2029 BS (1973) and Himali Rastriya Nikunja Niyamawali 2036 BS (Mountain National Parks Regulation 1979). Grazing is allowed to the local people of the Buffer Zone. The definition of the local people embodies the people living within the Buffer Zone of the Makalu BarunNational Park.

Current Land Use Practice

Most of the area is composed of rock and alpine rangeland. Nomads from nearby villages like Tashigaun, Nawagaun, Norbugaun, Robesha, Limdhumsa etc take their cattle for grazing. Collecting timber and non-timber Forest products are banned for commercial use except for local people by the permission of the chief conservation officer of Makalu Barun National Park.

Hydrological Features

Water Discharge

The discharge in outlet is 0.355 m^3/second from Thulo Pokhari to Ishuwa Khola (Karki, J., Adhikari, K., 2018).

Upstream

The water comes from Sipton hill, Keke hill and other surrounded hills to the Thulo Pokhari and drains to the Ishuwa Khola. There is no other use of the upstream. Similarly, water comes from Sipton pass and hills to Sano Pokhari. The discharge of this lake is observed about 200m down. Water from Sano Pokhari also joins Ishuwa Khola as well.

Water Depth

The team do not able to measures the depth of lake. However, it is assumed the average depth of the Thulo Pokhari is 50m.

Water Permanence

The melting of ice after winter increases the volume of water. The other main source of water is rain fall that increase the water level dramatically.

Fluctuation in Water Level

The level of water is high in rain and after melting of ice. The water quantity is low during the winter when ice is frozen. Hydrological function and values of wetland is high for ground water recharge, flood control and sediment trapping.

Source and Link with Ground Water

The source of the water is mainly the snow during winter. The Lakes receive water from the surrounded hills during rain. Water from the Keke, Sipton peaks is the main source of water.

Limnology

Colour is clear white. pH of both Thulo Pokhari and Sano Pokhari are low as per the WHO guideline value. Bacteriologically, both the samples are unsatisfactory for drinking purpose. The following table shows the details of the test of the water collected from outlets of Thulo and Sano Pokhari.

Parameters	Unit	WHO GV	Thulo Pokhari	Instruments/Method used
PHYSICAL				
Turbidity	NTU	5	<1.0	Turbidity Meter
Suspended Solids	Mg/l		<1.0	Gravimetric
CHEMICAL				
pH		6.5 - 8.5	5.8	pH Meter
Total Alkalinity	Mg/l as $CaCo_3$	500	2.0	Titrimetric
Acidity	Mg/l as $CaCo_3$		<2.0	Titrimetric
Chloride	Mg/l	250	2.5	Argentometric Titration
Total Phosphate	Mg/l		<0.01	UV-VIS Spectrophotometer
Total Kjeldhal Nitrogen	Mg/l as $CaCo_3$		0.5	Macro Kjedhal Method
BIOCHEMICAL				
BOD	Mg/l	100	32.5	Azid Modification
BIOLOGICAL				
Coliforms	MPN/100ml	Nil	28	MPN Tube

Source: (Karki, J.; Adhikari, K., 2018)

Laboratory Analysis of the Water of Sano Pokhari

Parameters	Unit	WHOGV	Sano Pokhari	Instruments/Method used
PHYSICAL				
Turbidity	NTU	5	1.0	Turbidity Meter
Suspended Solids	Mg/l		<1.0	Gravimetric
CHEMICAL				
P^H		6.5 - 8.5	5.8	pH Meter

Total Alkalinity	Mg/l as $CaCo_3$	500	6.0	Titrimetric
Acidity	Mg/l as $CaCo_3$		<2.0	Titrimetric
Chloride	Mg/l	250	1.9	Argentometric Titration
Total Phosphate	Mg/l		0.04	UV-VIS Spectrophotometer
Total Kjeldhal Nitrogen	Mg/l as $CaCo_3$		<0.5	Macro Kjedhal Method
BIOCHEMICAL				
BOD	Mg/l	100	28.5	Azid Modification
BIOLOGICAL				
Coliforms	MPN/100ml	Nil	1100+	MPN Tube

WHOGV – World Health Organization Guideline Value, 1998

Source: (Karki, J.; Adhikari, K., 2018)

Beliefs

Though the difficult access however due to religious belief, the major pilgrimage is seen during July-August especially Janaipurnima festival where about 200–300 people from Makalu Rural municipality and other places visit the area. Mostly, Rai, Bhrahman and Chhetri worship at Sano Pokhari and Thulo Pokhari whereas Sherpas worship mostly at Thulo Pokhari. It is believed that there was a competition between Rai and Sherpa for finding the Pokhari. Rai went ahead and found Sano Pokhari and occupied, whereas Sherpa began to make Khole (a type of locally made food) before going to find the Pokhari. When Sherpa reached to the Sano Pokhari, Rais were staying and already occupied. So, Sherpa went ahead and found Thulo Pokhari. Sherpa still say that Rai are poor because of having low water level or seasonally dry and the Sherpas are rich because of having large quantity of water.

Flora Of The Catchments

The coldest and hottest month at January and July is about–10˚C and 20˚C respectively. The snow period lasts for 3 to 5 months in this Himalayan zone. This zone represents a treeless region with range land interspersed by rocky slopes and alpine pasture. The vegetation is represented by Alpine pasture meadow and Dwarf *Rhododendron* scrub. The alpine pasture meadow is dominated by *Potentilla microphylla*, *Rhododendron lepidotum*, *Rhododendron ciliatum*, *Bergenia purpurascens*, *Primula deuteronana, Primula atrodentata, Bistorta affinis, Cassiope fastigiata, Aconogonum molle, Juniperus recurva* and many other species.

Yak, Chauri, sheep and goat heavily graze the vegetation resulting reduced palatable grasses and promoted the growth of unpalatable and toxic plants. Vegetation of this area associates a number of medicinal and aromatic plants. The common medicinal plants are *Bergenia purpurascens, Potentilla microphylla, Swertia spp., Dactylorhiza hatagirea, Meconopsis paniculata, Rheum australe, picrorhiza scrophulariiflora, Aconitum gammiei, Aconitum spicatum, etc*. The dwarf Rhododendron scrub is composed with *Rhododendron lepidotum, and Rhododendron setosum*, forming an extensive mat of several hectares.

Plants Recorded From Thulo Pokhari And Their Catchments are as follows.

SN	*Scientific Name*	Nepali Name	Type	Locality
1	*Acer caudatum*	Phirphire	Tree	Dobate
2	*Aonogonum molle*	Thotne	Herb	Thulo Pokhari
3	*Arisaema jacquemontii*	Sarpamakai	Herb	Mumbuk
4	*Berberis angulosa*	Chutro	Shrub	Thulo Pokhari
5	*Bergenia purpurascens*	Pashanved	Herb	Thulo Pokhari
6	*Bergenia ciliate*	Pashanved	Herb	Deurali
7	*Betula alnoides*	Saur	Tree	Mumbuk
8	*Betula utilis*	Bhoj Patra	Tree	Mumbuk
9	*Bistorta affinis*	-	Herb	Thulo Pokhari
10	*Cassiope fastigiata*	Phursan	Shrub	Thulo Pokhari
11	*Clematis Montana*	Junge lahara	Climber	Deurali
12	*Cononeaster microphyllus*	Sano ghangaru	Shrub	Thulo Pokhari
13	*Daphne bholua*	Lokta	Shrub	Khongma
14	*Fragaria nubicola*	Bhuin Kafal	Herb	Thulo Pokhari
15	*Gaultheria pyroloides*	-	Shrub	Thulo Pokhari
16	*Gaultheria trichophylla*	-	Shrub	Thulo Pokhari

17	*Heracleum wallichii*	-	Herb	Thulo Pokhari
18	*Juniperus indica*	Dhupi	Shrub	Thulo Pokhari
19	*Juniperus recurva*	Dhupi	Shrub	Thulo Pokhari
20	*Lonicera angustifolia*	Ghangaru	Shrub	Thulo Pokhari
21	*Meconopsis grandis*	-	Herb	Thulo Pokhari
22	*Meconopsis paniculata*	-	Herb	Thulo Pokhari
23	*Potentilla fructicosa*	Bajradanti	Shrub	Thulo Pokhari
24	*Potentilla microphylla*	Bajradanti	Herb	Thulo Pokhari
25	*Potentilla penduncularis*	Bajradanti	Herb	Thulo Pokhari
26	*Primula atrodentata*	-	Herb	Thulo Pokhari
27	*Primula deuteronana*	-	Herb	Thulo Pokhari
28	*Rhododendron arboretum*	Laligurans	Tree	Deurali
29	*Rhododendron barbatum*	Cimal	Tree	Deurali
30	*Rhododendron campylocarpum*	Gurans	Tree	Deurali
31	*Rhododendron ciliatum*	Gurans	Shrub	Thulo Pokhari
32	*Rhododendron lanatum*	Gurans	Shrub	Thulo Pokhari
33	*Rhododendron lepidotum*	Bhale sunpate	Shrub	Thulo Pokhari
34	*Rhododendron lowndesii*	Sunpati	Shrub	Deurali
35	*Rhododendron setosum*	Jhuse sunpate	Shrub	Thulo Pokhari
36	*Rhododendron wightii*	Gurans	Shrub	Deurali
37	*Rosa sericea*	Bhote gulab	Shrub	Thulo Pokhari
38	*Sorbus cuspidate*	-	Shrub	Deurali
39	*Swertia chirayita*	Ciraita	Herb	Thulo Pokhari
40	*Valeriana jatamansi*	Sugandawal	Herb	Mumbuk
41	*Viburnum grandiflorum*	-	Shrub	Mumbuk

Source: Survey of Wetlands, 2019.

Fauna

Birds Sighting In And Around Thulo Pokhari

Previous studied showed that 421 bird species recorded in Makalu Barun National Park, 3 species of them are wetland birds and 26 species are wetland dependent bird. None of the wetland birds were observed during the survey because of snow cover. This site is habitat for migratory and residential birds and other wildlife species. Himalayan monal, *Lophophorus impejanus,* Olive-backed Pipit, *Anthus hodgsoni,* Blyth's Pipit, *Anthus godlewski* were observed directly in and around the Thulo Pokhari.

Other Wildlife

Pika, *Ochotona* spp. was common in the rocky areas of this valley. The south aspect of the catchment is a habitat of musk deer, *Muschus chrysogaster*.

Socio-Culture Aspects of Thulo Pokhari

Cultural Use of Catchment by Local /Domestic And Other Users

The cultural and religious use is mainly celebrated during rainy season. People of all caste from different places visit this place while going to worship Shiva Dhara and Parbati Cave. Limited people visit Thulo Pokhari alone for religious purpose except Janaipurnima.

Fishery Production

Thulo Pokhari itself does not produce fish or fingerlings due to high altitude (4,030m) climatic condition. It has been said that frogs were observed by herders.

Forestry

Due to no public land and Buffer Zone in the Thulo Pokhari area, the Forestry use is limited to few locations for decoration, timber and fuel wood purpose in cattle shed and teashops.

Religious Importance
The religious importance of the site is high. Few hundreds of people having Hindu and Buddhist religion go to that place on rainy season during Janaipurnima. People worship to the Shiva Dhara, Parbati Cave, and Ama Phujung after worshiping Sano and Thulo Pokhari.

Archeological Sites
The archaeological study is yet to do for the area. Any excavation is not been recorded.

Social Relationship with Wetland
Nomads are dependent on the wetland in relation to drinking, grazing etc. Other people only visit this place during Janaipurnima. People of downstream depend on water for the domestic use.

Threats
This wetland lies on the trekking route to Makalu Base Camp, Mount Makalu, Baruntse Peak and Sherpini Col. Trekking and climbing tourists visit this place during March-May and September-October due to their spectacular landscape covered from almost all side by snow peaked mountains, unique flora and fauna. There is a threat for creating environmental problems like fuel wood collection, overgrazing and unsustainable use of natural resources by the nomads and village people.

Over Use of Fuel Wood and NTFPs
Felling of Rhododendron trees for timber and fuelwood is prominent by herders. The high Himalayan plants are used by local communities for medicinal purpose to cure different ailments and are also collected for trade. There is a practice to collect the underground parts (root, rhizome and tuber) of several species before maturity. Such practices have been hampering the regeneration of the species.

Collection of NTFPs for the traditional use by porters and the visitors particularly while returning from the site has potential to impede for the conservation. In particular, collection of Yarsagumba, *Cordyceps sinensis* is practiced since long by people.

Poaching
Poaching of musk deer in the nearby forest was reported. But, teashop owners, local villagers and nomads denies of poaching any wildlife.

Pollution
The main sources of pollution around Thulo Pokhari are plastics and bottles. Sometimes, people bury them under the soil. **"Pack It In and Pack It Out"** policy has been effective for reduction of the refuse (including tins and cans) disposals along the routes to some extent.

Grazing
The alpine meadows around Thulo Pokhari have heavily grazed by cattle (Yak, Chauri, Sheep) during summer and rainy seasons. The grazing pressure reduced the palatable legume species and increased the colony of unpalatable (or toxic plants), leading to change in floral and faunal composition and disrupting the natural succession process. Human and cattle are polluting the quality of the water of Thulo Pokhari. Extensive areas are found with *Cassiope fastigiata* and *Rhododendron* species, which are the indicator of over grazing.

Conservation Measures Taken
Field visits by National Park personnel regularly. NTFPs use for domestic purpose and traditional use is permitted. Park authority takes care of conservation and management of the catchments area.

Assessment of Ramsar Criteria
As this area provides following criteria listed by Ramsar 2006, nominating this site by Government to declare as Ramsar site would provide further support in the conservation of this high altitude wetlands.

Criteria 1: Sites Containing Representative, Rare or unique wetland types
Thulo Pokhari area is a unique and representative wetland type in the high Himalayan Paleoartic biogeographical region. This is an important source of water for the Ishuwa Khola, later feed to Arun river basin of Nepal.

Criteria 2-4: Sites of International Importance for Conserving Biological Diversity
Criteria based on species and ecological communities

Criteria 2: Thulo Pokhari wetland (alpine meadows, streams) is a unique or critical habitat for a number of endemic, rare and vulnerable species of plants and animals. Important plant species in and around the Thulo Pokhari wetland *includeS Pedicularis pseudoregeliana, Carex himalaica, Kobresia fissiglumis, Ranunculus himalaicus* and *Ranunculus makaulensis.* Similarly, other rare, endangered and vulnerable species are *Dactylorhiza hatagiera, Bergenia purpurscens, Aconitum species,* and *Rheum australe.*

This site is important for the national bird Himalayan Monal. The lower section of the catchments is the prime habitat of musk deer and red panda. The upper part is a potential habitat of endangered Snow Leopard, *Uncia uncia*.

The area provides endemic plant and potential for the nomination of the Ramsar Site. The conservation problem of over grazing, clearing Forest for extending grazing lands, excessive use of fuel wood and garbage is degrading the quality of wetland and the catchments.

All these criteria's and mounting pressure suggests the immediate need to prepare a detailed action plan and its inclusion in the Ramsar list of international important wetland site.

Activities Proposed by Local Communities

Informal meetings with some people from Tasigaun and Seduwa and other villages have been conducted. Recommendations made by the discussion with the people during the survey are as follows:

Cultural Conservation

- Locals should use their traditional grazing rights of the area after declaring the area as Ramsar Site.

Pollution Control

- Proper disposal of garbage should be done particularly plastics and bottles by the companies and travel agencies who organize trekking and expedition to this area to avoid the pollution.

Conservation and Management

- The proposed Ramsar site for Thulo Pokhari area is highly recommended and that should also focus to conserve the natural, rare and endemic wildlife and plant life by avoiding pressure due to grazing, use of natural resources and tourism.

Physical Infrastructure Development

- There is a high demand for the physical infrastructure development to provide facilities for the foreign and domestic tourist such as the construction and installation of emergency safety shelters, trail markers and improvements of trails and bridges.

Tourism

- This area is very attractive for tourism, trekking and mountaineering because of its landscape, beautiful lakes, rich flora and fauna and white capped mountains. In addition, this is a point of the trekking route to the Makalu base camp.

4.2.2 Barun Pokhari and Associated Wetlands

Physical Feature

Location

These lakes and their catchments lie in between 27° 50' 37" Latitude and 87° 05' 0'' Longitude. The altitude ranges between 4400m to 4680m in Higher Himalayan zone.

Barun Wetland

The Barun wetland is glacial originated alpine fresh water river and is oligotrophic in nutrient content. The main wetlands are Barun and Lower Barun Pokhari. Barun Lake system forms headwater of Barun River, one of the main tributary to the Arun River. The Barun River joins with Arun River at Barun Dovan of Sankhuwasabha district. Barun River starts at Makalu Barun National Park and ends also at Makalu Barun National Park. The other important lakes of the Barun series are Lower Barun, Rampuchho and one unnamed lake near Base Camp. Lower Barun glacial lake at the toe of Lower Barun glacier is one of the potentially dangerous lakes in Nepal.

List of lakes in Barun Pokhari Area of Makalu - Barun National Park

Lake Name	Elevation (m)	Latitude	Longitude
Barun Pokhari	4680	27° 50' 37"	87° 05'0''
Lower Barun	4570	27° 48' 0''	87° 07' 0''
Rampuchho	4400	27° 48' 09"	87° 08' 0''
Unnamed near Base camp	4500	27° 49' 41"	87° 04' 17"

Boundary of Barun Wetland

Barun Pokhari is surrounded by Mount Makalu on the North, Nepau Peak on the south and Chhyanma-Lengmo Peak on the west and south east flank of Makalu and ridges on the East.

Access

It takes 45-50 minutes by plane from Kathmandu to Tumlingtar. It takes about 4 hours drive to Num Bazar. Normal walking from Num takes 6 camps to reach Barun Pokhari which is at Makalu Base Camp. The camp would be at Seduwa, Tashigoan, Khongma (3500m), Mumbuk (3400m), Yangle (3540m), Langmale (4000m) and Makalu Base Camp. There is a possibility of meeting local herders and tourism operator along the trail during the summer. There is an alternative trail to reach Barun Pokhari via Solukhumbu by crossing Sherpeni Col.

Geology, Geomorphology and Topography

The secondary study shows that the Barun Pokhari lies in the higher crystalline group. The Main Central Thrust (MCT) separates lesser Himalaya with higher crystalline rocks of this Nappe are separated from the underlying garnet-biotite grade metamorphic rocks of the lesser Himalayan tectonic unit by the main central thrust. The rocks of the catchment including lake are predominantly of gneiss followed by mica schist, calc-silicate gneiss, migmatite, marble and quartzite.

Geographically, this zone is colluvial and morinal deposited surface, composed of various kinds of gneisses that forms the basement of the Tibetan-Tethys-Sedimentary

sequence and consists of high-grade metamorphic rocks that include various kinds of gneisses, schists and migmatites. Although, traditionally these rock units were thought to be very old rocks of the Indian shield forming the basement for the Tethyan as well as lesser Himalayan rocks, recent studies have shown that they are much younger rocks of the Neoproterozoic age, about 800 to 500 million years old.

Soil Type

The texture of the soil of Barun Pokhari is sandy loam (34.7% sand, 49.6% loam and 7.7% clay). The pH is 6.6, Organic matter content 0.103%, Nitrogen content is 0.013%, Phosphorus (P205 kg/ha) is 31.8 and Potash (k_{20} kg/ha) is 80.6 (Karki, J.; Adhikari, K, 2018)

Origin

The Lakes around Barun series are glacial in origin from the Baruntse Peak, Mount Makalu, and Nepau Peak etc, which are the main source of water.

Down-Stream Area

The downstream area of the Barun Pokhari lies inside the Makalu Barun National Park and its Buffer Zone. The main source of Barun River is Baruntse, Makalu, Nepau glaciers. The sources of water come from the Baruntse glacier and Makalu glaciers which forms the Barun Pokhari. Water from the Nepau glaciers forms lower Barun and mix with the Barun River near to the Langmale Kharka. Before meeting with the Nepau glacier, the Barun River travels along the Barun valley. Discharged water from the Rampuchho Lake joins with the Barun River at the Langmale Kharka. Later, Barun River mixes with Arun at Barun Dovan. The water is rarely used by human however; it is highly used at downstream for hydropower resources and other domestic purposes. Thus the clean, unpolluted and regular supply of water downstream from Barun Pokhari has high significance not only for the local communities of nearby villages but also to the downstream people.

General Climate

The general climate is pronounced winter with about sub – zero temperature. The Lakes are frozen for about 6 months in winter. The summer is mild with pronounced rain from June to September. The rest of the months are cold and are best for grazing, tourism and conservation activities.

Land tenure, Ownership and Jurisdiction

The area falls under the ownership of Makalu Barun National Park. The Ministry of Forest and Environment is the legal authority. The Park is governed by the National Parks and Wildlife Conservation Act 2029 BS (1973) and Himali Rastriya Nikunja Niyamawali 2036 BS (Mountain National Parks Regulation 1979). Grazing is allowed to the local people of the Buffer Zone.

Current Land Use Practice

Most of the areas are composed of rock and alpine rangeland. Nomads from nearby villages like Tashigaun, Nawagaun, and Norbugaun etc. take their cattle for grazing. Collecting timber and non-timber Forest products are banned for commercial use except for local people through the permission of the chief conservation officer of Makalu Barun National Park.

Hydrological Features

Water discharge

The discharge in outlet is 1.713 m^3/second (Karki, J., Adhikari, K, .2018) from Barun Pokhari to Barun River.

Upstream

The water comes from the glaciers of Baruntse, Makalu to the Barun Pokhari and directly goes to the Barun River. There is no other use of the upstream.

Water Depth

It is assumed that average depth of the Barun Pokhari is 40 m but it is not measured.

Water Permanence

The melting of ice after winter increases the volume of water. The other main source of water is glaciers that increase the water level

Fluctuation in Water Level

The level of water is high in rain and after melting of ice. The water quantity is low during the winter when ice is frozen.

Source and Link With Ground Water

The source of the water is mainly the glaciers in the form of water during winter. The Lakes receive water from the melting of glaciers. Glaciers of the Baruntse, Makalu, and Nepau Peaks are the main source of water.

Limnology

Colour is clear white. The P^H of Barun Pokhari is low as per the WHO guideline value. Bacteriologically, the sample is unsatisfactory for drinking purpose. The following table shows the details of the test of the water sample collected from the outlet of Barun Pokhari (Karki, J.; Adhikari, K., 2018).

Parameters	Unit	WHOGV	Barun Pokhari	Instruments/Method used
PHYSICAL				
Turbidity	NTU	5	19.0	Turbidity Meter
Suspended Solids	Mg/l		12.0	Gravimetric
CHEMICAL				
P^H		6.5 - 8.5	6.4	pH Meter
Total Alkalinity	Mg/l as $CaCo_3$	500	10.0	Titrimetric
Acidity	Mg/l as $CaCo_3$		<2.0	Titrimetric
Chloride	Mg/l	250	3.4	Argentometric Titration
Total Phosphate	Mg/l		<0.01	UV-VIS Spectrophotometer
Total Kjeldhal Nitrogen	Mg/l as $CaCo_3$		<0.5	Macro Kjedhal Method
BIOCHEMICAL				
BOD	Mg/l	100	27.4	Azid Modification
BIOLOGICAL				
Coliforms	MPN/100ml	Nil	9	MPN Tube

Source: Karki, J.; Adhikari, K., 2018.

Pilgrims

People mainly visit to worship Thulo Pokhari and move towards Shiva Dhara, Parbati cave and Amaphujung. Later on, some of them visit to the Barun Pokhari during July-August, especially around Janaipurnima festival. As per the local shepherds, about 100-150 people visit Barun Pokhari area from different places. The low number of religious people visiting Barun Pokhari is mainly due to the high altitude, remoteness, difficult access and unavailability of staying places and fuel wood.

However, the water of Barun is classified as one the sacred river because it consist the water from Shivadhara. Local people believed that the water is absolutely the Jal Mahadev, God of water.

Flora Of The Catchments

The bio-climate of this zone is the coldest and hottest month at January and July is about–10˚C and 17˚C respectively. The snow period lasts for 6-7 months in this Himalayan zone. This zone represents a treeless region with range land interspersed by rocky slopes. The vegetation is represented by Alpine pasture meadow and Dwarf *Rhododendron* scrub. The alpine pasture meadow is dominated by *Potentilla microphylla, Rhododendron lepidotum, Rhododendron anthopogon, Saussurea simpsoniana, Primula caveana, Bistorta affinis, Cassiope fastigiata, Ephedra gerardiana, Juniperus indica, Juniperus recurva* and many other species. Yak, Chauri, sheep and goat heavily graze the vegetation resulting reduced palatable grasses and promoted the growth of unpalatable plants. Vegetation of this area associates a number of medicinal and aromatic plants. The common medicinal plants are *Ephedra gerardiana, Potentilla microphylla, Swertia hookeri* and some species of *Aconitum*, etc. The dwarf *Rhododendron* scrub is composed with *Rhododendron lepidotum,* and *Rhododendron setosum*. It is also believed to be found *Pedicularis pseudoregeliana, Carex himalaica, Kobresia fissiglumis, Ranunculus himalaicus* and *Ranunculus makaulensis.*

List of Plants recorded from Barun Pokhari and its surrounding

SN	*Scientific Name*	Nepali Name	Type	Locality
1	*Abies spectabilis*	Talispatra	Tree	Yangle Kharka
2	*Androsace delavayi*	-	Herb	Base Camp
3	*Androsace tapete*	-	Herb	Base Camp

4	*Aonogonum molle*	Thotne	Herb	Yangle Kharka
5	*Arisaema jacquemontii*	Sarpamakai	Herb	Yangle Kharka
6	*Berberis erythroclada*	Cutro	Shrub	Base Camp
7	*Bergenia purpurascens*	Pasanved	Herb	Yangle Kharka
8	*Betula alnoides*	Saur	Tree	Yangle Kharka
9	*Betula utilis*	Bhoj Patra	Tree	Yangle Kharka
10	*Bistorta affinis*	-	Herb	Base Camp
11	*Cassiope fastigiata*	Phursan	Shrub	Base Camp
12	*Clematis montana*	Junge lahara	Climber	Yangle Kharka
13	*Cononeaster microphyllus*	Sano ghangaru	Shrub	Base Camp
14	*Ephedra gerardiana*	Somlata	Shrub	Base Camp
15	*Fragaria nubicola*	Bhuin Kafal	Herb	Yangle Kharka
16	*Gaultheria pyroloides*	-	Shrub	Base Camp
17	*Gaultheria trichophylla*	-	Shrub	Base Camp
18	*Gentiana depressa*	-	Herb	Base Camp
19	*Heracleum wallichii*	-	Herb	Yangle Kharka
20	*Juniperus indica*	Dhupi	Shrub	Base Camp
21	*Juniperus recurva*	Dhupi	Shrub	Base Camp
22	*Lonicera angustifolia*	Ghangaru	Shrub	Base Camp
23	*Meconopsis paniculata*	-	Herb	Yangle Kharka
24	*Potentilla fructicosa*	Bajradanti	Shrub	Jante
25	*Potentilla microphylla*	Bajradanti	Herb	Yangle Kharka
26	*Potentilla penduncularis*	Bajradanti	Herb	Yangle Kharka
27	*Primula atrodentata*	-	Herb	Yangle Kharka
28	*Primula cavaena*	-	Herb	Jack Kharka
29	*Primula deuteronana*	-	Herb	Yangle Kharka
30	*Rheum australe*	Padamchal	Herb	Yangle Kharka
31	*Rhododendron anthopogon*	Sunpati	Shrub	Base Camp
32	*Rhododendron camelliiflorum*	-	Shrub	Yangle Kharka
33	*Rhododendron ciliatum*	Gurans	Shrub	Base Camp
34	*Rhododendron hodgsonii*	-	Shrub	Yangle Kharka
35	*Rhododendron lepidotum*	Bhale sunpate	Shrub	Yangle Kharka
36	*Rhododendron nivale*	-	Shrub	Base Camp
37	*Rhododendron setosum*	Jhuse sunpate	Shrub	Base Camp
38	*Rhododendron thomsonii*	-	Shrub	Yangle Kharka
39	*Rhododendron wightii*	-	Shrub	Yangle Kharka
40	*Rosa sericea*	Bhote gulab	Shrub	Base Camp

41	*Rumex patentia*	-	Herb	Base Camp
42	*Salix calyculata*	-	Shrub	Base Camp
43	*Salix sikkimensis*	-	Shrub	Yangle Kharka
44	*Saussurea simpsoniana*	-	Herb	Base Camp
45	*Swertia hookeri*	Ciraita	Herb	Merek
46	*Usnea longissima*	Jhyau	Lichen	Yangle Kharka

Source: Survey of Wetlands, 2019.

Fauna

Birds Sighting In And Around Barun Pokhari

Wetland dependent species such as White-Capped River Redstart (*Phoenicurus leucocephalus*) was recorded along the Barun River. Other bird species recorded in the catchments and along the trail is listed below.

This site is habitat for migratory and residential birds and other wildlife species. The following birds have been recorded in and around the Barun Pokhari.

Common Name	Scientific Name	Most of the sighting areas
Himalayan Snowcock	*Tetraogallus himalayensis*	Base camp
Tibetan Partridge	*Perdix hodgsoniae*	Base camp
Himalayan Monal	*Lophophorus impejanus*	Yangle-Merek
White-capped Water Redstart	*Chaimarrornis leucocephalus*	Barun River
Olive-backed Pipit	*Anthus hodgsoni*	Merek
Blyth's Pipit	*Anthus godlewskii*	Jack Kharka

Source: Survey of Wetlands, 2019.

Wild Animal

Pika, *Ochotona* spp. is common in the rocky areas of this valley. Similarly, other small mammals in this area are *Soriculus nigrescens, Alticola stoliczkanus, Soriculus caudatus, Pitymus sikimensis, Niviventer eha*, *Rattus eha*, *Alticola bhatanagari*, *Mustela crminea*. The south section of the catchment is a habitat of Musk deer, *Muschus chrysogaster*. The endangered Snow leopard, *Uncia uncia* is said to be found.

Socio-Cultural Aspect

Cultural Use Of Catchments By Local /Domestic and Other Users

The cultural and religious use is mainly celebrated during rainy season. People of all races from different places visit this place after worshiping Shiva Dhara and Parbati Cave.

Fishery Production

The Barun Pokhari itself does not produce fish or fingerlings due to high altitude (4,630m) climatic condition.

Forestry

Due to the core zone of national park, the Forestry use is limited to few locations for decoration, timber and fuel wood purpose in cattle shed and teashops however it is strictly prohibited by law.

Religious Importance

The religious importance of the site is high. Few hundreds of people having Hindu and Buddhist religion go to that place on rainy season during Janaipurnima. On the way, they worship to the Shiva Dhara, Parbati Cave, and Ama Phujung as well.

Archaeological Sites

The archaeological study is yet to do for the area. Any excavation is not been recorded.

Social Relationship With Wetland

Nomads are dependent on the wetland in relation to drinking, grazing of their cattle. Tea shops extensively use Barun water for tourism purpose.

Threats

This wetland lies on the trekking route to Makalu Base Camp, Mount Makalu, Baruntse Peak and Sherpini Col. Trekking and climbing tourists visit this place during March-May and September-October. Due to its spectacular landscape covered from almost all side by snow peaked mountains, unique flora and fauna, tourist used to visit for trekking and expedition resulting threat for creating environmental problems like fuel wood collection and rubbish disposal. Dump of external goods including expedition waste are also the major threat. Overgrazing and unsustainable use of natural resources by the nomads is also being faced.

Over Use of Fuel Wood And NTFPs

Felling of Silver Fir, *Abies* spp. trees for timber is prominent and observed. Collection of fuel wood from forest of Yangle Kharka and Jack Kharka is rampant. The high Himalayan plants are used by local communities for medicinal purpose to cure different ailments and are also collected for trade. There is practice to collect the underground parts (root, rhizome and tuber) of several species before maturity. Such practices have been hampering the regeneration of the species. Collection of NTFPs for the traditional use by porters and the visitors particularly while returning back. In particular, collection of Yarsagumba, *Cordyceps sinensis* is practiced also by the people of Buffer Zone.

Poaching

Poaching of musk deer in the nearby forest was reported previously. But, teashop owners, local villagers and nomads denies of poaching any wildlife however it is always threatening the species.

Pollution

The main sources of pollution above Barun Pokhari are plastics and bottles. Sometimes people bury them under the soil.

Grazing

The alpine meadows around Barun Pokhari have heavily grazed by cattle (Yak, Chauri, Sheep) during summer and rainy seasons. The grazing pressure reduced the palatable legume. Human and cattle pollutes the quality of the water.

Conservation Measures Taken

National park personnel visit the area frequently. NTFPs use for domestic purpose and traditional use is permitted. Park authority takes care of conservation and management of the catchments area.

Assessment of Ramsar Criteria

As this area provides following criteria listed by Ramsar 2006, nominating this site by government to declare as Ramsar Site would provide further support in the conservation of this high altitude wetlands.

Criteria 1: Sites Containing Representative, Rare or Unique Wetland Types

Barun Pokhari area is a unique and representative wetland type in the high Himalaya. This is an important source of water for the Barun river and then to the Arun sub-basin of Nepal.

Criteria 2-4: Sites of International Importance for Conserving Biological Diversity

Criteria based on species and ecological communities

Criteria 2: Barun Pokhari wetland (alpine meadows, streams) is a unique or critical habitat for a number of endemic, rare and vulnerable species of plants and animals. The endemic plant species in and around the Barun Pokhari wetland includes *Pedicularis pseudoregeliana, Carex himalaica, Kobresia, fissiglumis, Ranunculus himalaicus* and *Ranunculus makaulensis.* Similarly, rare, endangered and vulnerable species are some *Aconitum species, Rheum australe* etc.

This site is habitat for the national bird, Himalayan Monal. The lower section of the catchments is the prime habitat of Musk deer and Red panda while mid and upper part is the habitat of Snow leopard.

The area provides endemic plant and specific location criteria have to be potential for the nomination of the Ramsar Site. The conservation problem of over grazing, clearing Forest for extending grazing lands, encroachment by local tourism entrepreneurs, over use of fuel wood and timber, garbage is degrading the quality of wetland and the catchments.

Activities Proposed by Local Communities

Informal meetings with some people from Tasigaun, Seduwa and other places have been conducted. Recommendations made by the discussion with the people during the survey are as follows.

Cultural Conservation

- Locals should use their traditional grazing rights of the area after declaring the area as Ramsar Site.

Pollution Control

- Proper disposal of garbage should be done particularly plastics and bottles by the companies and travel agencies who organize trekking and expedition to this area to manage the pollution.

Conservation and Management

- The proposed Ramsar Site for Barun Pokhari area is highly recommended and that should also focus to conserve the natural, rare and endemic wildlife and plant life by avoiding pressure due to grazing, use of natural resources and tourism.

Physical Infrastructure Development

- There is a high demand for the physical infrastructure development to provide facilities for the foreign and internal tourist such as the construction and installation of emergency safety shelters, trail markers and improvements of trails/ bridges to minimize accidents among tourists, support staff and local users.

Tourism

- This area is very attractive for tourism, trekking and mountaineering because of having wonderful landscape, beautiful lakes, rich flora and fauna and Mount Makalu, Baruntse and Chamlang. In addition, this is a point of the trekking route to the Makalu base camp. However, the condition of the trail is not very good because of the unstable geological features. The teashops do not have adequate facility for lodging and toilet.

4.2.3 Panch Pokhari And Associated Wetlands

Physical Features

These lakes and its core area lie in between 27036'14.5" Latitude and 86050'53.3" Longitude (Hurhure) and 27037'02.3" Latitude and 86050'39.7" Longitude (Kholakharka). The altitude ranges varies between 4312m (Hurhure) to 4122m (Kholakharka).

Panch Pokhari, as its name suggests that it represents 5 lakes. These lakes are called Bau Pokhari (Father Lake), Ama Pokhari (Mother Lake), Chhora Pokhari (Son Lake), Buhari Pokhari (Daughter-in-law Lake) and Nati pokhari (Grand Son Lake). In local Kulung language, it is called Umpa Tiu, Umma Tiu, Unchha Tiu, Namne Tiu and Chasa Tiu respectively.

Positions of Lakes in Panch Pokhari

SN	Lake Name	Area, Ha	Elevation, m	Latitude	Longitude
1.	Bau Pokhari (Umpa Tiu)	3.50	4,190	$27^0$36'36.9"	$86^0$50'50.3"
2.	Ama Pokhari (Umma Tiu)	1.02	4,130	$27^0$36'40.8"	$86^0$50'46.6"
3.	Chhora pokhari (Unchha Tiu)	0.89	4,169	$27^0$36'41.8"	$86^0$50'49.5"
4.	Buhari Pokhari (Namne Tiu)	0.20	4,150	$27^0$36'43.1"	$86^0$50'44.7"
5.	Nati Pokhari (Chasa Tiu)	-	4,120	$27^0$36'42.1"	$86^0$50'34.6"

Source: Field Survey, MBNP, 2019.

Distance among these lakes (Meter) in Panch Pokhari

Lake/ Lake	Bau Pokhari	Ama Pokhari	Chhora Pokhari	Buhari Pokhari	Nati Pokhari
Bau Pokhari	-	70 m	30 m	120 m	435 m
Ama Pokhari	70 m	–	105 m	130 m	55 m
Chhora Pokhari	30m	105 m	-	90 m	406 m
Buhari Pokhari	244 m	130 m	90 m	—	270 m
Nati Pokhari	435 m	55 m	406 m	270 m	–

Source: Survey of Wetlands, 2019.

Boundary of Panch Pokhari

These five Lakes are surrounded by Konkeluchho hill on the north, Hurhure hill on the east, Hurhure ridge on the south and narrow pass with outlet which joins with Khola Kharka stream and finally drain to Inkhu River.

Access

Major Routes to be at Panch Pokhari are as Follows.

1. Phaplu- Bung- Panch Pokhari
2. Lukla- Chharakhor- Panch Pokhari
3. Kangel- Bung – Panch Pokhari
4. Tumlingtar – Salpa- Gudel- Bung- Panch Pokhari
5. At Phaplu, there is seasonal airstrip. It takes 1 day to reach at Bung (1723m) by Jeep. At Bung, there are several restaurants/ lodges. From Bung it takes 1 and half days for Panch Pokhari. The last permanent village is Khiraule (2595m) where lodges are available. Along the way, name of the places are Chharkhor (2927m), Chholemu (3480m). Chharakhor is recently developed temporary settlement with few restrooms. A small tea shop is available at Chholemu. There is a possibility of meeting local herders hut along the trail during summer and rainy season.
6. It takes about half an hour flight from Kathmandu to Lukla. From Lukla, it takes 2 days to be at Chharakhor. After staying at Chharakhor, it takes 1 day to be at Panch Pokhari.
7. At Kangel (Solukhumbu), there is an airstrip. It takes 2 days walk to Bung. After Bung, it takes 1 and half days to be at Panch Pokhari.

Bau Pokhari (Main)

Ama Pokhari (Mother Lake)

Chhora Pokhari (Son Lake)

Buhari Pokhari (Daughter-in-law Lake)

Nati Pokhari (Grandson Lake)

Nati Pokhari (Grandson Lake)

After Arriving at Tumlingtar from Kathmandu/Biratnagar, it takes 4 days to be at Bung. The route is along the edge of Arun River for couple of hour. Along the way, the name of places is Chewa Besi (458m), Kattike Ghat (465m). These 2 sites are at edge of Arun. On the way to Bung, other places are Gothe Bazar (750m), Dovane (1020m) and Salpa Phedi (1581m). These 3 sites are along the edge of Irkhuwa Khola (river) of Bhojpur district. Rest sites along the way are Jaubari (2313m), Guranse (2939m), Salpa cross (3440m), Sanam (2799m), Gudel (1990m). Simple hotels and tea shops are available along the route. After reaching at Bung, it takes 1 and half days to be at Panch Pokhari.

Geology, Geo-Morphology And Topography

This area is composed of four litho tectonic units of various periods. These include tertiary granite, Precambrian Himalayan gneisses, Precambrian to Devonian and Precambrian to Paleozoic.

The Himalayan gneiss occupies the major portion of study area. The rocks are hard, resistant and massive in nature. They include mica schist, micaceous quartzite, migmatites, augen gneiss, prophyroblastic gneiss and calc gneiss. It is estimated that this land is formed very recently about 500-800 million years ago and called younger mountains.

Soil Type

Three sample of soil were taken from Bau pokhari, Chhora pokhari and Buhari pokhari.

The pH ranged from 3.9-4.4, organic matter content ranged from 10-20%, total nitrogen 0.5-1.2%. The amount of phosphorus available to plant ranged from 51-82 (P2O5 kg/ha) and Potash 591-1209 (K2O kg/ha). Two of the three samples were sandy loam and one was sand.

Soil Analysis of Panch Pokhari Wetlands (Bau Pokhari, Chhora Pokhari and Buhari Pokhari)

Parameters	Bau pokhari	Chhora pokhari	Buhari pokhari
pH	4	4.4	3.9
Organic matter (OM)	10.34	12.41	20.42
Total nitrogen (%)	0.517	0.62	1.02
Phosphorus P_2O_5 kg/ha	51.3	56.4	82.04
Potash (K_2O kg/ha)	672	591	1209
Sand%	61.6	31.6	61.6
Loam %	31.1	41.1	31.1
Clay %	7.3	27.3	7.3
Texture	Sandy loam	Clay Loam/Loam	Sandy Loam

Source: Karki, J, ; Adhikari, K, 2018.

Origin

The lakes around Panch Pokhari series are glacial in origin from Konkeluchho peak and Hurhure peak which are the main source of water. But, there is no sign of glacier at present.

Down- Stream Area

The downstream area of these lakes lies inside Makalu Barun National Park and Buffer Zone. Drain of these all lakes mixed with Khola Kharka stream and later on it mix with Inkhu Khola which is one of the major tributary of Dudh Koshi. Due to the sharp terrain people are not able to harvest these lakes water for commercial purposes but because of the dense forested area, it is used by wildlife and birds.

General Climate

The sharply-rising elevation of high mountain ranges acts as the barrier to prevailing high altitude winds, a major climatic factor which influences the meso- and micro-climates of the area.

The lakes are frozen for about four months in winter. The summer is mild with heavy rain from June to mid- September about 4000 ml. The rest of the months are cold and people extract MAPs during rainy season.

Land Tenure, Ownership And Jurisdiction

The land is under control of Ministry of Forest and Environment. The area is located under the jurisdiction of Makalu Barun National Park. This park is governed by National Parks and Wildlife Conservation Act 2029 BS (1973) and Himali Rastriya Niyamawali 2036 (Mountain National Parks Regulation 1979). According to the Mountain National Parks Regulation 1979, local people are allowed to walk along the trail and have traditional right to establish temporary hut for foraging their livestock at pastureland.

Current Land Use Practice

These lakes and its surrounding are used for the following purposes.

A. Grazing: Local herders graze their cattle in this area traditionally. Three households are involved for grazing their cows and 2 household for sheep. Number of cows is about 40 and number of sheep is about 400. Ten years ago, there were 7 households involved to graze their cattle in this area. The number of cattle and households involved in this business are being decreasing.

B. Trail: Currently, Naulekh area of MBNP is emerging as best tourist destination. People of Mahakulung Rural municipality are transforming themselves as service provider for tourist. So, these local people use trail along the edge of these lakes.

C. Extraction of MAPs: Local people collect Medicinal Aromatic Plants from this site for their own personnel use. Major species that collected are Padamchal, Rheum australe, Panchaule, Dactylorhiza hatagirea, Pakhanved, Bergenia spp Maikopila, Saussrea tridactyla.

Hydrological Features

Water Discharge

SN	Lake	Inlet Cum/sec	Outlet Cum/sec	Remarks
1.	Bau Pokhari	0.0061	0.068	
2.	Ama Pokhari	0.068	Not seen	
3.	Chhora Pokhari	Not seen	0.0044	
4.	Buhari Pokhari	0.0044	0.04	
5.	Nati Pokhari	-	-	Not observed

Source: Karki, J; Adhikari, K, 2018

Upstream

The major source of water for these lakes is Konkeluchho peak and Hurhure peak. There are no signs of snow at present but during winter, one can observe snow in these peaks. Above all these lakes there is an elongated glacial lake called Pangre Pokhari. Part of this glacial lake feed Khola Kharka stream and other outlets are not observed. But people beliefs this lake feeds these all 5 Pokharies.

These all lakes including Pangre Pokhari are associated in chain. Bau Pokhari feeds Ama Pokhari. Nati Pokhari is located just below Ama Pokhari but outlet is not seen. Similarly, Chhora Pokhari feeds Buhari Pokhari.

Water Depth

1. Bau Pokhari: People beliefs are that the lakes average depth would be more that 20m.
2. Ama Pokhari: Its blackish color indicates that it is more than average depth of glacial lakes at Himalaya. Because of its color, people scare to go near to lake. Some people believed that evil elements are residing in this lake.
3. Chhora Pokhari: By observing directly, this lakes average depth would be 10-12m.
4. Buhari Pokhari: By observing directly, this lakes average depth would be 6-8m.
5. Nati Pokhari: By observing directly, this lakes average depth would be 2m.

Water Permanence

The melting of ice from Konkeluchho peak and Hurhure peak after winter is the permanent source of water. The other sources are rainfall.

Fluctuation in Water Level

Normally, the level of water increased from June to September. The water volume is low during winter when ice is frozen. It is experienced that volume of water is not increasing as previous. Pilgrims and frequent travelers argued that the volume of water is being decreasing, marked specially during rainy season.

Source and Link with Ground Water

The source of water is mountains. These Konkeluchho and Hurhure mountains feed these lakes by providing regular water. It is also believed that Pangre Pokhari (Glacial Lake) supply water to these lakes probably through underground source but it is observed directly.

Limnology

The pH of the water samples from the wetlands is low as per WHO guideline value. Bacteriologically, the sample is unsatisfactory for drinking purpose.

Laboratory Analysis of the Water from the four sites in Panch Pokhari

Parameters	Unit	WHO GV	Pokhari				Instruments/Methods used
			1	2	3	4	
Physical							
Turbidity	NTU	5	<1.0	<1.0	<1.0	<1.0	Turbidity meter
Total Suspended Solids			<1.0	<1.0	<1.0	<1.0	Gravimetric
Total Dissolved Solids		1000	6.0	5.0	6.0	7.0	Gravimetric
Temperature	^{0}C	-	20.3	19.0	19.3	22.8	Thermometer
Chemical							
pH		6.5-8.5	5.8	5.9	555.8	6.2	pH Meter
Acidity	mg/l as $CaCO_3$	500	<2.0	<2.0	<2.0	<2.0	Titrimetric
Total Alkalinity	mg/l as $CaCO_3$	500	12.0	12.0	10.0	14.0	Titrimetric
Chloride	mg/l	250	10.9	10.0	10.0	5.9	Argentometric Titration
Ammonia	mg/l	1.5	0.05	0.04	0.03	0.03	UV-VIS Spectrophotometer
Total Phosphate	mg/l		<0.01	<0.01	<0.01	<0.01	UV-VIS Spectrophotometer
Total Kjeldhal Nitrogen	mg/l		<0.5	<0.5	<0.5	<0.5	Macro Kjeldhal
Potassium	mg/l as NO_2		0.38	0.41	0.51	0.58	Atomic Absorption spectrophotometer
Bio Chemical							
BOD	mg/l		7.2	7.8	7.4	7.6	Azide modification/5 days Incubation
Biological							
Coliforms	MPN/1000ml	Nil	1100+	1100+	1100+	1100+	MPN tube
WHOGV-World Health Organization Value, 2006 Update							

Source: Karki, j.; Adhikari, K. 2018.

Pilgrims

It is religious and cultural site for local people. Pilgrims visit these lakes thrice in a year in their own special days. These festivals and average number of pilgrims are as follows.

SN	Festival/Days	Pilgrim number	Arrivals add.
1.	Nagpanchami (Last week of July)	150-200	Mahakulung rural municipality of Solukhumbu and Dovane of Salpa Shilichho rural municipality of Bhojpur district.
2.	Janai Purnima (First week of August)	120-150	
3.	Mangsire Purnima (Udhauli) (First week of December)	50-70	

Flora

Panch Pokhari is representation of wetland of high Himalayan bio-geographical region. It is one of the Nepal's highest fresh water lake systems. It is an alpine fresh water oligotropic lake series with alpine meadows, lakes, ponds, streams which represents good example of high altitude Himalayan wetland.

The alpine region is represented by *Rhododendron* scrub, *Juniper* scrub and open pasture dominated by various species like, *Rhododendron anthopogon, Rhododendron lepidotum, Aconitum spicatum, Potentilla microphylla, Senacio species, Rhododendron species,Meconopsis species, Primula species, Bergenia purpurascens,Fritillaria chirsosa.* Other important plant species found in lake premises are *Carex himalaica, Ranunculus himalaicus*, *Aconitum spicatum, Bergenia ciliate, Ephedra gerardiana, Fritillaria cirrhosa, Meconopsis paniculata, Rheum austral.*

From the present study, altogether 32 plant species recorded from the study areas. Regarding the family, *Rosaceae* was found to be largest family with 4 species, followed by *Asteraceae, Ericaceae, Polygonaceae* and *Primulaceae* with 3 species each. Other thirteen families having 19 species of plants. Among the 32 species, 25 species was found in lake area whereas 29 species was found in catchment area. From the information gathered from the interview, 7 plants were found to use as medicine and 6 plants were used for the ritual purpose.

List of Plants Found at Panch Pokhari Surroundings

SN	Name	Family	Common Name	Lake	Catchment
1	*Aconitum spicatum*	Ranunculaceae	Bikh	√	√
2	*Anaphalis contorta*	Asteraceae	Pansan	√	√
3	*Androsace lehmannii*	Primulaceae	N/A	√	
4	*Bergenia ciliata*	Saxifragaceae	Pakhetnved	√	√
5	*Bistorta affinis*	Polygonaceae	N/A	√	√
6	*Bistorta amplexicaulis*	Polygonaceae	Raktrayaulo	√	√
7	*Carex himalaica**	Cyperaceae	N/A		√
8	*Cassiope fastigiata*	Ericaceae	Phursan	√	
9	*Corydalis spp*	Papaveraceae	N/A		√
10	*Ephedra gerardiana*	Gnetaceae	Somlata	√	√
11	*Fritillaria chirsosa*	Liliaceae	Kakoli		√
12	*Impatiens spp*	Balsaminaceae	N/A	√	√
13	*Juniperus recurva*	Cupressaceae	Dhupi	√	√
14	*Juncus himalensis*	Juncaceae	N/A	√	√
15	*Meconpsis paniculata*	Papaveraceae	Kyashar		√
16	*Parnassia spp*	Parnassiaceae	N/A	√	√
17	*Pedicularis scullyana*	Scrophulariaceae	N/A	√	√
18	*Pedicularis spp*	Scrophulariaceae	N/A	√	√
19	*Poa species*	Poaceae	N/A	√	√
20	*Potentialla spp*	Rosaceae	N/A	√	√
21	*Potentilla coriandrifolia*	Rosaceae	N/A	√	√
22	*Potentilla microphylla*	Rosaceae	N/A	√	
23	*Potentilla peduncularis*	Rosaceae	N/A		√
24	*Primula atsadentata*	Primulaceae	N/A	√	√
25	*Primula prupurea*	Primulaceae	N/A	√	√
26	*Rananculus himalaicus**	Ranunculaceae	N/A	√	√
27	*Rheum australe*	Polygonaceae	Padamchal	√	√
28	*Rhododendron anthopogan*	Ericaceae	Sunpati	√	√
29	*Rhododendron lepidotum*	Ericaceae	Bhale sunpati	√	√
30	*Senecio spp*	Asteraceae	Marcha		√
31	*unidenfied 1*	Asteraceae	N/A		√
32	*unidenfied 2*		N/A	√	√

Source: Survey of Wetlands, 2019.

Fauna

Birds Sighting In And Around Panch Pokhari

Five years ago, a couple of ducks were seen by a local people during rainy season. Along the way, Monal, *Satyr traogopon* and Blood pheasants were observed.

SN	Common name	Latin name	Area of sighting
1.	Robin Accentor	*Prunella rebeculoides*	Pokhari area
2.	White winged Redstart	*Phoenicurus erythrogaster*	Pokhari area
3.	Pink-browed Rosefinch	*Carpodacus rhodochrous*	Pokhari area
4.	Spot-winged Rosefinch	*Carpodacus rhodopeplus*	Pokhari area
5.	Yellow- billed Chough	*Spelaeornis chocolatinus*	Pokhari area
6.	Wren Babbler		Pokhari area
7.	Himalayan Monal	*Lophorous impejanus*	Pokhari area

Source: Survey of Wetlands, 2019.

Wildlife

At Lake site, we observe large eared Pika, *Ochotona macrotis*. Scat of Himalayan fox, *Vulpes* spp is seen. The area is suspected for Grey wolf, *Canis lupus* and Wild dog, *Cuon alpinus*. Local herder's argued that this area is the home of Snow leopard, *Uncia uncia*.

On the way to Panch Pokhari, there is habitat of Musk deer, *Moschus crysogaster* and Red panda, *Ailurus fulgens*. No signs of musk deer were found along the trail. On the way to Panch Pokhari, one can see Red panda.

Red panda at Panch Pokhari area

Socio- Culture Aspect

Cultural Use of Catchment by Local / Domestic and Other Users

The cultural and religious festivals are mainly celebrated three times in year. The lakes are considered as Basuki Nag (Water god) and People worship this lake from different races and ethnic groups. Four hundred pilgrims visit in this site in a year.

Fishery Production

Because of the frozen and semi- frozen climatic condition, this lake does not produce any fishes or fingerlings. No any productions are marked yet by lake.

Forestry

Though, the land is above tree line, but, herders collect the green shrubs of Rhododendron, *Rhododendron anthopopgan* illegally. People bring timbers from low land and constructing buildings at core area (Kholakharka). Herders bring fuel wood of woody Rhododendron from nearby land and process dairy products.

Religious Importance

Local people believed that this lake was created by god for the sake of people. Religious importance of lakes is categorized in two ways. One of them is considered as power source and the latter is considered as the giver.

Though there are five, but culturally, people worship only at Bau Pokhari (Father Lake).

A. Power Source

These lakes are used traditionally as the potwer source for local healers. These people have to be at lake at least once in three year to gain medicinal and healing power. They have been there by singing, dancing and chanting (Mundhum). After visiting lakes, they are considered the best healers in the village.

B. Giver

The lakes are considered as the donor. It is important for local people to achieve the desired objectives particularly cattle and crop wealth and descendant.

People offer cucumber, potato and pear for the well-being of descendant. They do offer maize and other crops for crop wealth and milk for cattle wealth. There is also tradition of soaking castles lash by this lakes water to upgrade the number of livestock. It is also marked that people pay coins to obtain more money.

Archaeological Sites

No any sign of archaeological sites were identified, though local people believed that once at a time king of Kulung were there and they develop this site as fort to protect the Kulung regime at Bung and Chheskam (The origin site of Kulung-Rai).

Social Relationship with Wetland

Herders are depending on the wetland in relation to drinking and grazing during rainy season. People of downstream depend on this water for the domestic use in negligible amount.

Threats/Issues

The major threats/ issues of Panch Pokhari sites are as follows:

1. Encroachment

Major issue of this lake is encroachment. Because of the increasing number tourist at Mera (Naulekh) region of MBNP, several houses are developed and few are in the process though it is illegal. They extract stones from this area to build house that induce the fragmentation of fragile Himalyan ecosystem.

Encroachment at Khola Kharka

2. Firing

Firing is the major threat to this area. Travelers and herders are blamed for firing in this fragile area. Species of *Rhodendron anthopogan* and other MAPs are burnt every year in pre- monsoon season.

3. Pollution

Pollution is another issue. Hoteliers are constructing their toilets at Khola Kharka stream. Similarly, at lakes several types of plastics, paper and rubbers are strewn. Sacrificed items by pilgrims are also seen elsewhere in lakes periphery.

4. Extraction of MAPs

Local people collect Medicinal Aromatic Plants (MAPs) for their domestic purposes. Recently, People start to extract MAPs e.g. *Rheum nobile, Rhododendron lepidotum, Bergenia* species and *Dactylorhiza hatagirea* for commercial purposes.

5. Grazing

Though numbers of cattle are being decreasing at field site, grazing system are not regularized and most of the shepherd erect their hut (Corral) at the core area of lake that ultimately persuaded pollution and weaken the fragile landscape.

Conservation Measures Taken

A. Regular Patrol

National Park personnel visits the park regularly. They frequently monitor the site. Issues and threats are raised at MBNP/BZMC meeting and resolve the problem.

B. Meeting With Stakeholders

Park authorities are carrying out the regular meeting with political parties and other stakeholders. Encroachment issues are being raised and MBNP is achieving success gradually.

C. Budget Allocation

On the basis of Buffer Zone Management regulation, BZMC is allocating budget for local people to aware about the conservation values. This trend is being started and authorities are hopeful for positive change gradually.

D. Assessment of Ramsar Criteria

This area provides following criteria listed by Ramsar 2006, nominating this site by government to declare as Ramsar Site would provide further support in the conservation of high altitude wetlands by preparing management plan in co-ordination with major stakeholders and political parties.

Criteria 1: Sites containing representatives, rare, unique wetland types

Panch Pokhari is a unique and representative wetland type in the high Himalayan Paleoartic biogeographical region.

Criteria 2: Panch Pokhari wetland (alpine meadows, streams) is a unique or critical habitat for a number of endemic rare and vulnerable species of plants and animals. The potential endemic plant species in and around Panch Pokhari wetland includes *Ranunculus makaluensis, Potentilla makaluensis, Swertia barunsis, impatiens arunensis, Pedicularis pseudoregeliana, carex himalaica, Kobresia fissiglumis, Ranunculus himalaicus*. Similarly, the site is the home of rare, endangered and vulnerable species *Dactylorhiza hatagiera*, *Bergenia* species, *Aconitum species, Rheum nobile, Gnetum montanum, Talauma hodgsonii.*

The site is important for the pheasants including Himalayan Monal, Tragopon, and Blood pheasant. Core area of Panch Pokhari is home to Snow leopard, wild dog and wolf. The lower belt of the catchments is the prime habitat of Musk deer, Red panda and Himalayan black bear.

Activities Proposed by Local Communities

Informal meetings with key stakeholders at Bung and Buffer Zone Management Committee (BZMC) of MBNP were conducted. Recommendations made by the discussion with the people are as follows for the long term sustainable conservation of Panch Pokhari.

A. Awareness Campaign

People asked to conduct awareness campaign at nearby villages immediately about the importance of wetland.

B. Manage The Conservation Issues And Threats

Identified threats and issues need to be resolved by MBNP thoroughly. The MBNP has to take the leading role for the conservation and restoration of fragile landscape and species. Local people and BZMC authorities have to coordinate with MBNP, political parties and administration for long term conservation.

C. Preparation of Management Plan

Local people suggest preparing a five year integrated management plan for the conservation and wise use of Panch Pokhari. It integrates planned physical infrastructure development, eco-tourism promotion and species / landscape conservation.

4.3. Other Important Lakes (Glacial/Non-glacial)

There are many lakes around MBNP. In Dudh Koshi sub-basin, several significant glacial lakes are existING followed by Arun Sub- basin within Koshi basin. It is assumed that almost 22% of glacial lakes are existing in these two sub-basin of Nepal. Glacial lakes and their area in the river basins and sub-basins of Nepal (Source: ICIMOD, 2011).

Basin	Sub-basin	Glacial Lakes				Meanarea Km²	Maxarea Km²	Minarea Km²
		Number	% of total	Area Km²	% of total			
Koshi	Tamor	209	14.26	6.584	10.16	0.032	0.615	0.001
	Arun	81	5.53	3.284	5.07	0.041	1.122	0.002
	DudhKoshi	243	16.58	13.207	20.39	0.054	0.943	0.002
	Likhu	13	0.89	0.312	0.48	0.024	0.082	0.003
	TamaKoshi	24	1.64	2.156	3.33	0.090	1.452	0.003
	SunKoshi	17	1.16	0.306	0.47	0.018	0.061	0.004
	Indrawati	12	0.82	0.109	0.17	0.009	0.024	0.003
	Basintotal	599	40.86	25.958	40.07	0.043	1.452	0.001
Gandaki	Trishuli	50	3.41	1.678	2.59	0.034	0.181	0.003
	BudhiGandaki	12	0.82	0.709	1.09	0.059	0.250	0.002
	Marsyangdi	22	1.50	5.158	7.96	0.234	3.322	0.003
	Seti	6	0.41	0.113	0.17	0.019	0.033	0.013
	KaliGandaki	26	1.77	1.880	2.90	0.072	0.670	0.003
	Basintotal	116	7.91	9.538	14.72	0.082	3.322	0.002
Karnali	Bheri	56	3.82	6.936	10.70	0.124	4.814	0.002
	Tila	73	4.98	3.576	5.52	0.049	0.434	0.003
	Mugu	218	14.87	5.020	7.75	0.023	0.382	0.002
	Humla	346	23.60	12.189	18.82	0.035	0.619	0.001
	Kawari	24	1.64	0.774	1.19	0.032	0.160	0.003
	WestSeti	25	1.71	0.652	1.00	0.026	0.298	0.002
	Basintotal	742	50.61	29.147	45.00	0.039	4.814	0.001
Mahakali	Mahakali	9	0.61	0.137	0.21	0.015	0.049	0.003
	Basintotal	9	0.61	0.137	0.21	0.015	0.049	0.003
Total		**1466**	**100**	**64.780**	**100**	**0.044**	**4.814**	**0.001**

Source: ICIMOD, 2011.

4.3. 1 Lower Barun Glacial Lake

Position 27^0 47'51 '' N 87^0 5' 26'' E Altitude 4550m

This glacial lake is identified as potential critical glacial lake and categorized I for GLOF. It indicates high priority lake demand extensive field investigation and mapping (ICIMOD, 2010). This study report identified 21 potentially critical lakes. Among them, 6 were classed as 1st category (high risk) and Lower Barun is one of them. Four are enlisted in category II and remaining 11 are enlisted in category III.

The growth of lower Barun glacial lake from the coalescence of small supra-glacial ponds (1960s) to a present day large pro-glacial lake (2017). Retreat of lower Barun glacier concurrent with the rapid growth of the pro-glacial lake area, which increased from 0.04 Km^2 to 1.8 Km^2, an average increase of 0.04 Km^2 per year. Imja Lake from Sagarmatha region was commonly considered to be the fastest growing lake in the region, however nowadays, it is identified that lower Barun has grown even more rapidly since 2000. The lake area grew by 34% from 2000 onwards. Now, the size of lower Barun is 2.7 Km x 660m approximately. Additionally, over the past three years, lower Barun lake has grown by 0.19 Km^2 reflecting accelerating growth. At the present, Lower Barun Lake is assumed to be the most voluminous and deepest glacial lake in the Nepal Himalaya. The volume of water is 112.3x 106 m^3 and maximum depth is 205m (Haritashya et. al., 2018). It consisting unstable outlet with numerous hazard triggers. Lower Barun is stored by a Meta stable ice cored moraine, which is subject to melting, gravitational collapse or buoyant flotation. Even if the moraine dams hold up, mass movements-debris flows, rock slope failures and avalanches - into the lakes can produce massive overtopping waves.

Lower Barun Lake

4.3.2 Dudh Pokhari

Dudh Pokhari lake (27^0 41'23'' N 86^0 51' 1'' E) is at Ingkhu valley and North East of Kothe (National park post) at 4765 m. Local people argued the possibility of outbreak of this lake. However, high cliffs and overhanging ice are separated from the lake by lateral moraine structures and we could expect it would block avalanches before they could reach the lake to some extent.

4.3.3 Andra Pokhari

Andra Pokhari is a series of melt water ponds within the Khahare and Ingkhu Shar glacier valley. It lies at 4800 m and nearby to Tama Pokhari (27°44' 42'' N 86° 52' 25'' E). This lake is believed to be stable because of less debris and not having over hanging ice.

Andra Pokhari

4.3.4 Chamlang South Pokhari

This Pokhari lies at 27° 45' 12'' N 86° 56' 52'' E at 4983m above sea level. As its name indicates that it is nearby to west side of Chamlang Mountain. It is considered as dangerous lake (Bajracharya et. al.2007) and local tourist entrepreneur also support argue. The lake is relatively big in compare with other associated lakes. Its size is assumed 1650 m X 550 m with maximum water depth is 87 m (Sawagakietal 2012).

Chamlang South Pokhari

4.3.5 Mera Glacier Lake

Position: 27°47' 22'' N 86° 54' 48'' E Altitude: 5266m

The name of this glacial lake was proposed by Alton Byers in 2009. It is classified as **"potentially dangerous"** by Bajracharya et al. (2007). Mera Glacier Lake appeared to be at lower risk of outburst because of its shallow depth (i.e., based on colour and the fact that it was already beginning to freeze in October), distance from the receding Mera glacier and lack of flood triggering mechanisms such as overhanging ice (Byers. et. al. 2013). However, it could be of concern if it continues to grow.

Mera Glacier Lake

4.3.6 Chamlang North Pokhari

Position

27^0 46 '35'' N 86^0 57' 6'' E Altitude: 5205m

This lake lies immediate to Chamlang Peak. The lakes deep green blue colour indicates its depth which contain huge amount of water. Its terminal is small and easily broken in the sudden surge, thus this lake need to be considered for further scientific and downstream impact analyses. Some authors indicate its unstable and risky lake (Byers et. al. 2013).

Chamlang North Pokhari

4.3.7 Hungu Lake

There are four glacial lakes in the Hungu valley floor. These all are above 5100m (5181-5483m). Because of not having hanging ice and direct connection to lakes with glaciers, these lakes are considered less risky however need to monitor regularly of its growth in the coming days.

Hungu Lake at centre of valley

4.3.8 Panch Pokhari

Position

$27^0$51 '22'' N 86^0 56' 21'' E Altitude: 5515m

There are two glacial lakes in the same height almost nearby to each other. One is relatively larger in comparison with next. The first one lack flood triggering content like overhanging ice and weak moraine dam however need to monitor regularly esp. in the rainy season. The next is small but seems very deep. Because of the immediate connection with glacier, it might be dangerous in the coming days.

Panch Pokhari Lake

4.4 Few Small Lakes of MBNP

Minor Lakes of MBNP/Buffer Zone

There are numerous small/minor ponds/lakes within MBNP and its Buffer Zone. Almost every pond nearby to settlement and pasture area consist cultural stories. These ponds stories are connected to the livelihood of local people especially about cattle rearing.

4.4.1. Maimatti Pokhari

This lake is existing at Bakang (3500m), lies in Tamku sector. Its seasonal lake and dry in summer. It is in Buffer Zone. It is important lake for herders to feed their cattle and for wildlife as well. Nearby to lake, several corals exist during rainy season. Because of the siltation, this lake is being shrinked.

4.4.2 Yekle Pokhari

This lake is at Core Zone of MBNP at 4200m. This lake is significant for herders/grazers. This Pokhari is on the way to Sankhuwa Sheer. In the rainy season, it drains to Apsuwa River.

Maimatti Pokhari

Yekle Pokhari (4200 m)

4.4.3 Tin Pokhari

This lake is on the way to Sankhuwa Sheer (top) at 4300m in the core zone of MBNP. It drains to Apsuwa River. It is nearby to high altitude pasture and many cattle utilize this Pokhari to drink water. Long ago, many sheep and Chauri were vanished regularly in this lake area. Herders believed

that a devil of this lake killing their cattle. After many incidents, herders call Lama (priest) to protect their cattle from evil elements. Then, Lama went to lake with her wife and using thunder power, he killed devil. After killing devil, they return back and stay at cave in the evening. In the midnight, Wife of lama (Lamini) was kidnapped by Sokpa (an imaginary human like giant creature believed to be stay in high altitude-also known as Yeti). Later, that cave was named Lamini Odhar. Cattles were not killed later by that demon but Lamini was missed forever.

Tin Pokhari

4.4.4. Kal Pokhari

It is on the top of Bala village at 4189m. It looks black in color from distance, so local people scare to look it. Like tin Pokhari, it also consist a tale. Once at a time, herders used to roam their cattle around this lake. Every season, they missed their sheep, cow and others. Herders thought that there would be a demon at Lake. They call *Charmop* (Priest of Rai people) to resolve the issue. Then *Charmop* had been there with their team at lake. *Charmop* ordered their team to chant regularly till his arrival from lake. He also informed that if they saw the milk in lake then he able to killed demon and if they saw the red blood in lake, then demon killed priest. *Charmop* enter into the lake. After few minute, *Charmop* able to caught a devil like horny male buffalo and dragged outside from lake. By seeing this, other team member frightened and ran away instead of continue chanting. Then, demon able to drag *Charmop* into the water and till now, no one knows about him. Still, people scare with this lake.

Kal Pokhari

4.4.5 Neuriri Pokhari

This lake is in Buffer Zone of MBNP at 2743m. It is nearby to settlement and local people frequently used to go there because of its religious and cultural importance. They do believe the site as second Haleshi religious center. The lake surrounding possesses Rhododendron and Michelia Forest. Neuriri denotes dizziness in Kulung language. People felt dizziness when they reach there and it is believed that it drags people towards lake. Till now, people afraid to go there alone. There are several folk tales about this lake. Long ago, a people saw that lake was dragging six cattle of one Lama. He was priest and immediately he broke lake into three parts and protects cattle using his super power. Nowadays, there are two other small lakes exist believed to be broken by priest. Nowadays people establish several small temples and offer wine, clothes, Trishul and fruits regularly to minimize the risk.

4.4.6 Ahal Danda Pokhari (Harelo Pokhari)

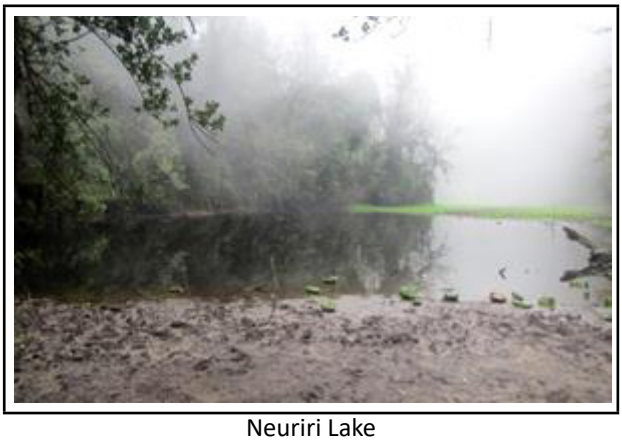
Position: 0530390 N 3050867 E Altitude: 1575m

This lake is nearby to settlement. Local cattle used to drink water in this pond. However, this lake is small but it never dries. Rainfall is only the source of this water.

Once in a year, Tuesday after Teej festival, people gather here from different villages. About 500 people visit this occasion. Long ago, there was practice of exchanging goods and sell in every 15 days but because of quarreling among villages, it is now stopped.

The area is now being developed as recreation center where people enjoy and view different panoramic mountains.

Aahal Danda Pokhari



Neuriri Lake

4.4.7 Popti/Molung Pokhari

Position 502723 N 3077757 E Altitude 4160m

This lake is situated at Buffer Zone of Hatiya sector. The land is habitat of musk deer. Poaching is severe issue of this land and sometimes, people observed even Tibetan poachers. it is pastureland and many herders used this area during rainy season.

Popti Pokhari

4.5 Glacial Lake Outburst Flood (GLOF)

Most of the perennial rivers in Nepal originate from the high Himalayas and they are fed in large amounts by melt water of snow and glacier ice. Snow and glaciers are important water resources in Nepal. While liquid precipitation is directly discharged through a river in a relatively short period, solid precipitation accumulates on the ground and melts gradually. The melt water from snow and ice contribute significantly to the sustained base flow of mountain areas throughout the dry period of the year. The sustained base flow is important for water resources planning and management.

A glacier lake outburst flood is one of the major natural hazards in Nepal. Most of the glacier lakes in Nepal are embanked by a moraine formed in the previous neo-glaciation period. The moraine dam structure is often not consolidated and unstable. The breach of a moraine dam and the catastrophic outflow of the lake create serious problems for the infrastructure, in addition to the inhabitants in the downstream area.

Since the early 1960s, hundreds of new glacial lakes have formed in the Nepal Himalaya as a result of warming trends and glacial retreat which suddenly releases the stored water. Triggering mechanisms, most often ice avalanches entering the lake can create a surge wave that breaches the unconsolidated terminal moraine dam. Other potential trigger mechanisms includes displacement waves from rock falls, moraine failure due to dam settlement and/or piping, the degradation of an ice-cored moraine, seismic activity or the rapid input of water from extreme events or from an outburst flood from a glacial lake located upstream (Rounce et al. 2017). 24 known glacial lake outburst flood events had been recorded for Nepal (ICIMOD 2011). At least five additional five GLOF or glacier-related floods have been reported since that time, i.e., the Seti Koshi (river) flood of May 5, 2012, the Langmoche lake flood of April 25, 2015 (Byers et al. 2017), the Lhotse glacier outburst floods of 2015 and 2016 and the April 20, 2017 Langmale glacial lake flood which was happened in Makalu Barun National Park.

4.5.1 Langmale Glacial Lake Flood (Barun Flood)

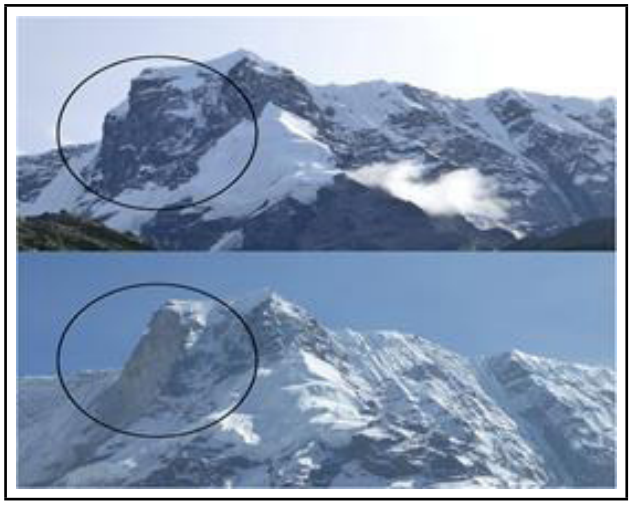
On April 20, 2017 a flood from the Barun River, Makalu Barun National Park of eastern Nepal formed about 2 Km long and 500m wide lake at its confluence with the Arun River as a result of blockage by debris at Barun confluence (Dovan). Fortunately, the lake drained spontaneously on April 21, 2017, less than 24h after it formed. It caused nationwide concern and triggered emergency responses. The primary flood trigger as a massive rock fall from the northwest face of Saldim peak (6388m) which fell approximately 570m down to a small glacial lake above Langmale glacial lake. The impact precipitated an avalanche, carrying blocks of rock and ice up to 5 m in diameter that fallen further 630m down into Langmale glacial lake, triggering a Glacial Lake Outburst Flood. The flood carved steep canyons and deposited sediment, debris, and boulders throughout much of the river channel from Langmale to Yangle Kharka about 6.5 Km downstream. Peak discharge was estimated at 4400 ± 1800 m^3 and total flood volume was estimated at 1.3×10^6 m^3 of water (Byers et. al. 2018).

The rock fall was not actually witnessed by anyone, partly because of the heavy fog that covered Saldim Peak that day however hotel owners and few tourists were there but associated sounds were heard and/or felt by numerous informants with a huge cloud of dust.

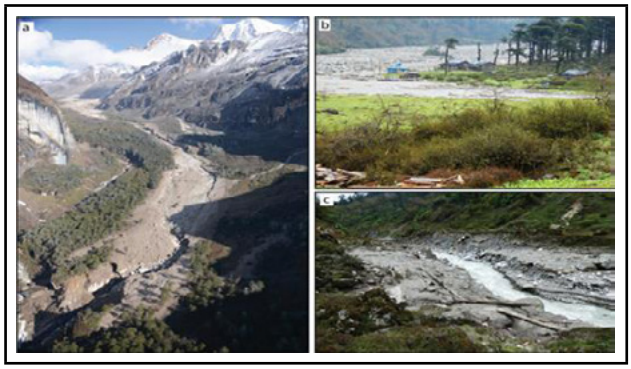
Debris had dammed the flood waters directly above the village of Barun Bazar, which displaced 10 families from their homes, destroyed fields, and threatened to impact at least 80 families living within the immediate area in the event that the dam suddenly failed (Shakya 2017). The lake also threatened downstream villages that included Phaksinda, Chewabesi, Tumningtar and other riverside communities in Bhojpur and Dhankuta districts as well as construction activities of the Arun Third hydropower project.

Fortunately, no one in either the Barun or Arun basins was killed or injured. Tourist lodges at Yangle Kharka and other sites including corals were destroyed which were constructed illegally. Similarly, the land suffered the loss of many hectares of valuable pastures because of flood deposits of coarse and debris. A numbers of wooden bridges were also washed away along the trekking route. forest of *Abies specatabilis* and other mixed forest were blown down. It is reported by this flood; at least 24 yaks and dozen yak-cattle cross- breed were washed away.

One dead body of Himalayan black bear, *Selenarctus thibetanus* was reported along the edge of Arun River at Chanuwa, Dhakuta after three days by local people. Similarly, huge amount of fishes were killed at Arun River in this flood. The impacts of Langmale flood are diverse. It impact on landscape beauty, biological diversity and cultural significance where local economies have been supplemented for decades by adventure tourists, pilgrims visiting sacred sites.



Before (upper) and after (lower) photographs of the large rock face that collapsed on April 20, 2017. Photo Alton Byers



a. The flood path b. Yangle Kharka immediate after flood
c. narrowed flood channel below Yangle Kharka

Lesson Learned By This Flood

Langmale GLOF experience demonstrates the need to conduct field-based GLOF analyses as soon as possible after the event; otherwise, valuable evidence may be lost and the complexity of the event misunderstood or misinterpreted. Clues to the sequence of triggering events and impacts, such as high water marks, air-borne deposits, blocks of ice within the remaining and drained lake bed, flood deposits, and eyewitness information.

Old flood marks, even aged stands of fir trees, *Abies spectabilis* in the riparian zone suggests that there have been at least two GLOF events in the Barun valley over the past 100 years, possibly more (Byersetal 2014). Thus, we should consider the GLOF is regular phenomenon.

Every glacial lakes or snow fed lakes that are dammed by moraine soils are under threat. Till now, it is considered that only 1 hectare and more than this size lake were classified as very high risk (Rounceetal 2017). In the case of Langmale Lake, it becomes exception. Thus, we should not ignore the small lakes, particularly at Makalu Barun National Park.

Increase in GLOF frequencies can be expected during then ex-decade because of retreating glaciers. New adaptive measures will be required in order to minimize the damage and loss of life that these floods may reproduce. Restricting to set up permanent tourist lodge along the Barun catchment area is crucial to mitigate the damage.

Major infrastructure initiatives such as large hydropower projects, need to recognize and plan for these events, which to date has been absent from most hydropower feasibility studies in Nepal. Likewise, risk awareness, disaster management and early warning system training is crucial for local people of down streams of high mountain glaciated landscapes.

Trekking tourism may experience temporary adverse impacts while lodges, trails, and bridges are rebuilt. Based upon observations of the climatically similar GLOF from the Tama Pokhari glacial lake in 1998, it will take about 15 years for the scoured boulders and river banks of the Barun riparian zone to re-establish pioneer vegetation such as mosses, which in turn will allow for the establishment of fir, birch, rhododendron, and other seedlings (Lamsal et al. 2015).

4.5.2 Tama Glacial Lake Outburst Flood

This lake was burst and it was triggered when an ice avalanche hit the front Alake and induced a surge wave which overtopped the end moraine dam. The incident was happened on 3 September 1998. Few people were lost and worth of NRs 156 million damage was incurred in down streams (Dwivedi et. al. 1999). At Thangnak area, immediately to the origin of flood, two illegally structured tourist hotels were washed away. In the down streams, two people were killed and two suspension bridges were destroyed.

The flood started at 5:00 a.m. and continued for 20 hours local people argued that they heard aloud noise and saw a huge white cloud from the ice avalanche and it exists about 20 hour. They also remember that there was a smell like gun powder in the air.

It is assumed that the terminal moraine was dismembered by the flood through which a large amount of the lake water was discharged. Scientist claimed that the water level lowered by 50- 60m from the original lake level after flood.

Local people argued that this lake has been grown gently by observing the level of water. However, it needs to be monitored regularly. It might happen because of retreating glacier. Once more, if avalanche occurred, then surge will not be blocked by lateral moraines.

This photograph was cached by LG Sherpa on 3 September 1998 from Thangnak of GLOF

Photograph of Tama Pokhari after 17 years of flood
Photo: Lakpad Rai, MBNP

5. Conclusions And Recommendations

On the basis of survey within Makalu Barun National Park and its Buffer Zone about wetlands and its conservation issue, following conclusions and recommendations are made.

5.1 Conclusions

A. There are about 121 glacial and other lakes, major 8 river systems, numerous glaciers and stream, cloud forest inside MBNP and these all natural source of water providing permanent water to downstream in vast amount. Makalu Barun National Park is probably the highest natural water producing protected areas in Nepal.

B. In Arun Sub-basin, there are major 5 river systems. These are Barun, Kasuwa, Ishuwa, Apsuwa and Sankhuwa. These rivers cover almost 1332.8 Km^2 Similarly, in Dudh Koshi Sub-basin, there are major three river systems and they are Hongu, Inkhu and Dudh koshi. There rivers cover almost 2602.81 Km^2. Among these, the longest river is Dudh Koshi and the shortest is Kasuwa. Among these rivers, the most sacred river is Barun which originates from Makalu massif and it is the only river that ends to park area.

C. Among these rivers, highest percentage of land occupied between 5000-6000m is Dudh Koshi, Inkhu and Barun. Similarly, highest percentages of land occupied between 4000-5000m are Apsuwa and Ishuwa and highest percentage of land occupied between 2000-3000m are Kasuwa, Sankhuwa and Hungu.

D. Most of the lakes are found 4000-5000m altitude. Study team don't found any lake above 5500m glacial lakes are changing their size from time to time. The cause of changing size is retreating glaciers, outburst, rock fall, avalanche etc. Similarly, lower elevations lakes are also dynamic based on season.

E. Lower elevation lakes are culturally important. These lakes are fond of tales. These tales are directly connected with livestoch husbandary, super power of ancient priest, evil elements etc. These lakes are also worshipped by local people and offer various goods accordingly. Among these lakes, three of them are highly prioritized for ecological study. These three lakes are also emphasized to nominate for nationally important wetlands. These lakes are Thulo Pokhari and associates, Barun Pokhari and associates and Panch Pokhari and associates.

F. Thulo Pokhari and associate lakes comprises four lakes. Its area is 16.16 ha. The lakes are from 4020m to 4389m. It feed Ishuwa Khola. The texture of Thulo Pokhari is sand (60%), silt (33%) and clay (7%). It is glacial in origin. The area falls in Makalu Barun National Park. The discharge of Thulo Pokhari is 0.355 m^3/second in May. Becaue of livestock rearing practice and tourism activities, the water contains coliform. Number of flora and fauna exist in its premises including endemic plants. The land is the habitat of Musk deer and Snow leopard. Tourism related environmental problems, encroachment, fuelwood collection, over grazing and sometimes poaching are the major threats to these associate lakes.

G. Barun Pokhari and associate wetlands comprise four lakes. The lakes are from 4400 m to 4680 m. It drains into Barun River. Barun is sacred river which consist the water from Shivadhara. The texture of Barun Pokhari is loamy (50%), sand (35%) and clay (15%). It is glacial in origin. The area falls in Makalu Barun National Park. The discharge of Barun Pokhari is 1.713 m^3/sec May. Because of livestock rearing practice and tourism activities, the water contains coliform. A number of flora and fauna

exist in its premises including endemic plants. The land is the habitat of Snow leopard. Tourism related environmental problems, encroachment, fuelwood collection, over grazing are the major threats to these associate lakes.

H. Panch Pokhari comprises five lakes. The lakes are from 4120 m to 4190 m. It drains into Hungu River. The texture of Panch Pokhari is sand (62%), loam (31%) and clay (7%). It is glacial in origin. The area falls in Makalu Barun National Park. The discharge of Panch Pokhari is 0.068 m^3 /second in May. Because of livestock rearing practice and tourism activities, the water contains coliform. A number of flora and fauna exist in its premises including endemic plants. The land is the habitat of Snow leopard and Musk deer. Just below Panch Pokhari, Red panda can be observed. Encroachments, fuelwood collection, forest fire, extraction of NTFPs/MAPS, over grazing are the major threats to these associate lakes.

I. Makalu Barun faces numerous GLOFs. In April 20, 2017, Langmale GLOF was occurred. Long ago, in 3 September, 1998, Tama Pokhari was burst. Similarly, In Barun valley, numbers of GLOFs were occurred but their date and impact is not cleared yet. Lower Barun is spreading rapidly and it is now considered the dangerous lake. West Chamlang glacial lake is another dangerous lake and need to monitor regularly.

J. Langmale Lake was burst because of massive rock fall from Saldim peak. It accelerates avalanche and flood take shape. Illegally, constructed numbers of tourist hotels and wooden bridges were washed away. Livestock were also flooded. Patches of forest and pasture were collapsed. Downstream settlements were threatened.

K. Tama Pokhari was burst and triggering agent was ice avalanche. It is said that, it helps to develop wonderful valley in Naulekh however, it swept few illegally constructed tourist hotels and other liabilities. Local people claimed that lake is being increasing its size.

5.2 Recommendations

A. A detail study is required to assess the real amount of water, released by the river systems of MBNP. We should use modern technology to obtain the data and need to analyse using authentic software. Similarly, Cloud Forest of MBNP needs to be calculated. Contribution of Cloud Forest to supply water is neglected in Nepal. The time has come to study about the Cloud Forest and its contribution to environmental services.

B. Among several rivers, Barun River and its catchment need to be focussed to keep sacred forever. Cultural tourism need to be promoted at Shivadhara area. An ultra development infrastructures (eg. hydro power/ mega hotels) need to be be banned in this sacred area.

C. High altitude wetlands are source of perennial water however, they are also threatening the lives. MBNP should coordinate with department of hydrology and meteorology regularly to monitor the wetlands and to do actions accordingly to protect the land, life, infra structures of down streams. Now, the time has come to study extensively about Lower Barun and West Chamlang glacial lake and need to do action accordingly.

D. Low altitude wetlands are economically, ecological and culturally significant for community. These lakes are being degraded these days by siltation, pollution and other external factors. Encroachment is another severe issue. These lakes need to be protected in coordination with herders, users committee, Buffer Zone Community Forest User Groups and local government.

F. MBNP should prepare Resource Information Sheet (RIS) of Thulo Pokhari and associate lakes, Barun Pokhari and associate lakes and Panch Pokhari. To draw the attention of local government and local people for wetland conservation, these 3 lakes need to be enlisted in national priority lakes. Moreover, MBNP should proceed to enlist in Ramsar Site.

G. Succession process needs to be studied of Langmale GLOF, Tama GLOF and other small floods. MBNP should design where to construct tea shops within Makalu Barun National Park.

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अनुसूचीहरू

तालिका–१: निकुञ्ज कार्यालयमा कार्यभार सम्हाल्ने कार्यालय प्रमुखज्यूहरु

क्र.सं.	दर्जा	नाम, थर	सेवा अवधि	
			देखि	सम्म
१.	प्रमुख संरक्षण अधिकृत	श्री नारायण प्रसाद पौडेल		
२.	प्रमुख संरक्षण अधिकृत	श्री श्याम सुन्दर बजिमय		
३.	प्रमुख संरक्षण अधिकृत	श्री मेघ बहादुर पाण्डे		
४.	नि. प्रमुख संरक्षण अधिकृत	श्री मेघ नाथ काफ्ले	२०५६.९.३०	२०५८.११.८
५.	नि. प्रमुख संरक्षण अधिकृत	श्री निलाम्बर मिश्र	२०५९.५.२	२०६२.१.१३
६.	प्रमुख संरक्षण अधिकृत	श्री फणिन्द्र राज खरेल	२०६२.१.१४	२०६३.४.३०
७.	नि. प्रमुख संरक्षण अधिकृत	श्री युवराज रेग्मी	२०६३.५.१	२०६४.४.३०
८.	प्रमुख संरक्षण अधिकृत	श्री टिकाराम अधिकारी	२०६४.५.१	२०६५.८.१९
९.	प्रमुख संरक्षण अधिकृत	श्री युवराज रेग्मी	२०६५.८.२०	२०६६.३.९
१०.	प्रमुख संरक्षण अधिकृत	श्री गोपाल प्रकाश भट्टराई	२०६६.३.१०	२०६७.९.३०
११.	प्रमुख संरक्षण अधिकृत	श्री युवराज रेग्मी	२०६६.१०.१	२०६७.२.१४
१२.	प्रमुख संरक्षण अधिकृत	श्री निलाम्बर मिश्र	२०६७.३.१०	२०६९.६.२१
१३.	नि. प्रमुख संरक्षण अधिकृत	श्री ऋषि रानाभाट	२०६९.६.२२	२०७०.९.१५
१४.	नि. प्रमुख संरक्षण अधिकृत	श्री अणनाथ बराल	२०७०.९.१६	२०७१.५.१७
१५.	प्रमुख संरक्षण अधिकृत	श्री मनोज कुमार साह	२०७१.५.१८	२०७४.११.१२
१६.	नि. प्रमुख संरक्षण अधिकृत	श्री संजीव गुप्ता	२०७४.११.१४	२०७५.४.२४
१७.	नि. प्रमुख संरक्षण अधिकृत	श्री मनोज ऐर	२०७५.४.२४	२०७५.८.५
१८.	प्रमुख संरक्षण अधिकृत	श्री चन्द्र शेखर चौधरी	२०७५.८.५	२०७७.७.१
१९.	प्रमुख संरक्षण अधिकृत	श्री रामदेव चौधरी	२०७७.७.२	हालसम्म

तालिका–२: निकुञ्ज कार्यालयको स्वीकृत दरबन्दी

क्र.सं.	पद	श्रेणी	सेवा	समुह/ उपसमुह	स्वीकृत दरबन्दी संख्या	पदपुर्ति संख्या	खुद रिक्त संख्या	कैफियत
१	प्र.सं.अ.	रा.प.द्वि.(प्रा.)	वन	ने.पा.वा.ला.	१	१	०	
२	स.सं.अ.	रा.प.तृ.(प्रा.)	वन	ने.पा.वा.ला.	५	४	१	
३	रेञ्जर	रा.प.अनं.प्र.(प्रा.)	वन	ने.पा.वा.ला.	१०	७	३	
४	ना.सू.	रा.प.अनं.प्र.(अप्रा.)	प्रशा.	सामा.प्रशा.	१	०	१	
५	ना.सू.	रा.प.अनं.प्र.(अप्रा.)	न्याय	न्याय	१	०	१	
६	ले.पा.	रा.प.अनं.प्र.(अप्रा.)	प्रशा.	लेखा	१	१	०	
७	क.अ.	रा.प.अनं.प्र.(प्रा.)	विविध	विविध	१	०	१	
८	प.स्वा.प्रा.	रा.प.अनं.प्र.(प्रा.)	कृषि	भेटेरिनरी	१	०	१	
९	खरिदार	रा.प.अनं.द्वि.(अप्रा.)	प्रशा.	सामा.प्रशा.	१	०	१	
१०	ना.प्रा.स.	रा.प.अनं.द्वि.(प्रा.)	कृषि	कृषि प्रस	१	०	१	
११	सि.गे.स्का.	रा.प.अनं.द्वि.(प्रा.)	वन	ने.पा.वा.ला.	१५	९	६	
१२	गेमस्काउ६	श्रेणीबिहिन	वन	ने.पा.वा.ला.	४५	४०	५	
१३	ह.स.चा.	श्रेणीबिहिन	इन्जि.	मेकानिकल	१	१	०	करार
१४	का.स.	श्रेणीबिहिन	प्रशा.	सामा.प्रशा.	१	१	०	करार
	जम्मा				**८५**	**६४**	**२१**	

तालिका-३: निकुञ्ज कार्यालयमा हाल कार्यरत कर्मचारीहरुको विवरण

क्र.सं	कर्मचारीको नाम	पद	स्थायी/करार	सम्पर्क नं.
१	रामदेव चौधरी	प्रमुख संरक्षण अधिकृत	स्थायी	९८६५४०८२८९
२	बद्री बिनोद दाहाल	सहायक संरक्षण अधिकृत	स्थायी	९८४०९८३४३३
३	राम एकवाल दास	सहायक संरक्षण अधिकृत	स्थायी	९८४८४०६९३४
४	मनोज ऐर	सहायक संरक्षण अधिकृत	स्थायी	९८६५९०१४२४
५	मन्जित विष्ट	रेञ्जर	स्थायी	९८४००६२७२६
६	अजित पराजुली	रेञ्जर	स्थायी	९८४५२८६६८७
७	उपेन्द्र अधिकारी	रेञ्जर	स्थायी	९८५२०५२१४९
८	लाकपद राई	रेञ्जर	स्थायी	९८४२१०७७४१
९	हिमाल पाठक	रेञ्जर	स्थायी	९८४५४६०३१६
१०	जयकला राई	रेञ्जर	स्थायी	९८६१३११९९०
११	ईश्वरी प्रसाद महतो	रेञ्जर	स्थायी	९८४५१४१०३०
१२	जोहन ल्हामु शेर्पा	रेञ्जर	स्थायी	९८४६७२९१९१
१३	उपेन्द्र अधिकारी	लेखापाल	स्थायी	९८५२०५२१४९
१४	रिक्त	नायब सुब्बा	स्थायी	
१५	रिक्त	पशु.स्वा.प्रा.	स्थायी	
१६	रिक्त	खरिदार	स्थायी	
१७	कर्मठीले शेर्पा	सिनियर गेमस्काउट	स्थायी	९७४१३७९२२०
१८	जीवन बहादुर खड्का	सिनियर गेमस्काउट	स्थायी	९८६२१८३१९९
१९	विजय दास	सिनियर गेमस्काउट	स्थायी	९८१४८७६४३५
२०	पर्शुराम श्रेष्ठ	सिनियर गेमस्काउट	स्थायी	९८४२०७०९८०
२१	हरिशंकर न्यौपाने	सिनियर गेमस्काउट	स्थायी	९८४८३०५५५५
२२	हरिकला चोङबाङ	सिनियर गेमस्काउट	स्थायी	९८१७३९२२७६
२३	संजयकुमार यादव	सिनियर गेमस्काउट	स्थायी	९७४८६४९६०४
२४	प्रकाश बुढा	सिनियर गेमस्काउट	स्थायी	९८४८३६२६८९
२५	ठगबहादुर मगर	सिनियर गेमस्काउट	स्थायी	९८५२०५०९३४
२६	केशर बहादुर कार्की	गेमस्काउट	स्थायी	९८४२१२६४१५
२७	ललितबहादुर राई	गेमस्काउट	स्थायी	९७४१४३८६४१
२८	लुनाङ भोटे	गेमस्काउट	स्थायी	९७४२०६२४२३
२९	लाक्पाधर्चे भोटे	गेमस्काउट	स्थायी	९७४२०७५३६०
३०	हर्कबहादुर बि.क.	गेमस्काउट	स्थायी	९७४२०२१२२७
३१	थोमिक भोटे	गेमस्काउट	स्थायी	९७४१४९२३५९
३२	पासाङ भोटे	गेमस्काउट	स्थायी	९७४२०८०५२३
३३	मन बहादुर आले	गेमस्काउट	स्थायी	९८४२३३५८८६
३४	रिनेन भोटे	गेमस्काउट	स्थायी	९७४२१५०७७९
३५	राज बहादुर राई	गेमस्काउट	स्थायी	९८४२९५८१११
३६	बत्तीमाया बि.क.	गेमस्काउट	स्थायी	९८४२१०७७२९
३७	उच्चेन भोटे	गेमस्काउट	स्थायी	९७४१४९२३५२
३८	छिरिपासा भोटे	गेमस्काउट	स्थायी	९७४२११५११५
३९	भोला सरदार	गेमस्काउट	स्थायी	९८६२०५३७१७
४०	शिशिर शाही	गेमस्काउट	स्थायी	९७४८०७४१२१
४१	एकराज राई	गेमस्काउट	स्थायी	९८६२७१२२३७
४२	राम कुमार राई	गेमस्काउट	स्थायी	९८६०७२६२९१

४३	अविनाश श्रेष्ठ	गेमस्काउट	स्थायी	९८६२२८३००५
४४	रमेश विश्वकर्मा	गेमस्काउट	स्थायी	९८२५३१५५२३
४५	पदम कुमार राई	गेमस्काउट	स्थायी	९८१२३९३४४५
४६	अशोक कुमार राई	गेमस्काउट	स्थायी	९८६४५४४०००
४७	अशोक राई	गेमस्काउट	स्थायी	९८०४०२५१६२
४८	अंगिता राई	गेमस्काउट	स्थायी	९८६०७४६१२६
४९	देवेन्द्र कार्की	गेमस्काउट	स्थायी	९८४०३९९६४५
५०	दूर्गानन्द यादव	गेमस्काउट	स्थायी	९८४८०४६८५४
५१	दिवन तामाङ	गेमस्काउट	स्थायी	९८१६३२४०४३
५२	दिनेश राई	गेमस्काउट	स्थायी	९८४२४७५६६४
५३	गोविन्दलाल राई	गेमस्काउट	स्थायी	९८१२३०९५४५
५४	कबीर राई	गेमस्काउट	स्थायी	९८१२३०६७७५
५५	उमेश राई	गेमस्काउट	स्थायी	९८०५३७६३२७
५६	मेहर राई	गेमस्काउट	स्थायी	९८६२०६६९९८
५७	समित्रा राई	गेमस्काउट	स्थायी	९८१०५१३५३६
५८	सुकबहादुर राई	गेमस्काउट	स्थायी	९८४८५२५८५०
५९	रीता सुब्बा	गेमस्काउट	स्थायी	९८१९३८७९२०
६०	नीरकला भुजेल	गेमस्काउट	स्थायी	९८६९६२३९०५
६१	गंगा बहादुर थापा	गेमस्काउट	स्थायी	९८४२५९०२६७
६२	शान्त कुमार राई	गेमस्काउट	स्थायी	९८४२२५५९७३
६४	कर्मदावा भोटे	गेमस्काउट	स्थायी	
६४	छिरिङ जुमिक भोटे	गेमस्काउट	स्थायी	९८६२२०११०५
६५	तेन्जिन नावा भोटे	गेमस्काउट	स्थायी	९७४१४०२२७२
६६	पदम कुमारी राई	कार्यालय सहयोगी	करार	९८६३४०५६५३
६७	ईश्वर बोगटी	हल्का सवारी चालक	करार	९८११३३२८७५

तालिका-४: मध्यवर्ती उपभोक्ता समितिको विवरण

क्र.सं.	उपभोक्ता समितिको नाम	ठेगाना	घरधुरी संख्या	जनसंख्या	
				महिला	पुरुष
१.	किमाथाँङ्का मध्यवर्ती क्षेत्र उपभोक्ता समिति	भोटखोला गा.पा.१	९०	२४५	२५५
२.	चेपुवा मध्यवर्ती क्षेत्र उपभोक्ता समिति	भोटखोला गा.पा.३	२९५	७२२	७०५
३.	अरुण वरुण मध्यवर्ती क्षेत्र उपभोक्ता समिति	भोटखोला गा.पा.३	९२६	१६१६	१६८३८
४.	पाथिभरा मध्यवर्ती क्षेत्र उपभोक्ता समिति	मकालु गा.पा.३	७५०	२०४३	२२८६
५.	सेदुवा मध्यवर्ती क्षेत्र उपभोक्ता समिति	मकालु गा.पा.२	८५६	१८८५	२०८१
६.	पौवाखोला मध्यवर्ती क्षेत्र उपभोक्ता समिति	मकालु गा.पा.६	७७८	१८८४	१८५९
७.	माङ्तेवा मध्यवर्ती क्षेत्र उपभोक्ता समिति	सिलिचोङ गा.पा.५	४४१	१३४७	१२४९
८.	ताम्कू मध्यवर्ती क्षेत्र उपभोक्ता समिति	सिलिचोङ गा.पा.३	५९६	१५७६	१६६९
९.	बाला मध्यवर्ती क्षेत्र उपभोक्ता समिति	सिलिचोङ गा.पा.२	५०९	१३०७	१५७१
१०.	सिसुवा मध्यवर्ती क्षेत्र उपभोक्ता समिति	सिलिचोङ गा.पा.१	५९३	१४७३	१५२५
११.	बुङ मध्यवर्ती क्षेत्र उपभोक्ता समिति	सिलिचोङ गा.पा.१	११९७	२७५४	२८८१
१२.	छेस्काम मध्यवर्ती क्षेत्र उपभोक्ता समिति	महाकुलुङ गा.पा.६	८९९	२३१८	२३१३
जम्मा			**७९३०**	**१९१७०**	**२००७७**

तालिका-५: मध्यवर्ती क्षेत्र व्यवस्थापन समितिको पदाधिकारीहरुको विवरण

क्र.सं.	पद	नाम	ठेगाना	सम्पर्क नम्बर
१.	अध्यक्ष	श्री किशोर कुलुङ राई	बुङ, सोलुखुम्बु	९८६६७९०६१७
२.	सदस्य	श्री पर्खिधन नाछिरिङ	बुङ, सोलुखुम्बु	९७४२१३७४२५
३.	सदस्य	श्री दूर्गा किरण राई	बला, संखुवासभा	९८४१४०९५२६
४.	सदस्य	श्री बालकिशोर राई	ताम्कू, संखुवासभा	९८१२३२११३१
५.	सदस्य	श्री लिला राम कुलुङ राई	माङ्तेवा, संखुवासभा	९८१४३०५५५३
६.	सदस्य	श्री बुद्धिमान राई	याफु, संखुवासभा	९८४१४३८७७३
७.	सदस्य	श्री पञ्च बहादुर राई	सेदुवा, संखुवासभा	९७४२०७५४४०
८.	सदस्य	श्री नरेन्द्र कुमार राई	सिसुवा, संखुवासभा	९८६९७३३६३२
९.	सदस्य	श्री पदम बहादुर राई	पाथिभरा, संखुवासभा	९७४२१०२९६१
१०.	सदस्य	श्री नमयाङ राई	चेपुवा, संखुवासभा	९७४२११५००४
११.	सदस्य	श्री दावानावा लामा	किमाथाँङ्का, संखुवासभा	९८४९४२९४४३
१२.	सदस्य	श्री मिक्मा तेम्बा लामा	हटिया, संखुवासभा	९८५२००५७५५
१३.	सदस्य सचिव	श्री रामदेव चौधरी	हेटौंडा उ.म.न.पा.१०, मकवानपुर	९८६५४०८२८९

तालिका-६: मध्यवर्ती क्षेत्रमा सञ्चालित होमस्टेको विवरण

क्र.सं.	होटलको नाम	ठेगाना	घरधुरी	क्षमता	वार्षिक आगन्तुक संख्या
१.	मकालु सामुदायिक होमस्टे	मकालु गा.पा.२, सेदुवा	६	२४	
२.	टासी शेर्पा मध्यवर्ती सामुदायिक होमस्टे	मकालु गा.पा.२, टासीगाउँ	७	१४	
३.	सिम्मा सामुदायिक होमस्टे	मकालु गा.पा.३, सिम्मा	५	१०	
४.	गोलेचौर मध्यवर्ती सामुदायिक होमस्टे	मकालु गा.पा.३, गोलेचौर	८	८	
५.	याम्फू सामुदायिक होमस्टे	मकालु गा.पा.३, हेदाङ्ना गढी	१४	२८	
६.	चेपुवा मध्यवर्ती सामुदायिक होमस्टे	भोटखोला गा.पा.२, चेपुवा	८	१६	
७.	गोला मध्यवर्ती सामुदायिक होमस्टे	भोटखोला गा.पा.४, गोला	९	१८	
८.	ताम्कू मध्यवर्ती सामुदायिक होमस्टे	सिलिङचोङ गा.पा.३, ताम्कू	५	१०	
९.	बुङ मध्यवर्ती सामुदायिक होमस्टे	महाकुलुङ गा.पा. ३, सोलु	७	२८	
जम्मा			**६९**	**१५६**	

तालिका-७: मध्यवर्ती क्षेत्र सामुदायिक वन उपभोक्ता समूहको विवरण

सि.न.	समुहको नाम	ठेगाना		घरधुरी संख्या	जनसंख्या			क्षेत्रफल हे.
		जिल्ला	गा.पा.		पुरुष	महिला	जम्मा	
१	छोकाङ म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-१	९०	२५५	२४५	५००	४२७.४
२	गुइम खर्क म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-२	४२	१०४	९९	२०३	४९६.३९
३	पेजुङ डाँडा म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-२, हटिया	१४१	३४७	३६०	७०७	१४५
४	दाम्दाङमा म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-२ च्याम्ताङ	११२	२५४	२६३	५१७	४९७.३७
५	पोप्टी भन्ज्याङ म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-३	१९२	५०४	४९७	१००१	४९३
६	लोम्बा तेम्बाङ म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोलागा.पा.-४, श्याक्सीला	१२८	३४९	३१९	६६८	४८५
७	टुडि फुर्वुदिन म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-४, हटिया	४९८	५२८	४९७	१०२५	४९८
८	ठुलोचन्दने म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-४	५२	१५५	१५९	३१४	४९८.४५
९	टुटिन म.क्षे.सा.व.उ.स.	संखुवासभा	भोटखोला गा.पा.-४	५६	१४७	१४४	२९१	१९९.७
१०	आँखेढुङगा म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	५१	१२५	१३१	२५६	४९५
११	मकालु म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	६८	१७०	१७२	३४२	४४९.५
१२	लालीगुरास म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	४६	१३२	१२२	२५४	४९७
१३	मूल गाँउ म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	१२४	३१४	३१४	६२८	३१०
१४	कुम्भकर्ण म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	२१०	५१९	५२८	१०४७	३०४.३
१५	अरुण म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	१६६	४३५	१२६	५६१	३०५
१६	सुम्निमा म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	९९	२४९	२३८	४८७	४९८
१७	सेप्ताक म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	४०	१२२	११३	२३५	४९७
१८	तितेखोला म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-२	५२	१५६	१४२	२९८	२५१
१९	एकुवा म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	७६	१९५	२३२	४२७	२२७.७

२०	सुनगाभा म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४७	१३४	१२७	२६१	१८०
२१	उलिङ म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	५९	१३५	१४४	२७९	१५५.६
२२	वरुण महिला म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४२	१०९	१२४	२३३	२२.८७
२३	देवीथान म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४०	८८	९३	१८१	१९०
२४	पाथिभारा माता म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४८	१२५	१२५	२५०	१६८
२५	चिसापानी जलुके म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	१०२	२६१	२७९	५४०	१२६.९
२६	तेर्से सिमखर्क म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	१५२	४३१	४२१	८५२	१९६.३
२७	डडेली तेर्से म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	९०	५५३	२५९	८१२	१८६.४
२८	हाङहोङ चावा म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४७	१५६	१५०	३०६	४३.७१
२९	इन्जोङमा मृगस्थली म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-३	४७	१००	८९	१८९	५१.६६
३०	छापछिलुङ म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-६	६४	११५	१२५	२४०	१२०
३१	कन्या म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-६	६७	१४५	१४३	२८८	१२५
३२	मिलन म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-६	५६	१३८	१४५	२८३	१०१
३३	क्षितिज देउराली म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-६	८०	१८३	१८३	३६६	२९१.२
३४	अरुणकालिका म.क्षे.सा.व.उ.स.	संखुवासभा	मकालु गा.पा.-६	७५	१९२	१५८	३५०	४३३.३
३५	सिंहपोखरी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-१, तेन्छोङ्ग	६१	१६२	१५२	३१४	४९४.८१
३६	वुकुरचोङ म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्गगा.पा.-१, शिशुवाखोल	१२५	३५१	३४९	७००	४७८
३७	श्री मिलन म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-१	९६	२०८	२१२	४२०	४९७
३८	श्री सिंहदेवी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-१ , छुदाक	६०	१४७	१५७	३०४	११७
३९	जलकन्या कालिका म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्गगा.पा.-१, शिशुवाखोला	४५	११३	९३	२०६	४२०
४०	श्री तारेभीर म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-१	५०	१४०	१३७	२७७	४४०

४१	शिलिचोङ म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङगा.पा.-१, शिशुवाखोला	७५	१९०	२०१	३९१	४९६.३९
४२	साउनेथान म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङगा.पा.-१, शिशुवाखोला	८१	२१४	१७२	३८६	४९५
४३	जलकन्या म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-१, बाला	२४	६९	६९	१३८	३२.९९
४४	यायोख्खा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-२, बाला	३७	११०	१०८	२१८	४२०
४५	वालाङ्खा म.क्षे.सा.व.उ.स.	संखुवासभा	सिलिचोङ गा.पा.-२	५३	१६२	१५४	३१६	९०
४६	सिंहदेवी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-२, पेलुङ्बा	९४	२७१	२५६	५२७	४८८.८१
४७	हिसुहिमुख म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-२, बेतेनी	७०	२०४	२००	४०४	४६८.८५
४८	याम्दाङ म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-२	७३	२५७	२६६	५२३	८८
४९	मिश्रित मिलन म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-२	११५	३८०	३३९	७१९	४९९.५
५०	महाकाली म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, बाला	४३	११८	११५	२३३	४५२
५१	खिलाखिस्का म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, ताम्कु	१३६	३७५	३५४	७२९	४८१.८५
५२	पैइसपानी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-३, ताम्कु, मुलगाँउ	३९	९६	१११	२०७	२२.३५
५३	श्री मूलपानी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलीचोङ गा.पा.-३, ताम्कु	६१	१५८	१३५	२९३	५७
५४	लालिगुँरास म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३,	५२	१९६	१५७	३५३	२५७.२
५५	पिप्वुङ किरात म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, ताम्कु	३७	१०५	८५	१९०	५१.१५
५६	संखुवा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, ताम्कु	६४	१५७	१८४	३४१	११०
५७	मुनाल म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, सितुपा	१७	४८	४९	९७	४८९.४७
५८	साप्तोवातुतोवा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३, ताम्कु	७२	१९९	१९७	३९६	४९५
५९	नागीटार म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३,	५३	१४०	१२७	२६७	१६७
६०	साप्दोखा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-३	६५	१९५	१७७	३७२	४९७

६१	श्री सल्लेरी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४ बाला, सल्लेरी	१९	५४	५३	१०७	२६४
६२	साल्पा पोखरी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	२९	७१	८०	१५१	२६.३६
६३	मुना म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	४८	३९	१०९	१४८	९०
६४	अरुणा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	२५	३२	३७	६९	६४.६
६५	सुनखरी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	४१	१०९	१२६	२३५	६२.७
६६	देउराली म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	१६	३९	४८	८७	१२२
६७	अरुणा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	५०	११७	१५०	२६७	१२८
६८	कल्याण म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	८१	२०७	२५४	४६१	८८.०४
६९	बगुवाखोला म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	४५	१२८	११९	२४७	६५
७०	सयपत्री म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-४	२७	९३	९५	१८८	६९.०४
७१	नागेश्वरी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-४, मांतेवा	२९	९५	७३	१६८	७९.६६
७२	लालिगुँरास म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ्ग गा.पा.-४,	५८	१६५	२०३	३६८	३०१
७३	कोशी गंगा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-५	५६	१५२	१५२	३०४	४०
७४	सगरमाथा म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-५	४६	१३२	१२१	२५३	८२
७५	हिमालफेदी म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-५	६३	१३५	१४४	२७९	४९६.४
७६	खेम्पालुङ म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-५	४४	१२७	११०	२३७	४९७
७७	संयुक्त म.क्षे.सा.व.उ.स.	संखुवासभा	शिलिचोङ गा.पा.-५	२२७	५८०	६०३	११८३	४९३
७८	दोजम्बु पाताल म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	११३	२८४	२९१	५७५	९५.५
७९	खार्दो महिला म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	६०	१३९	१५८	२९७	५.६
८०	सिरुबारी धाप म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गागा.पा.-१, बुङ	१४९	४०८	४०४	८१२	४७.१४

८१	हुंगा चाम्लाङ म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	४६६	११९८	११८७	२३८५	४९७
८२	मामेर्कु म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	३४	१०५	१०५	२१०	४४६
८३	रुक्दु दिप्ला म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	११५	२८३	२९६	५७९	४००
८४	वेलपौदो म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-१, बुङ	१३५	३१९	३२६	६४५	४९९
८५	चेरेम म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२	३२	८०	८०	१६०	४८८
८६	नाजीङ म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२	६८	२५५	२१३	४६८	४९०
८७	जनसुधार गाईखर्क म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२	३०	८६	७२	१५८	१३२
८८	मामादी सुप्लोला म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२	६२	१६६	१८०	३४६	६०.७६
८९	सेउपाताल म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२	७६	१९९	१७५	३७४	९७.४८
९०	शाद्धिशान्ती म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२, बुङ	१६५	४३९	३९६	८३५	१०४.३३
९१	खिसरो पोखरी म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२, बुङ	१६५	४३९	३९६	८३५	१०४.३३
९२	चाम्पेम्मा म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-२, बुङ	१५५	४४५	४००	८४५	४४.३८
९३	तितिछो पच्छाक म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-३	४९	१६६	१३६	३०२	६१
९४	भीरथाप्ला म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-३	१५०	१६६	१३६	३०२	११४.३
९५	पेल्माङ म.क्षे.सा.व.उ.स.	सोलुखुम्बु	माहाकुलुङ गा.पा.-३	७२	१८३	१२१	३०४	४८७.७
जम्मा			**जम्मा वडा १५**	**७९५७**	**२०३२५**	**१९३७१**	**३९६९६**	**२५७१६.५**

तालिका–८: बेरुजुसम्बन्धी विवरण

क्र.सं.	बेरुजूको किसिम	रुकम रु.	फछ्र्योट रु.	बाकी रु.
१.	असूल गर्नूपर्ने	५५८९०	०	५५८९०
२.	नियमित गर्नूपर्ने	२०४००९८	१८९२५९८	१४७५००
३.	प्रमाण जूटाउनूपर्ने	६६९९१	६६९९१	
४.	अन्य पेश्की	९६२०००	९६२०००	
५.	अन्य	३८२००	३३००	३४९००
	जम्मा	**३१६३१७९**	**२९२४८८९**	**२३८२९०**
नोटः ९२.४६ प्रतिशत बेरुजू फट्र्योट भएको ।				

तालिका-९: आर्थिक वर्ष २०७६७७ मा निकुञ्जको मध्यवर्ती क्षेत्रबाट निकासी भएका वन पैदावार

क्र.सं.	विवरण	इकाइ	परिमाण	प्रति इकाइ रु.	रकम रु.
१	वन लसून	केजि	०	०	०
२	यार्सागुम्बा	केजि	०	०	०
३	पदमचाल	केजि	११०	१०	११००
४	पाखनवेद	केजि	४४२	५	२२१०
५	धूपी	केजि	१०३७	२	२०७४
६	चिम्फिङ	केजि	५५	५	२७५
७	ठुलो ओखती	केजि	१८७	५	९३५
८	टिमूर	केजि	३२	८	२५६
९	सिल्टिमूर	केजि	१७०	२	३४०
१०	हडचूर	केजि	१८	३	५४
११	गनार	केजि	८	५	४०
१२	चिराइतो	केजि	२२	१५	३३०
	जम्मा				**७६१४**

तालिका-१०: वनको किसिम अनुसार हिमाली कालो भालूले ओगटेको क्षेत्रफल

SN	Forest Types	Occupancy %
1	East Himalayan Oak-Laurel Forest	32%
2	Deciduous Maple-Magnolia-Sorbus Forest	21%
3	Temperate Mountain Oak Forest	12%
4	Mixed Broad Leaved Forest	9%
5	Fir-Birch-Rhododendron Forest	7%
6	Birch- Rhododendron Forest	7%
7	Lower Temperate Oak Forest	5%
8	Alpine Pasture Forest	3%
9	Schima-Castanopsis Forest	2%
10	Dwarf Rhododendron Scrub Forest	1%
11	Fir Forest	1%
Total		**100%**

Source: Survey Report, MBNP, 2019.

तालिका-११: राष्ट्रिय निकुञ्ज तथा आरक्ष आयोजनातर्फको बार्षिक प्रगती विवरण

बजेट रु. लाखमा

क्र. सं.	कार्यक्रम/क्रियाकलाप	इकाइ	बार्षिक लक्ष्य		सम्पादित कामको		प्रगति %	
			परिमाण	बजेट	भौतिक परिमाण	बित्तीय परिमाण	भौतिक	भारित
अ) पूँजीगत खर्च अन्तर्गतका कार्यक्रमहरु								
१	सेक्टर कार्यालय भवन निर्माण	संख्या	१	७०.०	०.७	५७.४	६५	८२
२	पोष्ट भवन निर्माण	संख्या	१	५०.०	१.०	४४.०	१००	८८
३	डेस्कटप कम्प्युटर खरिद	सेट	१	०.६	२.०	०.६	२००	१००
४	फोटोकपी मेशिन खरिद	वटा	१	०.५	१.०	०.५	१००	१००
५	जि.पि.एस. खरिद	वटा	१	०.२	१.०	०.२	१००	१००
६	डढेलो नियन्त्रणका लागि अग्निरेखा निर्माण	कि.मि.	५	५.०	५.०	५.०	१००	१००
७	गोरेटो बाटो निर्माण	कि.मि.	५०	२५.०	४५.०	२५.०	९०	१००
८	काठेपुल निर्माण	वटा	८	८.०	८.०	७.६	१००	९६
९	खानेपानी निर्माण (पाइप जडान)	वटा	३	३.०	३.०	३.०	१००	१००
१०	फोहोर ब्यवस्थापनका लागि खाडल निर्माण	वटा	३०	६.०	१७.०	६.०	५७	१००
११	पोष्टमा सोलार जडान	वटा	२	६.०	२.०	६.०	१००	१००
१२	क्याम्पसाइट निर्माण	वटा	६	६.०	६.०	६.०	१००	१००
१३	पर्यटक विश्रामस्थल निर्माण	वटा	५	१५.०	५.०	१४.७	१००	९८
१४	काठको भ्यू टावर निर्माण	वटा	१	५.०	१.०	५.०	१००	१००
१५	होमस्टे प्रवर्द्धन	प्याकेट	१	१०.०	१.०	१०.०	१००	१००
१६	साईनबोर्ड र सूचना बोर्ड निर्माण	वटा	३०	४.५	३०.०	४.५	१००	१००
१७	सार्वजनिक शौचालय निर्माण	वटा	३	९.०	३.०	९.०	१००	१००
१८	गोलघर र प्रतिक्षालय निर्माण	वटा	१	३.०	१.०	३.०	१००	१००
१९	प्रवेशद्वार निर्माण	वटा	१	५.०	१.०	५.०	१००	१००
२०	कम्पाउण्ड वाल निर्माण	वटा	१	५.०	१.०	५.०	१००	१००
२१	तारवार र काँडे तारबार निर्माण	कि.मि.	०.२५	२.५	०.३	२.५	१००	१००
२२	काठेपुल मर्मत	वटा	३	१.५	३.०	१.५	१००	१००
२३	वन्यजन्तुका लागि पानी पोखरी मर्मत	वटा	५	५.०	५.०	५.०	१००	१००
२४	क्याम्पसाइट मर्मत	वटा	३	२.३	३.०	२.३	१००	१००
२५	कार्यालय भवन मर्मत सुधार	वटा	१	३.०	१.०	३.०	१००	१००
२६	पोष्ट भवन मर्मत	वटा	३	६.०	३.०	५.७	१००	९५
२७	सूचना केन्द्र मर्मत	वटा	१	२.०	१.०	२.०	१००	१००
२८	मठ/मन्दिर/गुम्बा मर्मत	वटा	३	२.३	३.०	२.३	१००	१००
२९	बिजुली वाइरिंग मर्मत	वटा	१	०.७	१.०	०.७	१००	१००
३०	कार्यालयको लागि फर्निचर खरिद	पटक	१	१.२	१.०	१.२	१००	१००
क) पूँजीगत खर्च कार्यक्रमको जम्मा			१७३	२६३.२	१५५.९	२४३.४९	९०	९३

आ) चालु खर्च अन्तर्गतका कार्यक्रमहरु								
१	गेमस्काउट/सेनालाई पुनर्ताजकि तालिम	पटक	३०	१.५	०.०	०.०	०	०
२	जैविक विविधता संरक्षणसम्बन्धी जनसमन्वय गोष्ठी	पटक	२	१.०	२.०	१.०	१००	१००
३	वन्यजन्तु अपराध नियन्त्रण ब्यूरो बैठक	पटक	२	१.५	२.०	१.५	१००	१००
४	चोरी शिकार नियन्त्रण तालिम	पटक	१	०.५	१.०	०.५	१००	१००
५	वार्षिक प्रगती प्रतिवेदन प्रकाशन	संख्या	२००	१.०	२००.०	१.०	१००	१००
६	संरक्षणसम्बन्धी प्रचारप्रसार सामग्री उत्पादन तथा बितरण	पटक	१	१.०	१.०	१.०	१००	१००
७	संरक्षणसम्बन्धी संचार माध्यमबाट प्रचारप्रसार	महिना	१२	०.६	१२.०	०.६	१००	१००

८	संरक्षणसम्बन्धी स्कूल शिक्षा कार्यक्रम	पटक	३	१.१	३.०	१.१	१००	१००
९	कालो भालुको अवस्था अध्ययन	पटक	१	३.०	१.०	३.०	१००	१००
१०	सिमसार क्षेत्र व्यवस्थापनसम्बन्धी अध्ययन	पटक	१	३.०	१.०	३.०	१००	१००
११	प्लास्टिक सामग्री नियन्त्रण र रोकथामर व्यवस्थापन	पटक	१	०.६	१.०	०.६	१००	१००
१२	चोरी शिकार नियन्त्रण स्विप अपरेसन	पटक	६	३.०	६.०	३.०	१००	१००
१३	संरक्षित क्षेत्रका सरोकारवालारुसंग अन्तरक्रिया	पटक	२	१.०	२.०	१.०	१००	१००
१४	डढेलो सचेतना तालिम	पटक	१	०.८	१.०	०.८	१००	१००
१५	डढेलो सचेतना तालिम (समुदाय स्तर)	पटक	१	०.८	१.०	०.८	१००	१००
१६	गाउँ बस्ति नजिक डढेलो जोखिमयुक्त वन क्षेत्रको ब्यबस्थापन	पटक	३	०.९	३.०	०.९	१००	१००
१७	वन डढेलो व्यवस्थापनसम्बन्धी प्रचारप्रसार	पटक	१	०.५	१.०	०.४	१००	८०
१८	वन डढेलो ब्यवस्थापनसम्बन्धी संचार माध्यमबाट प्रचारप्रसार	पटक	६	०.३	६.०	०.३	१००	१००
१९	सेना, प्रहरी, प्रशासन, नागरिक समाजसंगको सहकार्यमा डढेलो नियन्त्रण	पटक	१	१.०	१.०	१.०	१००	१००
२०	वन डढेलो व्यवस्थापनका लागि सुराकी र स्वयं सेवक परिचालन	जना	५	०.३	०.०	०.०	०	०
२१	टुहुरा तथा समस्याग्रस्त वन्यजन्तु व्यवस्थापन	पटक	३	०.६	३.०	०.६	१००	१००
२२	वन्यजन्तु अपराध नियन्त्रण कार्यक्रम	पटक	१	०.५	१.०	०.५	१००	१००
२३	मुद्दा अनुसन्धान तथा तहकिकात	पटक	५	१.३	१.०	०.३	२०	२०
२४	संरक्षित क्षेत्रभित्र लाग्ने मेला व्यवस्थापन	पटक	१	१.०	१.०	०.९	१००	९४
२५	वन्यजन्तु सप्ताह (१-७ वैशाख)	पटक	१	१.०	१.०	०.९	१००	९४
चालु खर्च अन्तर्गतका कार्यक्रमहरु			२९१	२७.६	२५२.०	२४.६	८६.६	८९.२
पुँजी तथा चालु खर्च जम्मा			**४६४**	**२९०.७**	**४०७.९**	**२६८.१**	**८७.९**	**९२.२**

तालिका–१२: मध्यवर्ती क्षेत्र आयोजनातर्फको बार्षिक प्रगती विवरण

क्र.सं.	कार्यक्रम/क्रियाकलाप	इकाइ	बार्षिक लक्ष्य		सम्पादित कामको		प्रगति %	
			परिमाण	बजेट	भौतिक परिमाण	वित्तीय परिमाण	भौतिक	भारित
क.	**संरक्षण कार्यक्रम** (३०%)							
१	चोरी शिकार नियन्त्रण युवा परिचालन	पटक	१२	३.६०	११	३.३	९२	९२
२	चोरी शिकार नियन्त्रण स्वीप अपरेशन	पटक	१	०.४०	१	०.४	१००	१००
३	अध्ययन अवलोकन भ्रमण (स्वदेशी)	पटक	१	५.००	०	०	०	०
४	यार्सागुम्बा संकलन व्यवस्थापन तथा अनुगमन	पटक	१	१.००	१	१	१००	१००
५	सामुदायिक वन कार्ययोजना र विधान नवीकरण	वटा	१०	५.००	०	०	०	०
६	म.सा. वन र धार्मिक बनको विधान कार्ययोजना तयार र हस्तान्तरण	वटा	२	०.५२	२	०.५२	१००	१००
७	गैह्रकाष्ठ वन पैदावार योजना तयार	वटा	१	१.००	१	०.५	१००	५०

८	सामुदायिक वन व्यवस्थापन तालिम	पटक	३०	१.००	३०	१	१००	१००
	जम्मा		५८.००	१७.५२	४६.००	६.७२	७९	३८
ख.	**सामुदायिक विकास कार्यक्रम** (३०%)							
१	समितिको भवन मर्मत	वटा	१	२०.००	१.००	१९.६	१००	९८
२	खानेपानी निर्माण तथा मर्मत	वटा	४	६.०२	४.००	६.०२	१००	१००
३	पाटी पौवा विश्रामस्थल निर्माण	वटा	३	४.५०	३.००	४.५	१००	१००
४	सुधारिएको बाख्राको खोर निर्माण सहयोग	वटा	३	१.५०	३.००	१.५	१००	१००
	जम्मा		११	३२	११	३२	१००	९९
ग.	**आय आर्जन तथा सीप विकास कार्यक्रम** (२०%)							
१	प्लाष्टिक टनेल लगाई बेमौसमी तरकारी र च्याउ खेती गर्ने	पटक	३.०	१.५	३.०	१.५	१००	१००
२	सहभागीतात्मक वन व्यवस्थापन तालिम	पटक	३.०	१.५	३.०	१.५	१००	१००
३	पर्यापर्यटन प्रवर्द्धधन, व्यवस्थापन तथा सचेतना तालिम	पटक	३.०	१.५	३.०	१.५	१००	१००
४	हस्तकला तथा सीप विकास तालिम	पटक	१.०	१.०	१.०	१.०	१००	१००
	जम्मा		१०	६	१०	६	१००	१००
घ.	**संरक्षण शिक्षा कार्यक्रम** (१०%)							
१	संरक्षणसम्बन्धी स्कूल कार्यक्रम	वटा	४.०	०.६	३.०	०.५	७५	७५
२	इको-क्लब गठन र पुनर्ताजकी तालिम	वटा	५.०	१.०	४.०	०.८	८०	८०
३	संरक्षणसम्बन्धी प्रचारप्रसार सामाग्री प्रकाशन र वितरण	पटक	१.०	२.०	१.०	२.०	१००	१००
४	वन्यजन्तु राहत निर्देशिका सम्बन्धी गोष्ठी/अन्तरक्रिया	पटक	६.०	१.२	५.०	१.०	८३	८३
५	उपभोक्ता समूहलाई विधान कार्ययोजना कार्यान्वयन सम्बन्धी गोष्ठी/तालिम	पटक	६.०	१.२	६.०	१.२	१००	१००
६	प्राकृतिक स्रोतको संरक्षण तथा व्यवस्थापन सम्बन्धी गोष्ठी/तालिम	पटक	१	०.५१	१.००	०.५१	१००	१००
ङ.	**संरक्षण शिक्षा कार्यक्रम** (१०%)		२३	७	२०	६	८७	९२
	कुल जम्मा खर्च		१०२	६२	८७	५०	८५	८१

तालिका–१३: प्रदेश नं. १, बाट प्राप्त आयोजनाको प्रगती विवरण

बजेट रु. लाखमा

क्र.सं.	कार्यक्रम/क्रियाकलाप	इकाइ	बार्षिक लक्ष्य		सम्पादित कामको		प्रगति %	
			परिमाण	बजेट	भौतिक परिमाण	बित्तीय परिमाण	भौतिक	भारित
अ)	पूँजीगत खर्च अन्तर्गतका कार्यक्रमहरु							
१	पर्यटक सूचना केन्द्र व्यवस्थापन	पटक	१	२५	०	०	०	०
२	पदमार्ग निर्माण तथा व्यवस्थापन	वटा	१	२५	१	२४.८१	१००	९९
३	धार्मिक स्थल शिवधारा जाने पदमार्ग निर्माण (नेहे खर्क देखि शिवधारा, पार्वती गुफा हुँदै नेहेसम्म जाने पदमार्ग (Stone Solling and Stone Cutting गरी निर्माण)	प्याकेट	१	५०	१	४८.११	१००	९६
४	पदमार्ग सुधारका लागि काठेपूल निर्माण	वटा	५	२५	५	२४.९०	१००	१००
	जम्मा		**८**	**१२५**	**७**	**९७.८२**	**८८**	**७८**

तालिका–१४: खोटाङ जिल्लामा वन्यजन्तुले गरेको क्षतिको राहत पाउनेहरुको नामावली

क्र.सं	पीडितको नाम	ठेगाना	क्षतिको किसिम			रकम	क्षतिगर्ने वन्यजन्तु	कैफियत
			मानवीय	पशुधन	संख्या			
१	देव कुमार राई	केपिलासगढी गा.पा.-१, खोटाङ	मानिस	०	१	१०४४८८	भालू	सख्त घाइते
	जम्मा					**१०४४८८**		

तालिका–१५: संखुवासभा जिल्लामा वन्यजन्तुले गरेको क्षतिको राहत पाउनेहरुको नामावली

क्र.सं	पीडितको नाम	ठेगाना	क्षतिको किसिम			रकम	क्षतिगर्ने वन्यजन्तु	कैफियत
			मानवीय	पशुधन	संख्या			
१	छाम्जे भोटे	भोटेखोला-४, संखुवासभा	मानिस	०	१	१४८,०५३	भालू	सख्त घाइते
२	दावा नुर्बु शेर्पा	मकालु-२, संखुवासभा	मानिस	०	१	२८७८४	भालू	घाइते
३	टासी शेर्पा	मकालु-२, संखुवासभा	मानिस	०	१	३७३८९	भालू	घाइते
४	दावा नुपु शेर्पा	मकालु-२, संखुवासभा	मानिस	०	१	१२८३२८	भालू	सख्त घाइते
५	लाक्पा शेर्पा	मकालु-३, संखुवासभा	०	खसी	२	२०,०००	चितुवा	मारेको
६	भारुछिरिङ भोटे	भोटेखोला-४, संखुवासभा	०	गोरु	१	३०,०००	चितुवा	मारेको
७	दिनेश राई	मकालु-३, संखुवासभा	०	खसी	१	१००००	चितुवा	मारेको
८	वाङ दोर्ची शेर्पा	मकालु-३, संखुवासभा	०	बाख्रा	१५	१०९०००	चितुवा	मारेको
	जम्मा					**५११,५५४**		

तालिका-१६: ओखलढुङ्गा जिल्लामा वन्यजन्तुले गरेको क्षतिको राहत पाउनेहरुको नामावली

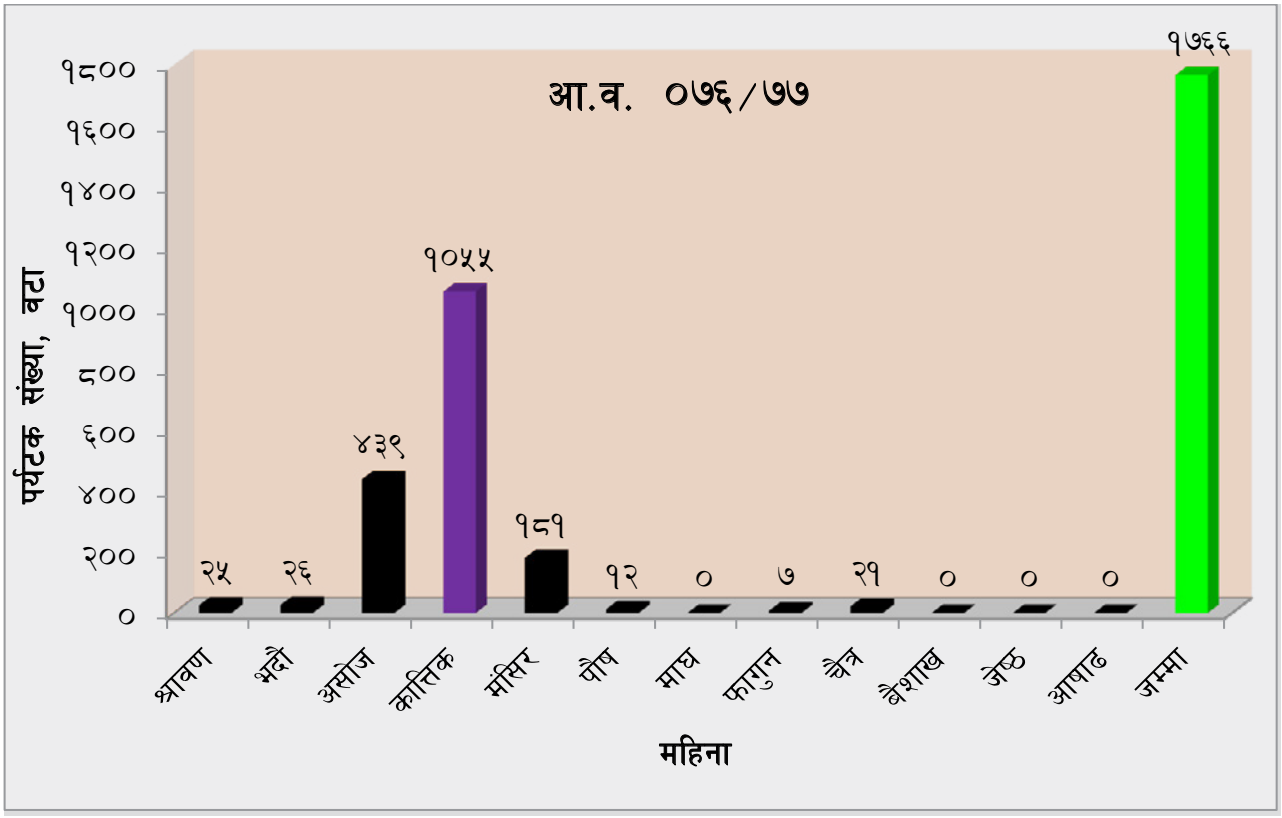
क्र. सं.	पीडितको नाम	ठेगाना	क्षतिको किसिम			रकम रु.	क्षतिगर्ने वन्यजन्तु	कैफियत
			मानवीय	पशुधन	संख्या			
१	हिरा बहादुर श्रेष्ठ	चम्पादेवी न.पा.-१, ओखलढुङ्गा	०	०	३	४८८५	चितुवा	घाइते
२	झलक बहा.मगर	चम्पादेवी न.पा.-१, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
३	मसलीमायाँ श्रेष्ठ	चम्पादेवी न.पा.-१, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
४	सोपे मगर	चम्पादेवी न.पा.-१, ओखलढुङ्गा	०	बाख्रा	४	३५०००	चितुवा	मारेको
५	छममायाँ मगर	चम्पादेवी न.पा.-१, ओखलढुङ्गा	०	बाख्रा	१	१०,०००	चितुवा	मारेको
६	पृथी कुमार मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	०	१	२७५९	चितुवा	घाइते
७	बहादुर मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	मानिस	०	१	२७६०	चितुवा	घाइते
८	सेर बहादुर मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	मानिस	०	१	२७६०	चितुवा	घाइते
९	खुम कुमारी मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
१०	ऋषिराम मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
११	बुद्धिमायाँ मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
१२	पविमाया सुनुवार	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
१३	लोकबहादेर मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	खसी	१	१००००	चितुवा	मारेको
१४	भिममायाँ मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	बाख्रा/गाई	३/१	४००००	चितुवा	मारेको
१५	सितामायाँ मगर	चम्पादेवी न.पा.-२, ओखलढुङ्गा	०	बाख्रा	८	७५,०००	चितुवा	मारेको
१६	दलबहादुर तामाङ्ग	मानेभन्ज्यङ्ग-४, ओखलढुङ्गा	०	बाख्रा	५	५०,०००	चितुवा	मारेको
	जम्मा					**२९३,१६४**		

तालिका-१७: सोलुखुम्बु जिल्लामा वन्यजन्तुले गरेको क्षतिको राहत पाउनेहरुको नामावली

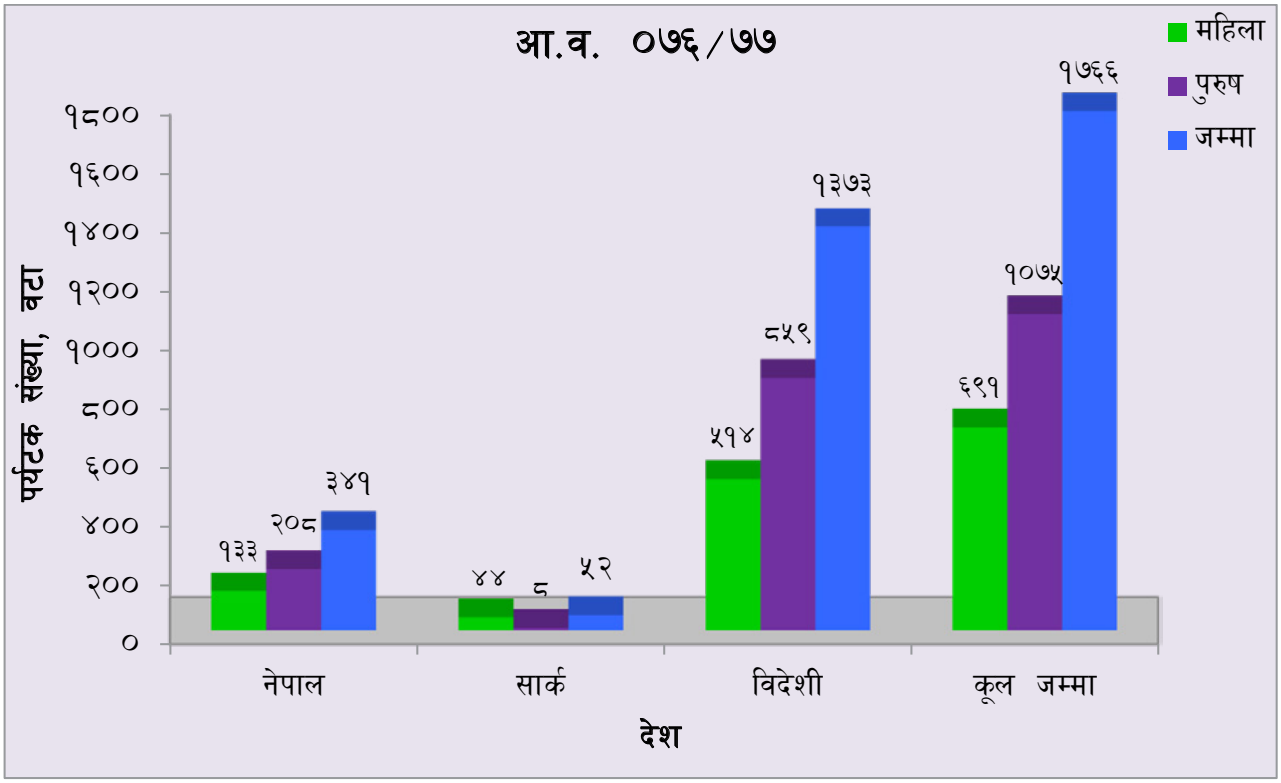
क्र.सं.	पीडितको नाम	ठेगाना	क्षतिको किसिम			रकम रु.	क्षति गर्ने वन्यजन्तू	कैफियत
			मानवीय	पशुधन	संख्या			
१	जैमनी राई	माहाकुलुङ्ग-२, सोलुखुम्बु	०	खसी	१	१०,०००	चितुवा	मारेको
२	उत्र कुमार राई	माहाकुलुङ्ग-३, सोलुखुम्बु	मानिस	०	१	५३७०	भालू	घाइते
३	सुजन कुलुङ राई	माहाकुलुङ्ग-३, सोलुखुम्बु	मानिस	०	१	२०००००	भालू	सख्त घाइते
४	जैमनी राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	३	२५,०००	चितुवा	मारेको
५	बिष्णुमाया बि.क.	माहाकुलुङ्ग-३, सोलुखुम्बु	०	गोरु	१	२०,०००	चितुवा	मारेको
६	बृगराज राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	१	१०,०००	चितुवा	मारेको
७	नन्दराज राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	१	१०,०००	चितुवा	मारेको
८	हर्क बहादुर राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	गोरु	१	३०,०००	चितुवा	मारेको
९	राज कुमार कुलुङ	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	३	३००००	चितुवा	मारेको
१०	दुति शंकर राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	१	१००००	चितुवा	मारेको
११	लिला चतुर राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	गोरु/खसी	१/३	६००००	चितुवा	मारेको
१२	नैसिंह मान राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	१	१०,०००	चितुवा	मारेको
१३	चतुर राज राई	माहाकुलुङ्ग-३, सोलुखुम्बु	०	खसी	१	१०,०००	चितुवा	मारेको
१४	राज बहादुर राई	माहाकुलुङ-३, सोलुखुम्बु	०	गोरु	१	३००००	चितुवा	मारेको
१५	नर बहादुर राई	माहाकुलुङ-३, सोलुखुम्बु	०	गोरु	१	१०,०००	चितुवा	मारेको
१६	१ान बहादुर राई	माहाकुलुङ-३, सोलुखुम्बु	०	भेडा/बाख्रा	५/११	१६०,०००	चितुवा	मारेको
१७	राज कुविर राई	माहाकुलुङ-३, सोलुखुम्बु	०	बाख्रा	२	२०,०००	चितुवा	मारेको
१८	कितेम्बा शेर्पा	माहाकुलुङ-३, सोलुखुम्बु	०	गोरु	१	३०,०००	चितुवा	मारेको
	जम्मा					**६८०,३७०**		

रेखाचित्र (ग्राफ)

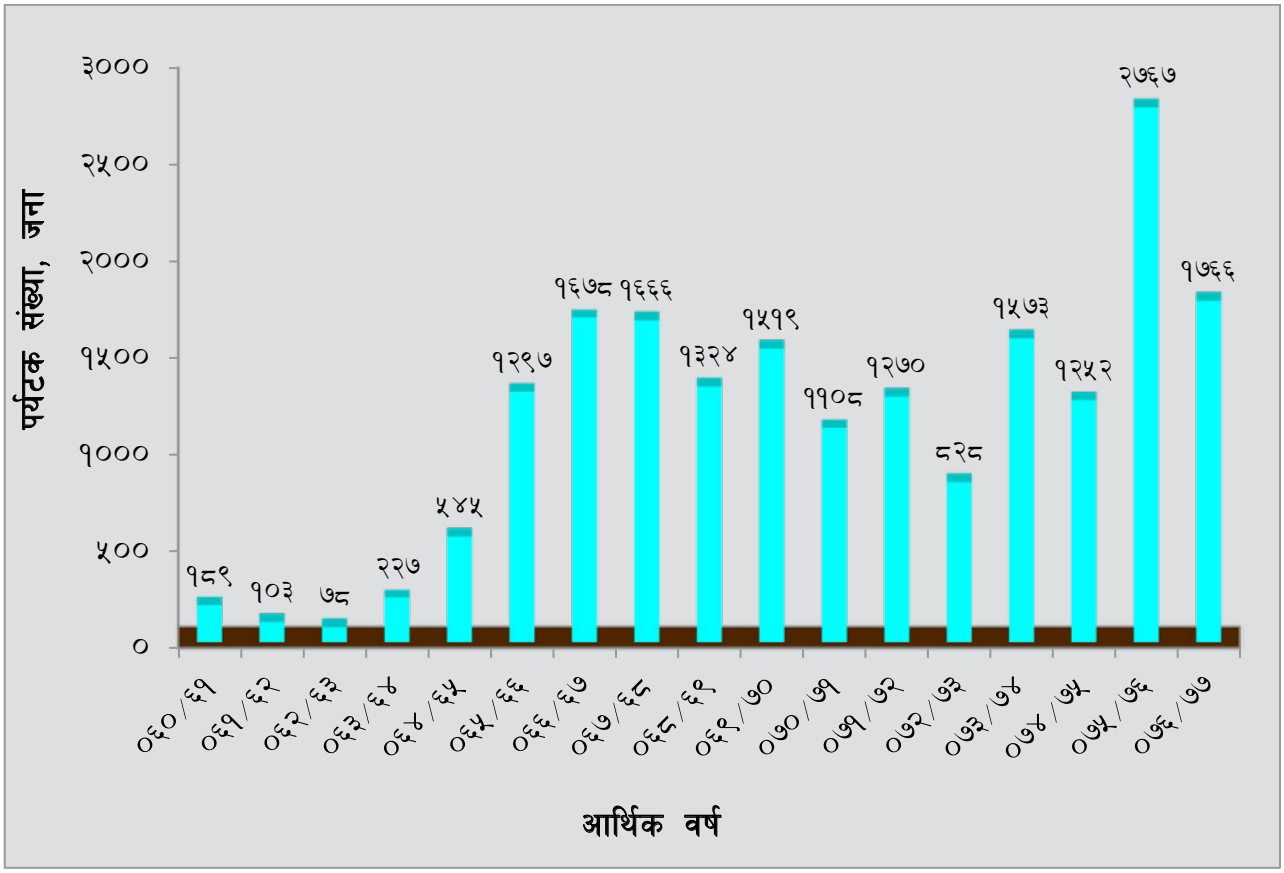
रेखाचित्र-१: मासिक पर्यटक विवरण



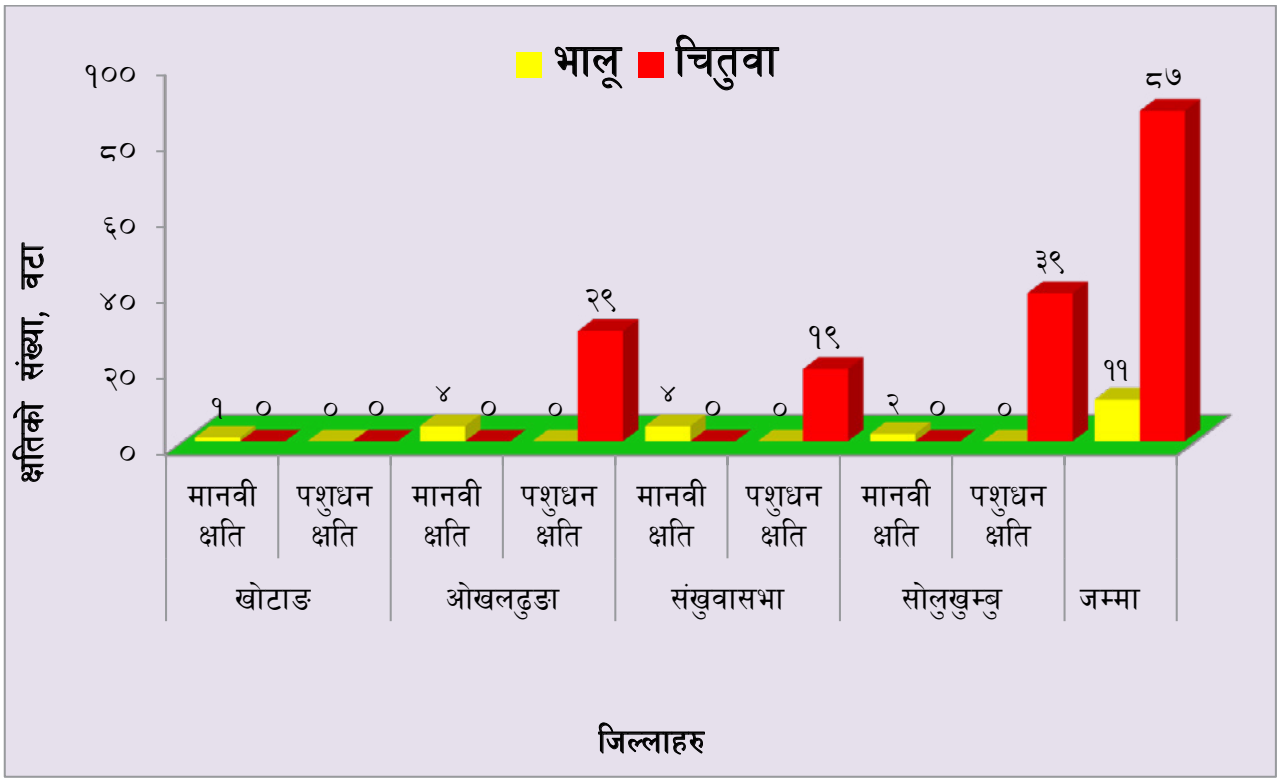
रेखाचित्र-२: देश अनुसार लैंङ्गिक पर्यटक विवरण



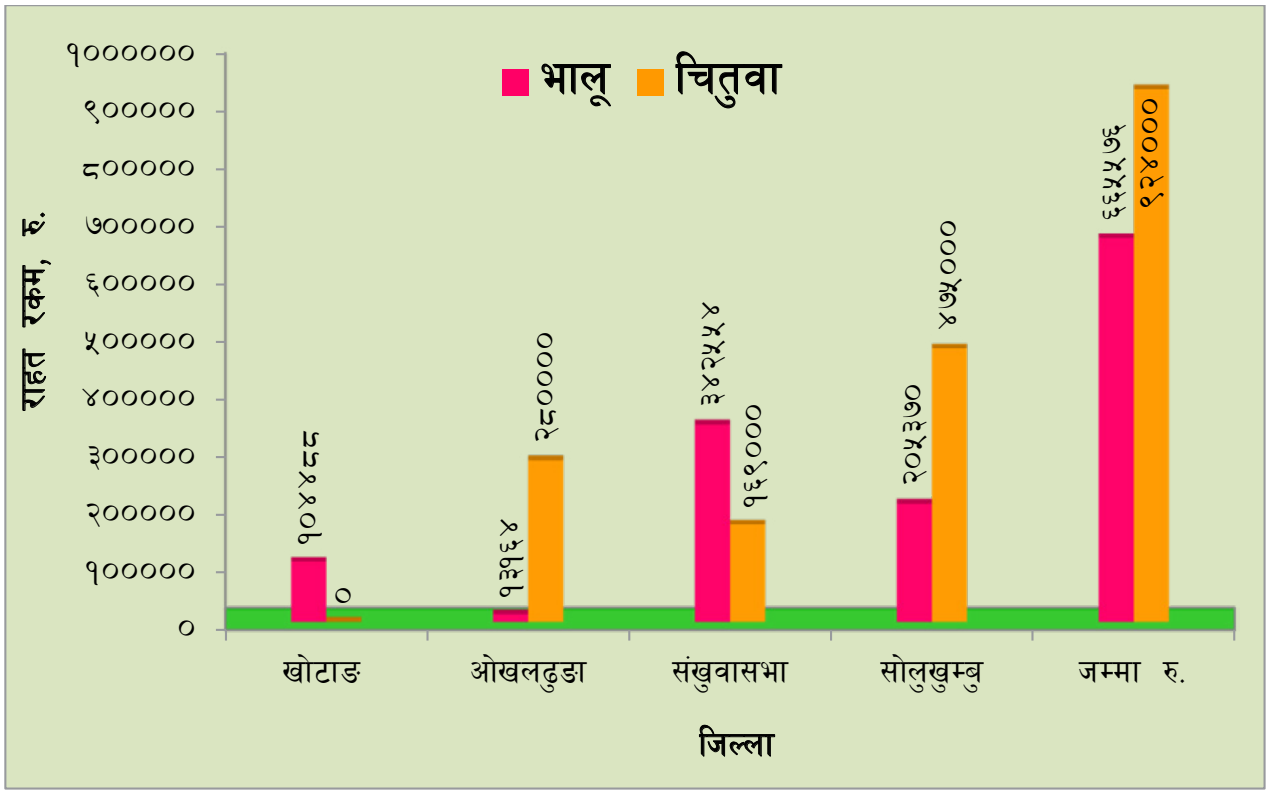
रेखाचित्र-३: आर्थिक वर्ष अनुसार पर्यटक विवरण



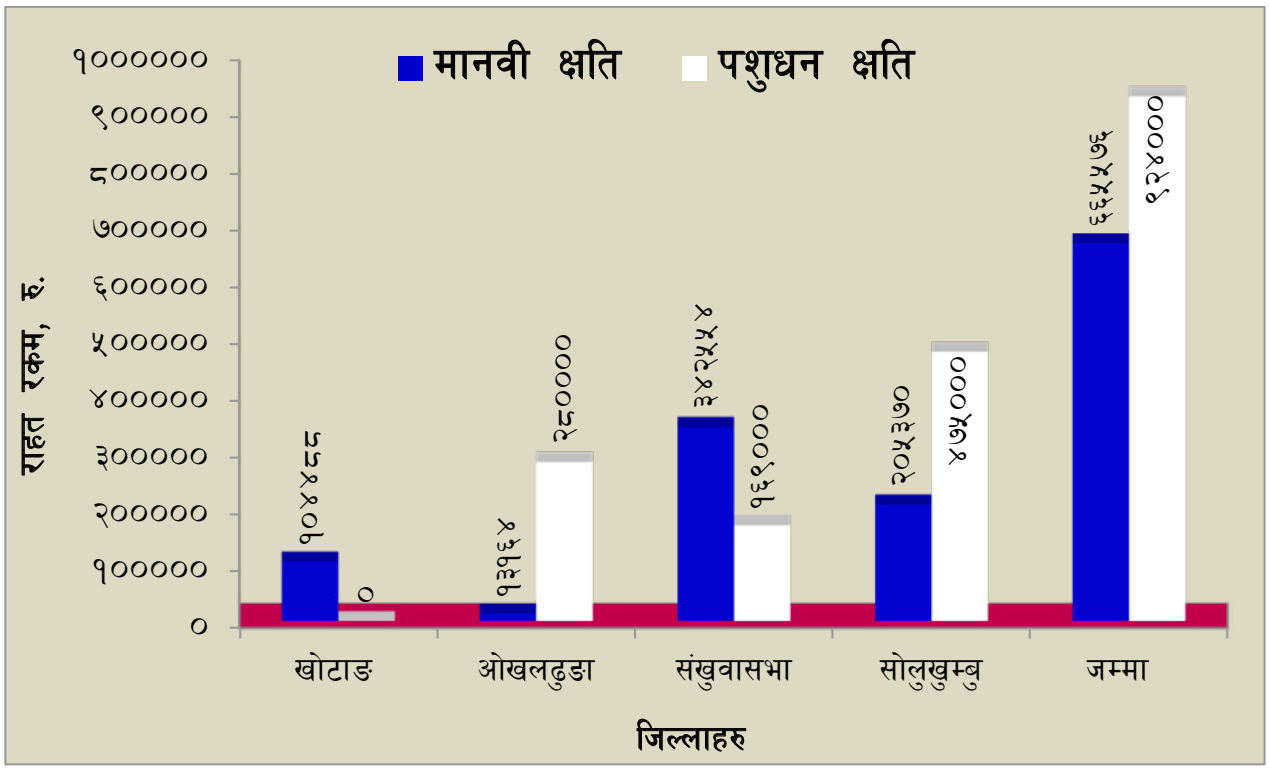
रेखाचित्र-४: जिल्ला अनुसार वन्यजन्तुले गरेको क्षतिको संख्यात्मक विवरण



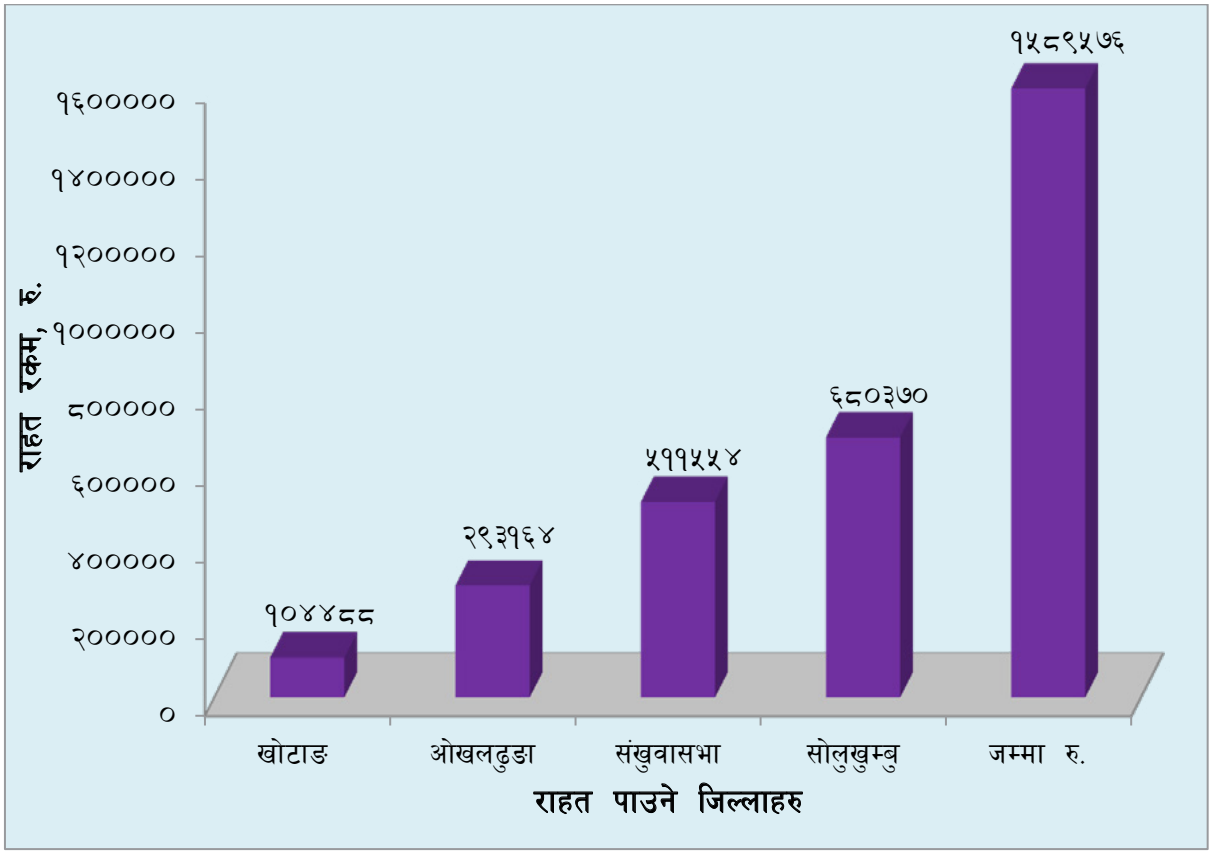
रेखाचित्र-५: वन्यजन्तुको प्रजाति अनुसार गरेको क्षतिको राहत विवरण



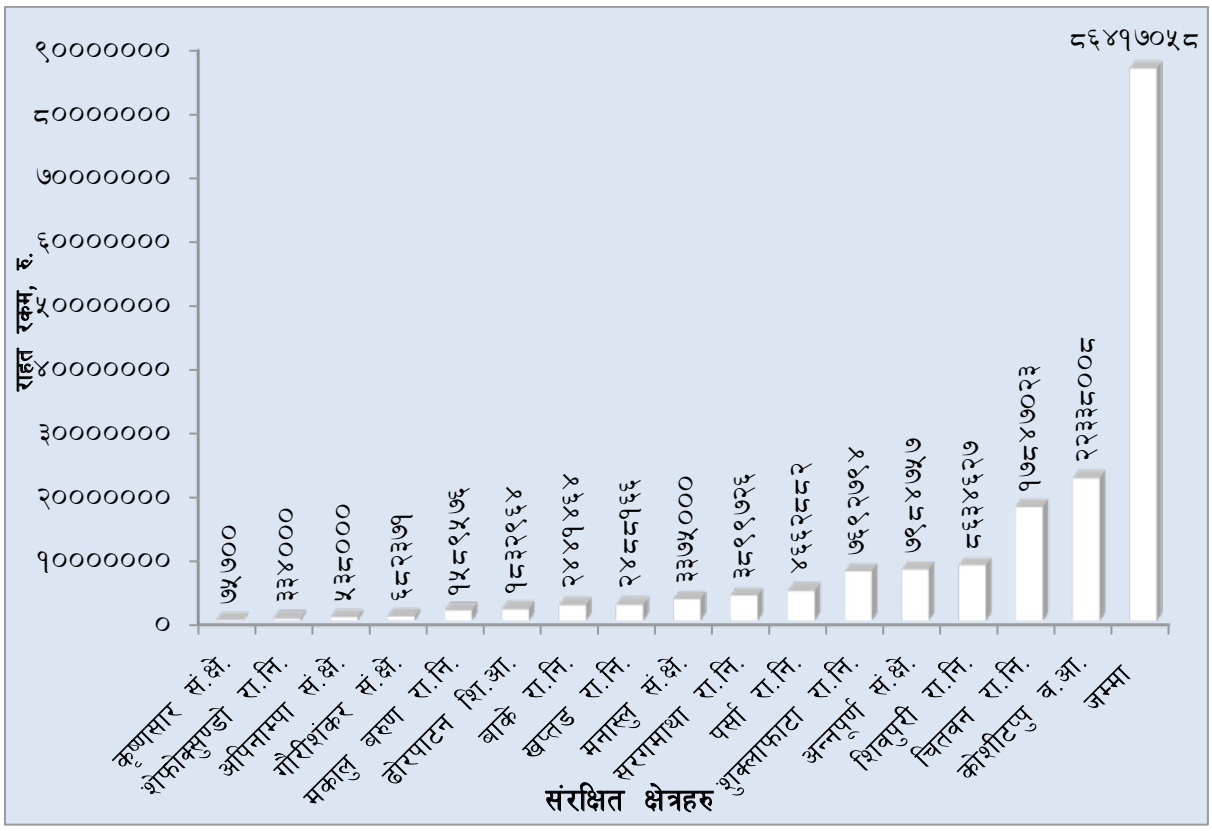
रेखाचित्र-६: क्षतिको किसिम अनुसार राहत वितरणको विवरण



रेखाचित्र-७: जिल्ला अनुसार राहत वितरणको विवरण



रेखाचित्र-८: नेपालका संरक्षित क्षेत्र अनुसार वितरित राहतको विवरण



नोट: सं.क्षे.. संरक्षण क्षेत्र, रा.नि.. राष्ट्रिय निकुञ्ज, शि.का.. शिकार आरक्ष, व.आ.. वन्यजन्तु आरक्ष

भौतिक संरचनाहरू निर्माण/मर्मतका केही तस्वीरहरू

सेक्टर कार्यालय भवन निर्माण, हेदाङ्ना गढी

पोष्ट भवन निर्माण, हेदाङ्नागढी

मध्यवर्ती समिति भवन, हेदाङ्ना गढी

पर्यटनज विश्राम स्थल खोङ्मा

याङ्सीमा पोष्ट भवन मर्मत, संखुवासभा

गोलघर निर्माण, हेदाङ्ना गढी, संखुवासभा

सूचना केन्द्र निर्माण, हेदाङ्ना गढी, संखुवासभा

भौतिक संरचनाहरू निर्माण/मर्मतका केही तस्वीरहरू

पर्यटक विश्रामस्थल, मकालु बेस क्याम्प

पर्यटक विश्रामस्थल, खुङ्मा

पर्यटक विश्रामस्थल, नेहेखर्क

पर्यटक विश्रामस्थल, याङ्सीमा, संखुवासभा

शौचालयल निर्माण, गोला पोष्ट, संखुवासभा

शौचालयल निर्माण, मकालु बेस क्याम्प

फोहर व्यवस्थापनका लागि खाल्डो निर्माण, खोङ्मा माने डाँडा र हटिया

भौतिक संरचनाहरू निर्माण/मर्मतका केही तस्वीरहरू

खोङ्मा माने डाँडा

खेम्पालोङ जाने बाटो निर्माण, प्रदेश नं.१ सरकारको सहयोग

पूल निर्माण, काली खोला, ताम्कू सेक्टर

पूल निर्माण,टासीगाउ, टासीखोला

काठे पूल निर्माण, मकालु बेस क्याम्प

पूल निर्माण,सेरसुङ, बरुण खोला

खानेपानी निर्माण, हेदङ्ना गढी

डिजिटल सूचना प्रविधि जडान,

सूचना बोर्ड तयारी र स्थापना

संरक्षणसम्बन्धी सञ्चालित तालिम तथा गोष्ठीका केही तस्वीरहरू

जिल्ला स्तरीय अपराध नियन्त्रण इकाइ र संरक्षित क्षेत्रका सरोकारवालाहरुसंगको अन्तरक्रिया

चोरीशिकार नियन्त्रणका लागि सञ्चालित गस्ती र खानतलासीका केही तस्वीरहरू








वन्यजन्तु उद्धार तथा बरामदी आखेटोपहारका केही तस्वीरहरू