

Biodiversity Impact Assessment (BIA)
of
Marsyangdi Corridor 220kV Transmission Line Project

Final Report



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कार्यकारी सारांश

आयोजनाको परिचय

प्रस्तावित मर्स्याङ्दी कोरीडोर 220 के.भी. प्रसारण लाइन (MCTLP) नेपालको गण्डकी प्रदेश अन्तर्गतको मनाङ्ग, लमजुङ्ग, तनहुँ तथा गोरखा जिल्ला र वागमती प्रदेश अन्तर्गतको चितवन जिल्लामा रहेको छ। यस आयोजनाको लम्बाइ करिब 1१२ किलोमिटर (4६ किलोमिटर मनाङ्ग-उदीपुर खण्ड र 6६ किलोमिटर उदीपुर-भरतपुर खण्ड) रहेको छ। यस प्रसारण लाइनबाट पाँच वटा गाउँपालिका (मनाङ्ग जिल्लाको नासोड, लमजुङ्ग जिल्लाको मर्स्याङ्गदी र दोर्दी, तनहुँ जिल्लाको आबुखैरेनी र चितवन जिल्लाको ईच्छाकामना), छ वटा नगरपालिका (लमजुङ्ग जिल्लाको बेंसीशहर, सुन्दरबजार र राईनास, गोरखा जिल्लाको गोरखा र पालुङटार) र एक महानगरपालिका (चितवन जिल्लाको भरतपुर) प्रभावित हुन्छ।

डबल सर्किटको यो आयोजनाको विद्युत क्षमता 220 के.भी.को रहेको छ। आयोजनाको कुल 1१२ किलोमिटर लम्बाइ रहेकोमा करिब 27.034 किलोमिटरको भाग अन्नपूर्ण संरक्षण क्षेत्रमा परेको छ। यस आयोजनाको मनाङ्ग-उदीपुर खण्डको वातावरणीय प्रभाव मूल्याङ्कन वन तथा वातावरण मन्त्रालयबाट सन् 2018 मा स्वीकृत भइसकेको छ। तयसैगरी, उदीपुर-न्यू भरतपुर खण्डको प्रारम्भिक वातावरणीय परीक्षण ऊर्जा जलस्रोत तथा सिंचाइ मन्त्रालयबाट सन् 2017 मा स्वीकृत भएको छ।

अध्ययनको दायरा

सन् 2018 मा स्वीकृत भएको आयोजनाको मनाङ्ग...उदीपुर खण्डको वातावरणीय प्रभाव मूल्याङ्कन (EIA) तथा उदीपुर...भरतपुर खण्डको प्रारम्भिक वातावरणीय परीक्षण (IEE)को थप अध्ययनको रूपमा जैविक विविधता प्रभाव मूल्याङ्कन (BIA) अध्ययनलाई लिइएको छ । आयोजना प्रभावित अन्नपूर्ण संरक्षण क्षेत्रको जैविक विविधता तथा दातृ निकाय (EIB) को मापदण्डहरू (Environmental and Social Standard 3 on Biodiversity and Ecosystems) र Guidance Note for Standard 3 on Biodiversity and Ecosystems आदिको पालना गर्ने गरी BIA को अध्ययन गरिएको छ । स्तरीय तथा प्रभावकारी जैविक विविधता प्रभाव मूल्याङ्कन तयार पार्नु यस अध्ययनको मुख्य उद्देश्य रहेको छ। यस अध्ययनले आयोजना प्रभावित सम्पूर्ण क्षेत्रको वन्यजन्तु, चराहरू र वन/वनस्पतिको अध्ययन गर्नेछ। साथै, मुख्य गरेर अन्नपूर्ण संरक्षण क्षेत्र भित्रको आयोजना प्रभावित क्षेत्रलाई प्राथमिकतामा राखी अध्ययन गरिएको छ ।

अध्ययन विधि

स्थलगत अध्ययन

- आयोजनाको मार्गमा पर्ने अन्नपूर्ण संरक्षण क्षेत्र भित्र मार्च...2022 र मई/जुन...2022 मा दुई ऋतुमा 20/20 स्थानमा र संरक्षण क्षेत्रवाहिर मार्च...2022 मा एक ऋतुमा 31 स्थानमा क्यामेरा ट्र्यापको (Camera Trap) सहायताले वन्यजन्तु सम्बन्धी विवरण संकलन गरियो।
- प्रसारण लाइन मार्गको प्रत्येक 1.5 किलोमिटरमा उपर्युक्त स्थान पहिचान गरी चराहरूको अध्ययनका लागि 71 स्थानमा भेन्टेज पोइन्ट (Vantage Point) सर्भे गरियो र प्रत्येक भेन्टेज पोइन्टमा न्यूनतम 30 मिनेट चराहरूको विवरण संकलन गरियो।
- प्रसारण लाइन मार्गमा रहेको वन तथा वनस्पतिको लागि 35 स्थानमा रुख, वल्लवल्ली, लाथा र पोथ्राको भिन्न...भिन्न साइजका प्लट माफत नमुना सर्वेक्षण गरी तथ्याङ्क संकलन गरियो।
- स्थलगत अध्ययनबाट प्राप्त वन्यजन्तु, वनस्पति तथा चराहरूको विवरण IUCN Red List, CITES List तथा Nationally Protected Species संग तुलना गरियो।
- 6 स्थानमा सामुहिक छलफल तथा मुख्य जानकार व्यक्तिहरूसंग अन्तरक्रिया गरियो।

सन्दर्भ सामाग्री अध्ययन

- अध्ययनको क्रममा स्वीकृत वातावरणीय अध्ययन प्रतिवेदन (मनाङ...उदीपुर खण्डको EIA तथा उदीपुर...भरतपुर खण्डको IEE) तथा अन्नपूर्ण संरक्षण क्षेत्रको जैविक विविधता सम्बन्धी प्रकाशित प्रतिवेदनहरूको अध्ययन गरिएको छ।
- अन्नपूर्ण संरक्षण क्षेत्रमा पाइने संरक्षित वन्यजन्तु तथा वनस्पति सम्बन्धी प्रकाशित प्रतिवेदनहरूको अध्ययन गरिएको छ।

विद्यमान वातावरणीय अवस्था

वन्यजन्तु

51 स्थानमा राखिएको क्यामेरा ट्र्यापमा विभिन्न 18 प्रकारका वन्यजन्तुहरू आयोजना क्षेत्रमा पाइएको छ। सवैभन्दा धेरै स्थानमा कस्तुरी विरालो (*Paguma larvata*) देखिएको थियो भने त्यसपछि चितुवा (*Panthera pardus*) देखिएको थियो। यसका साथै, प्रसारण लाइन क्षेत्रमा पहरे बाँदर (*Macaca assamensis*), रतुवा (*Muntiacus vaginalis*), घारल (*Naemorhedus goral*), सानो सुङ्गुरेभालु (*Melogale sp*), वन बिरालो (*Felis chaus*), कालोमुखे बाँदर (*Semnopithecus schistaceus*), निर विरालो (*Viverra zibetha*), चरी बाघ (*Prionailurus bengalensis*), दुम्सी (*Hystrix brachyura*), रातो बाँदर (*Macaca mulatta*), मलसाप्रो (*Mustela kathiah*), स्याल (*Canis aureus*), न्याउरीमसो (*Herpestes sp.*) लोखर्के, मुसा तथा पहिचान हुन नसकेको थप एक प्रजाति पाइएको छ।

सवै, क्यामेरा ट्र्यापमा मानिसहरूको तस्विर पनि देखिएकोले प्रसारण लाइनको 2 कि.मि. क्षेत्रमा मानिसहरूको चहलपहल हुने गरेको देखिएको छ। स्थलगत अध्ययनबाट प्राप्त विवरण अनुसार पहरे बाँदर, सानो सुङ्गुरेभालु, चरीबाघ तथा चितुवा संरक्षणका हिसावले आयोजना क्षेत्रमा पाइने महत्वपूर्ण वन्यजन्तुहरू रहेका छन्।

आयोजनाको निर्माण चरणमा हुने गतिविधिको कारणले वन्यजन्तुमा पर्ने प्रभावहरूको पहिचानका लागि वन्यजन्तु र मानिसहरूको गतिविधिको नक्साङ्कन गरिएको छ। यसका लागि वन्यजन्तुहरू क्यामेरामा रेकर्ड भएको समयलाई आधार मानेर प्रमुख 7 प्रजातिलाई (कस्तुरी विरालो, चितुवा, चरी बाघ, मलसाप्रो, कालोमुखे बाँदर, रतुवा र निर विरालो) अध्ययनमा समेटिएको छ। वन्यजन्तुको गतिविधिको आधारमा मलसाप्रो र कालोमुखे बाँदरको मानिससंग जम्काभेट हुने सम्भावना दिनभर नै रहेको देखिन्छ भने रतुवाको विहान र साँझपख मानिससंग जम्काभेट हुन सक्छ। आयोजनाका कामदारहरूसंग उल्लेखित जनावरहरू जम्काभेट हुन सक्ने भएकाले जोखिममा रहेको देखिन्छ। यसका साथै अध्ययन गरिएका अन्य प्रजातिहरूको दिनको समयमा मानिससंग जम्काभेट नहुने देखिन्छ।

चराहरू

आयोजना क्षेत्रमा चराहरूको लागि विभिन्न 3 सिजनमा गरिएको अध्ययनमा कुल 256 प्रजातिका चराहरू पाइएका छन्। अध्ययनमा पाइएका चराहरू मध्य सिकारी चराहरू (Raptors) 26 प्रजातिका र सिमसारमा पाइने चराहरू 27 प्रजातिका रहेका छन्।

धारापानी...खुदी क्षेत्र

धारापानी देखि खुदी सम्मको क्षेत्रमा धेरै चट्टानी पहाडहरू र थोरै वन क्षेत्र रहेको छ। यो क्षेत्रमा गृष्म ऋतु (Summer) सिजनमा 109 प्रजातिका चराहरू, शरद ऋतुमा (Autumn) 55 प्रजातिका चराहरू र शिशिर ऋतुमा (Winter) 78 प्रजातिका चराहरू पाइएका छन्। यो क्षेत्रमा पाइएका 8 प्रजातिका चराहरू सिकारी चराहरू छन् भने धेरैजसो आवासीय (residential) चराहरू रहेका छन्।

खुदी...उदीपुर क्षेत्र

खुदी देखि उदीपुर सम्मको आवासीय क्षेत्र रहेको छ। यो क्षेत्रमा कुल 68 प्रजातिका चराहरू पाइएका छन्। यो क्षेत्रमा पाइएका 6 प्रजातिका चराहरू सिकारी चराहरू छन् भने धेरैजसो आवासीय (residential) चराहरू रहेका छन्। खुदी क्षेत्रमा निर्माणका कार्यहरूले गर्दा बासस्थानमा असर परेकाले चराहरू कम पाइएको छ। सिमलचौर क्षेत्रमा (भेन्टेज पोइन्ट...21) सिमलका रुखहरू धेरै रहेकाले गिद्धको लागि यो क्षेत्र महत्वपूर्ण रहेको देखिन्छ। उदीपुर सवस्टेसन नजिकै जलद्युतको जलाशय रहेकाले यो क्षेत्रमा बसाइसराइ गर्ने चरा 'कालीजुरे हाँस' देखिएको छ।

उदीपुर...मार्किचौक क्षेत्र

उदीपुर मार्किचौक सम्मको क्षेत्र आवासीय क्षेत्र रहेको छ। यो क्षेत्रमा कुल 79 प्रजातिका चराहरू पाइएका छन्। यो क्षेत्रमा पाइएका 5 प्रजातिका चराहरू सिकारी चराहरू छन् भने धेरैजसो आवासीय (residential) चराहरू रहेका छन्। विश्वव्यापि रूपमा खतरामा (Globally threatened) रहेको सुन गिद्ध यो क्षेत्रमा पाइएको छ।

मार्किचौक...भरतपुर क्षेत्र

यो क्षेत्रमा कुल 110 प्रजातिका चराहरु पाइएका छन् जसमध्ये सिकारी चराहरु 7 प्रजातिका रहेका छन् । विश्वव्यापि रुपमा खतरामा रहेको सेतो गिद्ध (Endangered), सुन गिद्ध (Critically Endangered) र डंगर गिद्ध (Critically Endangered) प्रजातिहरु यस क्षेत्रमा पाइएका छन्। यो क्षेत्र बसाइसराइ गर्ने चराहरुका लागि बराइसराइ गर्ने मार्ग हुनसक्ने देखिएको छ।

वन/वनस्पति**धारापानी...खुदी क्षेत्र**

आयोजनाको धारापानी क्षेत्रमा ग्रोब्रेसल्ला र उत्तिसका रुखहरु मात्र पाइएका छन् खुदी क्षेत्रमा ग्रोब्रेसल्ला, उत्तिस, मौवा, खिरी, चिलाउने, सिमल, काफल, सिरिस, फलेदो, गुएलो, बयर, क्यामुन लगायतका 16 प्रजातिका रुखहरु पाइएका छन्। त्यसैगरी, 42 प्रजातिका जडिबुटि/झाडि/घाँसहरु मुख्य गरेर बमलो बनमारा, पानी अमला, सिस्नु, बिलाउने, दत्तिउन, मोथे, लोकता, अमिसो, आदि पाइएका छन्। यस खण्डको च्याम्चे क्षेत्र बनस्गतिहरुको विविधताको हिसावले महत्वपूर्ण रहेको पाइएको छ। स्थानियले दिएको जानकारी अनुसार गुछीच्याउ, सुगन्धवाला, जटामसी, कुट्की र अतिसजरा यस क्षेत्रमा पाइने हुने मुख्य जडिबुटि हुन्। यस क्षेत्रमा पाइने ओखर राष्ट्रिय निकुञ्ज तथा वन्यजन्तु संरक्षण ऐन, 2029 अन्तर्गत संरक्षण गरिएको छ।

खुदी...उदीपुर क्षेत्र

प्रस्तावित आयोजनाको यस क्षेत्रमा 27 प्रजातिका रुखहरु पाइएका छन्। यस क्षेत्रमा मुख्य गरेर खनिउ, सिन्धुरे, मौवा, साल, खोटेसल्ला, टुनि, खिरी, सिरिस आदि पाइएका छन्। यस क्षेत्रमा खोला किनारमा खयर, सिसौ र सिमल मुख्य गरेर पाइन्छन्। त्यसैगरी, 41 प्रजातिका जडिबुटि/झाडि/घाँसहरु मुख्य गरेर फुर्केघाँस, बनमारा, धुर्सिलो, उन्यु, दुवो, गन्धे झार, सिस्नु, चरीअमिलो, मोथे, अमिसो, तितेपाती, आदि पाइएका छन्। यो क्षेत्रको बेशिसहर नजिकैको क्षेत्र वनस्पतिको विविधताको हिसावले महत्वपूर्ण रहेको छ। यस क्षेत्रमा पाइने साल नेपाल सरकारद्वारा कटान, ओसार पसार र बिदेश निकासिका लागि प्रतिवन्ध गरेको प्रजाति हो।

उदीपुर...मार्किचौक क्षेत्र

प्रस्तावित आयोजनाको यस क्षेत्रमा 27 प्रजातिका रुखहरु पाइएका छन् । यस क्षेत्रमा मुख्य गरेर साल, चिलाउने, राजविक्ष, वोटधाइरो पङ्के, सिसौ, बकाइनो, सिरिस आदि र ख प्रजातिहरु पाइएका छन् । त्यसैगरी, 50 प्रजातिका जडिबुटि/झाडि/घाँसहरु मुख्य गरेर उन्यु, चरीअमिलो, कालो बनमारा, दुवो, बनमारा, बन्सोघाँस, तितेपाती, सेतोवनमारा, पानीअमला, बिलाउने, सिस्नु, अंगेरी, मोथे, आदि पाइएका छन् । यो क्षेत्रको राइनास नगरपालिका खण्ड वनस्पतिको विविधताको हिसावले महत्वपूर्ण रहेको छ। यस क्षेत्रमा पाइने साल नेपाल सरकारद्वारा कटान, ओसार पसार र बिदेश निकासिका लागि प्रतिवन्ध गरेको प्रजाति हो।

मार्किचौक...भरतपुर क्षेत्र

प्रस्तावित आयोजनाको यस क्षेत्रमा 21 प्रजातिका रुखहरू पाइएका छन् । यस क्षेत्रमा मुख्य गरेर वोटधाइरो, साल, चिलाउने, झिंगाइने, साज, कटुस आदि पाइएका छन् । त्यसैगरी, 46 प्रजातिका जडिबुटि/झाडि/घाँस मुख्य गरेर उन्यु, भन्टि, सेतो वनमारा, कडिपत्ता, घोडे झार, उन्यु, कालो बनमारा, तितेपाती, बन तुलसी, काँडे फुल आदि पाइएका छन्। यो क्षेत्रको आवुखैरेनी नगरपालिकाको छिम्केश्वरी खण्ड वनस्पतिको विविधताको हिसावले महत्वपूर्ण रहेको छ। यस क्षेत्रमा पाइने साल, र सतिसाल नेपाल सरकारले कटान, ओसार पसार र बिदेश निकासिका लागि प्रतिवन्ध गरेको प्रजाति हो ।

प्रभाव र न्यूनिकरणका उपायहरू**वन्यजन्तु**

- आयोजनाले प्रसारण लाइनको अधिकार क्षेत्रको रुखहरू कटान गर्दा वन्यजन्तुहरूको बासस्थानमा क्षति पुग्नेछ। यो प्रभाव न्यूनिकरण गर्नको लागि सम्भव भएसम्म कम रुखहरू कटान गर्ने र खाली क्षेत्रमा वृक्षारोपण गर्नुपर्नेछ। प्रसारण लाइनको तारमुनि उपयुक्त प्रजातिका विरुवाहरू रोपी वन्यजन्तुहरूको नयाँ बासस्थान विकास गर्नु पर्नेछ।
- प्रसारण लाइनको अधिकारक्षेत्रका रुखहरू पुरै कटान गर्दा सो क्षेत्र खुल्ला हुनेछ र चोरीसिकारी गर्नेका लागि वन्यजन्तुहरू पहिचान गर्न सजिलो हुनेछ । यसले गर्दा चोरीसिकारीका घटनाहरू बढ्न सक्छन्। यसका लागि आयोजनाका कामदार तथा स्थानीयलाई सचेतनामुलक कार्यक्रम संचालन गर्ने र आयोजना क्षेत्रमा चोरीसिकारी निरुत्साहन गर्ने खालका होडिङ्ग वोर्डहरू राख्नु पर्नेछ।
- बासस्थानको क्षतिको परिणाम स्वरूप, स्थानीय पारिस्थितिकी प्रणालीको वहन क्षमता घट्नेछ जसले केही प्रजातिहरूलाई खानाको खोजीमा मानव बस्ती र कृषि क्षेत्रहरू नजिक पुग्ने हुनाले मानव...वन्यजन्तु द्वन्द्व बढ्नेछ। मानव...वन्यजन्तु द्वन्द्वको उचित समाधानका लागि वृहत छलफल तथा वैज्ञानिक अध्ययन...अनुसन्धान हुनु पर्ने देखिन्छ । तत्कालका लागि वन्यजन्तुसंगको व्यवहार कस्तो हुनुपर्ने सम्बन्धमा सचेतनामुलक कार्यक्रमहरू संचालन गर्नु पर्ने देखिन्छ । आयोजना क्षेत्रमा मानव...वन्यजन्तु द्वन्द्व सम्बन्धमा अनुगमनका कार्यहरू निरन्तर गर्नु पर्नेछ।
- रुखहरूको कटान तथा प्रसारण लाइनको संरचना बनाउँदा वन्यजन्तुहरूको दुर्घटना हुने सम्भावना हुन्छ। यसका लागि रुख कटान पूर्व रुखमा चराको गुँड तथा अन्य जनावर रहे नरहेको ख्याल गर्ने, वन्यजन्तुलाई उच्च जोखिम रहेको क्षेत्रमा वरिपरी तारवार गर्ने गर्नु पर्नेछ।
- प्रसारण लाइन बनाउँदा वनक्षेत्रमा भारी उपकरणहरू प्रयोग गर्नु पर्ने भएमा दिउसोको समयमा मात्र प्रयोग गर्नु पर्नेछ।

चराचुरुङ्गी

- बेशिसहरमा मर्स्याङ्गी नदी नजिकै ल्यानफिल्ड साइड रहेकाले चराहरूको गतिविधि बढि छ। यहि कारणले गर्दा यस क्षेत्रमा चराहरू प्रसारण लाइनको तारमा ठोकिने सम्भावना बढी हुन्छ। त्यसैले, ल्यानफिल्ड साइड व्यावस्थापन गर्ने वा प्रसारण लाइन तारमा डिफ्लेक्टर उपकरण राख्नु पर्नेछ।
- प्रसारण लाइनले नदी/खोला पार गर्ने स्थानमा प्रसारण लाइन तारमा डिफ्लेक्टर उपकरणहरू राख्नु पर्नेछ।
- प्रसारण लाइनको लमजुङको सिमलचौर क्षेत्र, गोरखा...पालुङ्गटारको उत्तरी क्षेत्र तथा चितवनको चौकिडाँडा क्षेत्र सिकारी चराहरूको उडानका लागि महत्वपूर्ण रहेको पाइएको छ । यस क्षेत्रको प्रसारण लाइन तारमा चराहरू ठोकिने सम्भावना बढि रहेको छ। त्यसैले यस क्षेत्रमा प्रसारण लाइन तारमा डिफ्लेक्टर उपकरणहरू राख्नु पर्नेछ।
- आयोजनाको मर्स्याङ्गी नदी आसपासको क्षेत्र सिमसार क्षेत्र हुनाले बसाइसराइ गर्ने चराहरू यस क्षेत्रमा पाइएका छन्। यस क्षेत्रको प्रसारण लाइन तारमा चराहरू ठोकिने सम्भावना बढि रहेको छ । त्यसैले यस क्षेत्रमा प्रसारण लाइन तारमा डिफ्लेक्टर उपकरणहरू राख्नु पर्नेछ।
- बस्ति क्षेत्रमा स्थानीयहरूले हाँस र कुखुरा पाल्ने भएकाले सिकारी चराहरू बढि आकर्षित हुन्छन्। त्यसैले बस्ती नजिक रहेको प्रसारण लाइनमा सिकारी चराहरू ठोकिएर दुर्घटना हुने सम्भावना रहेकाले हाँस वा कुखुरा पाल्दा बन्द क्षेत्रभित्त (Closed area) पाल्नको लागि स्थानीय स्तरमा जनचेतना जगाउने।

वन/वनस्पति

- वन क्षेत्रवाट प्रसारण लाइन निर्माण गर्दा रुखहरू कटान हुने भएकाले कटान भएका रुखहरूको प्रचलित कानून वमोजिम वृक्षारोपण गर्ने।
- आयोजनाका कामदारहरू वन क्षेत्रवाट दाउरा तथा गैह्रकाष्ट वन पैदावारको अवैध संकलनमा संलग्न हुन सक्ने भएकाले कामदार सिविरमा दाउराको प्रयोगलाई बन्देज लगाउने र कामदारहरूलाई वन क्षेत्रमा प्रवेश र गैह्रकाष्ट वन पैदावार संकलनमा रोक लगाउने।
- प्रसारण लाइन मार्गमा रहेको जैविक विविधताका हिसावले महत्वपूर्ण क्षेत्रमा निर्माण कार्य गर्दा विशेष सावधानी अपनाउने।

निष्कर्ष

आयोजना प्रभावित अन्नपूर्ण संरक्षण क्षेत्रको जैविक विविधताको महत्व तथा आयोजनाको दातृ निकाय (EIB) को मापदण्डहरू अनुसार स्वीकृत वातावरणीय अध्ययन प्रतिवेदनको थप अध्ययनको रूपमा BIA अध्ययन गरिएको छ । वैज्ञानिक विधि तथा उपकरणहरूको सहायताले गरिएको यस

अध्ययनले स्वीकृत वातावरणीय अध्ययन प्रतिवेदन भन्दा थप जानकारीहरु संकलन गरेर जैविक विविधतामा पर्ने प्रभावलाई सहि रूपमा आँकलन गर्दै प्रभाव न्युनिकरणका थप कार्यक्रमहरु प्रस्ताव गरेको छ । यस अध्ययनले प्रस्ताव गरेका न्युनिकरणका उपायहरुको पूर्ण पालना गरेर आयोजना निर्माण गर्दा आयोजना क्षेत्रको जैविक विविधतामा पर्ने प्रभाव न्यूनिकरण गर्न सकिने देखिएको छ ।

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1 PROJECT DESCRIPTION

The proposed Marsyangdi Corridor 220kV Transmission Line project (MCTLP) is located in Gandaki and Bagmati Provinces of Nepal. The MCTLP passes through Manang, Lamjung, Tanahu and Gorkha districts of Gandaki Province and Chitwan district of Bagmati Province. The total length of the project is about 109.70km and is divided into two main sections (45.25km Manang-Udipur Section and 64.45km Udipur-New Bharatpur Section). Altogether 5 Rural Municipalities (Nasong RM of Manang; Marsyangdi RM and Dordi RM of Lamjung; Anbukharieni RM of Tanahu; and Ichchyakamana RM of Chitwan) and 6 Municipality (Besishahar Municipality, Sundarbazar Municipality and Rainas Municipality of Lamjung; Gorkha Municipality and Palungtar Municipality of Gorkha district; and Bharatpur Metropolitan City (MC) of Chitwan district) are to be affected by the project.

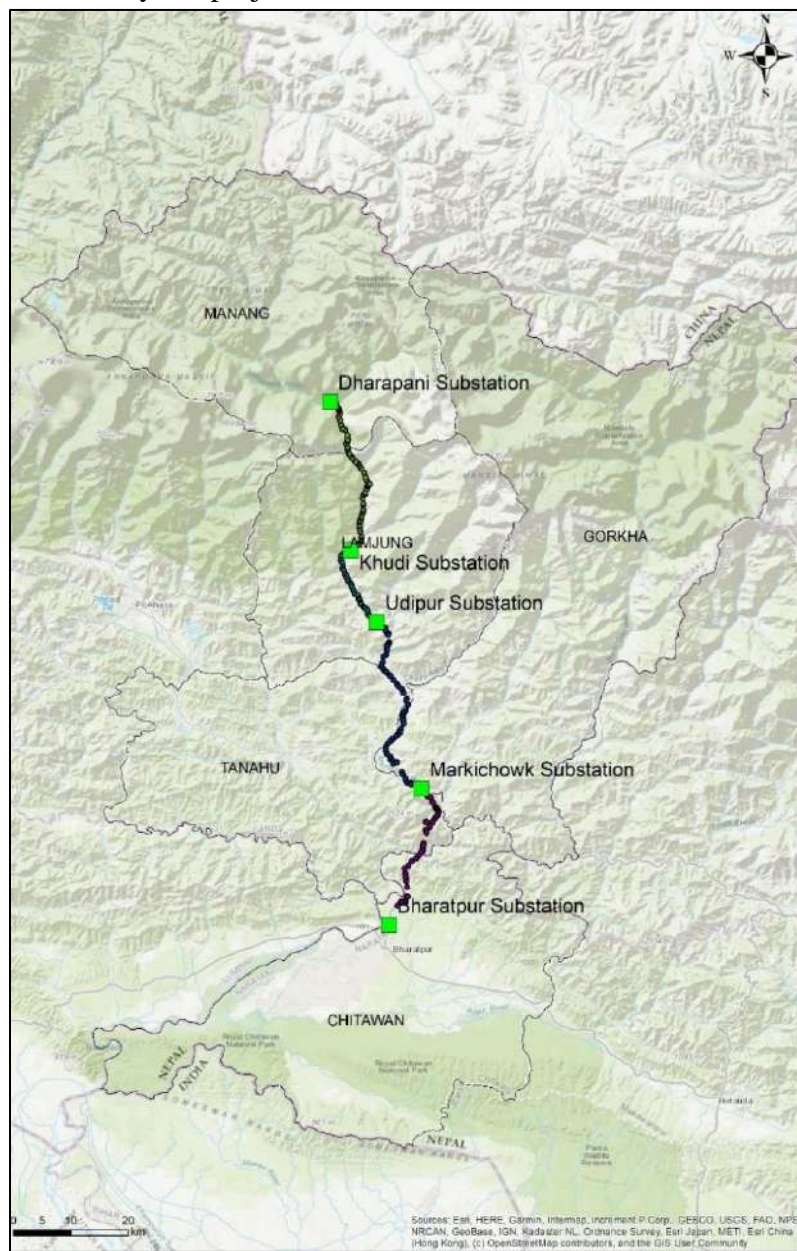


Figure 1: Project Location Map

The voltage level of the project will be 220kV. The proposed TL will be double circuit and the standard tower base dimensions will be 20m x 20m (for 220kV) of each tower leg foundation/ footing. The right of way (RoW) of the proposed TL is 15m on each side from the centerline from 220kV as per the Electricity Regulation, 2050 (1993).

The Marsyangdi Corridor TL project area also covers some part of Annapurna Conservation Area. Out of the total length of 109.07km, about 27.034km of the TL lies within the Annapurna Conservation Area (ACA) which is the first Conservation Area and largest Protected Area in Nepal. ACA covers an area of 7,629 sq. km. and is home to over 100,000 residents of different cultural and linguistic groups. ACAP is rich in biodiversity and is characterized by 1,226 species of flowering plants, 105 mammals, 518 birds, 40 reptiles and 23 amphibians. Considering the ecological sensitivity of the ACAP, the Biodiversity Impact Assessment (BIA) is carried out for the Manang –Udipur Section of the 220kV MCTLP.

The Manang-Udipur Section of the proposed project is located in Lamjung and Manang districts of Gandaki Province of Nepal. Altogether 2 Rural Municipalities (Nasong RM of Manang and Marsyangdi RM of Lamjung) and 1 Municipality (Besishahar Municipality of Lamjung) will be affected by the project. It has two sections namely; (i) Khudi-Manang Section and (ii) Khudi-Udipur Section. The Khudi-Manang section starts from the proposed Khudi substation at Marsyangdi RM and end at the proposed Dharapani substation at Ghelanchowk, Nasong RM. Similarly, Khudi-Udipur section starts from the proposed Khudi substation at Marsyangdi RM and end at the proposed substation at Udipur, Besishahar Municipality. The total length of the proposed TL is about approximately 45.25km (29.623km for Khudi-Manang section and 15.627km for Khudi-Udipur section).

1.1 Scope of the Work

The biodiversity impact assessment was carried out as EIA addendum so as to meet the EIB standards (Environmental and Social Standard 3 on Biodiversity and Ecosystems) and the EIB Guidance Note for Standard 3 on Biodiversity and Ecosystems. The Biodiversity impact assessment was focus in particular on the Project's potential impacts to the Annapurna Conservation Area Project (ACAP).

The objective of this study was to develop a standalone Biodiversity Impact Assessment (BIA) for the Marsyangdi Corridor (Manang-Udipur) 220kV TL project. However, given the biodiversity richness beyond ACA region, this BIA has also included the assessment of biodiversity of the area outside ACA. The Barandabhar corridor connects Chitwan National Park (CNP) with the Mahabharat range to the north. The Corridor covers an area of 161 km² (DNPWC, 2014). It is an important biological corridor for the Gandaki river basin, connecting the Terai with higher altitude areas.

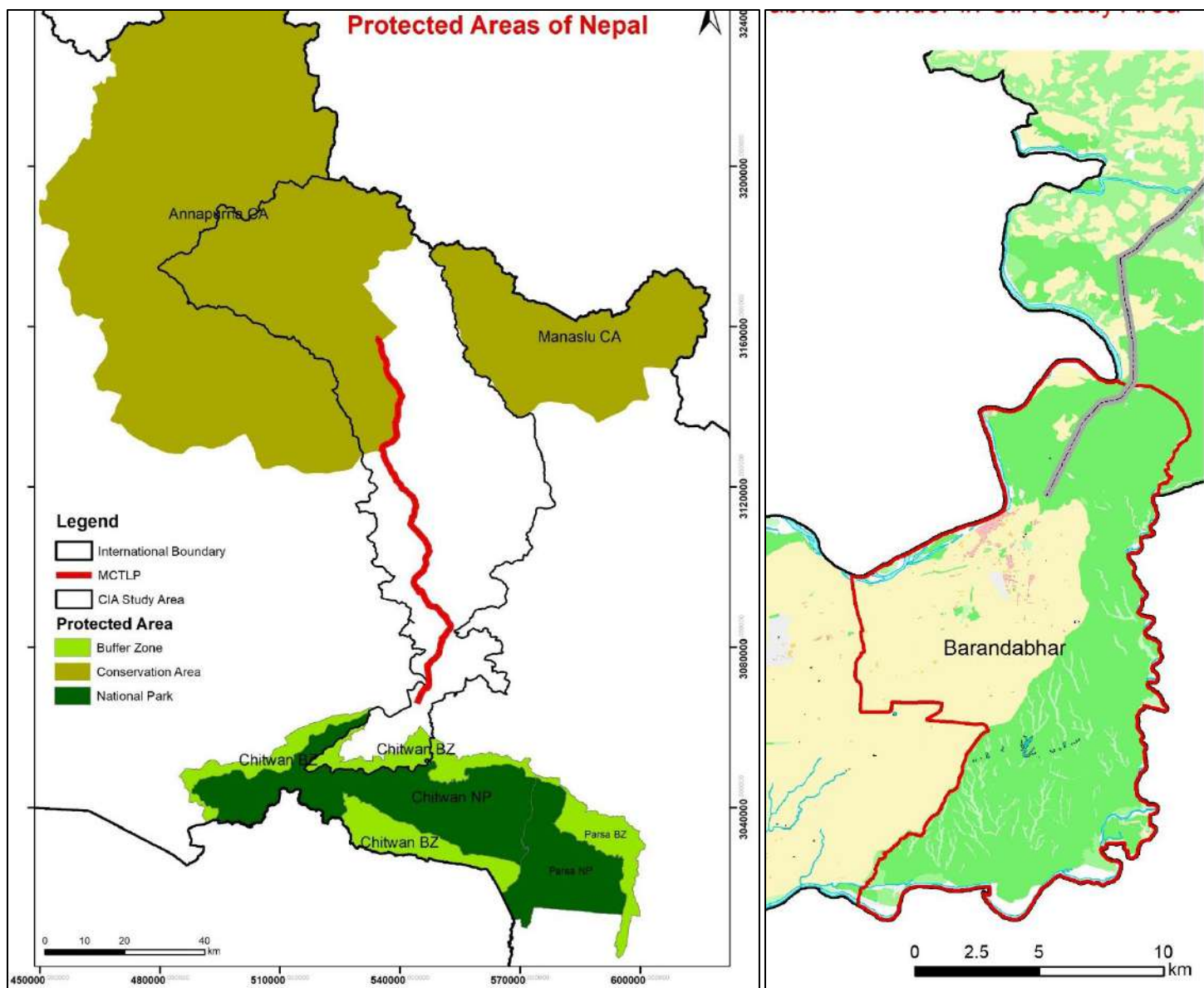


Figure 2: Protected Area System and Barandabhar Corridor within BIA Study Area

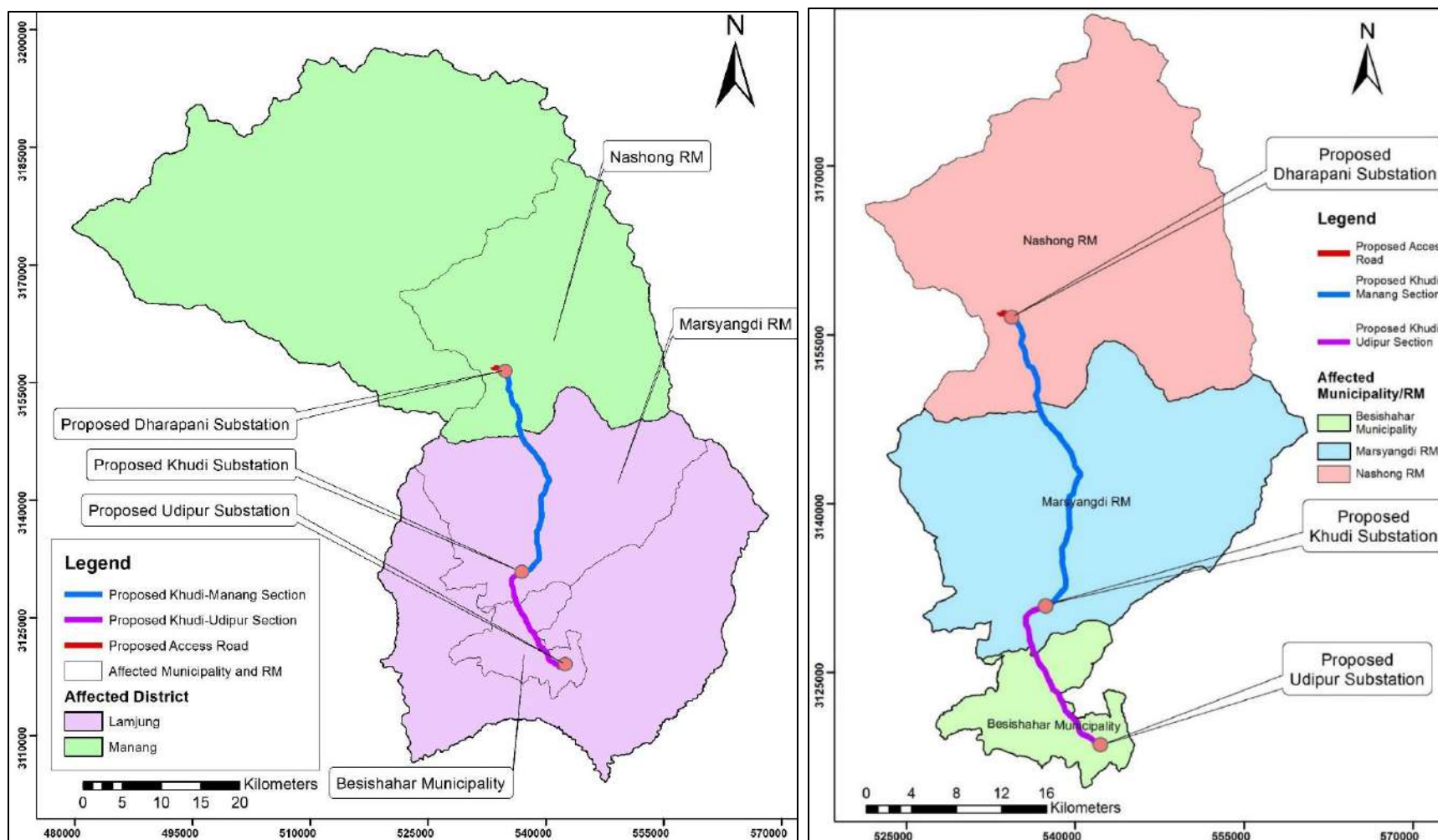


Figure 3: Manang-Uidpur Section of 220kV MCTLP

2 APPROACH AND METHODOLOGY

2.1 Literature Review

EIA and other relevant Project related documents available was reviewed. Following informations were gathered from the literature review:

- The total range or area the project cover.
- Size and other specifications of the project.
- The relationship (e.g. key distances etc.) between the project and the ACAP site.
- Baseline information of the ACA in the transmission line alignment

In addition, the following information about ACAP were collected through literature review.

- The reasons for the designation of the ACAP site.
- The conservation objectives of the site and the factors that contribute to the conservation value of the site.
- The existing baseline condition of the site.
- The key attributes of any protected nationally or internationally species or critically endangered, endangered or vulnerable species on the site.
- The dynamics of the habitats, species and their ecology.
- Those aspects of the site that are sensitive to change.
- The key structural and functional relationships that create and maintain the site's integrity.
- The seasonal influences on the key protected nationally or internationally species or critically endangered, endangered or vulnerable species on the site.
- Supporting documentation and permits, various permitting processes.

2.2 Data Collection

The study supplement the existing baseline data of the EIA report with field survey data and informations. During this BIA study, a detail survey of birds, wildlife, forest and vegetation were conducted adopting scientific tools and methodologies. The detail of the tools and methodologies used is discussed in the following section.

The study area surveyed includes as many as habitat type, taxnomic groups and bioclimatic zone as possible. The methodologies used in this BIA is repeatable and has collected the quantitative data.

Field study plans was formulated in line with 'Assessment of plans and projects significantly affecting Natura 2000 sites - Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive' of the European Commission. Further key informant interviews (KII) and focus group discussion (FGD) was also carried out during the field study enrich the field survey information.

2.2.1 Wild Animals

Forest, grassland and other suitable habitats were selected using GIS and updated landcover maps. Within these habitats, grids of 1 x 1km² were laid within 2km corridor of the proposed transmission line. For the study, we considered 2km on either side of the transmission line. For logistic simplicity while conducting the study, we divided the randomly selected sample sites into five different clusters. Two clusters spread across Manang and Lamjung district, two clusters spread across Lamjung district, and a single cluster in Chitwan district concentrated in the Barandabar area around the vicinity of the NEA power station.

2.2.1.1 Camera Trapping

A. First Camera Trap Survey - March 2022

During the first survey in March, the 20 camera trap units were distributed across two clusters at any given time. Each of the camera trap units monitored their assigned station site for an average period of a week after which they were collected in the same order of deployment and moved to a new location at a different cluster. This allowed us to smoothly circulate the available 20 units across the 51 sites maintaining a constant number of trap nights for each unit.

For the first survey, we started our monitoring work from the northernmost camera trap site in Bagarchhap village in Manang and moved southwards towards Lamjung as time progressed and finally completed the first phase survey in Chitwan (Figure.1). Detail information of camera trap setup date and retrieved date with the coordinate and camera trap nights is given in Appendix A.

B. Second Camera Trap Survey - May and June 2022

During the second survey in May and June, the 20 camera trap units were distributed across the four clusters from Manang and Lamjung. We selected 20 sites out of the 41 sites from the first study. These 20 sites for the second survey were selected based on habitat representation and logistics. We deployed the camera trap units in fewer locations but increased the survey duration from the previous average of a week to 16 days per camera trap station.

For the second survey, we started placing the camera trap units from the northernmost grid site in Bagarchhap village in Manang and gradually moved to sites in Lamjung. After deploying the 20 available camera trap units within a period of a week, we returned back from the field. We later went to retrieve the camera trap units in the same order they were placed, thus each unit was able to collect data for 16 days. Detail information of camera trap setup date and retrieved date with the coordinate and camera trap nights is given in Appendix A.

2.2.1.2 Social survey

Focus Group Discussion (FGD) and Key Informant Interviews (KII) were conducted with local communities and key stakeholders in the project area to supplement the data collected from camera traps and live sightings.

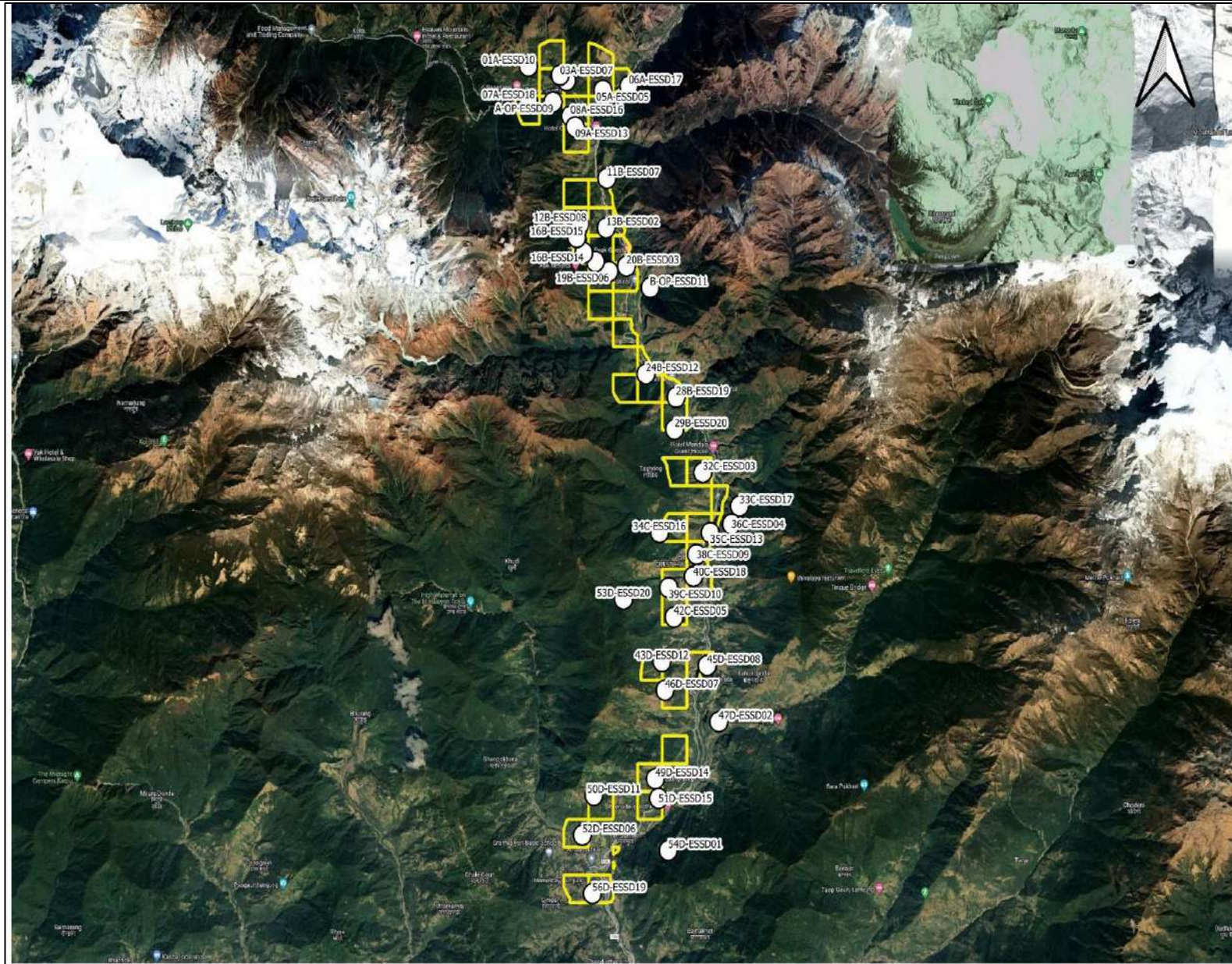


Figure 4: Camera Trap Station and Grids Overlaid for BIA in First Season

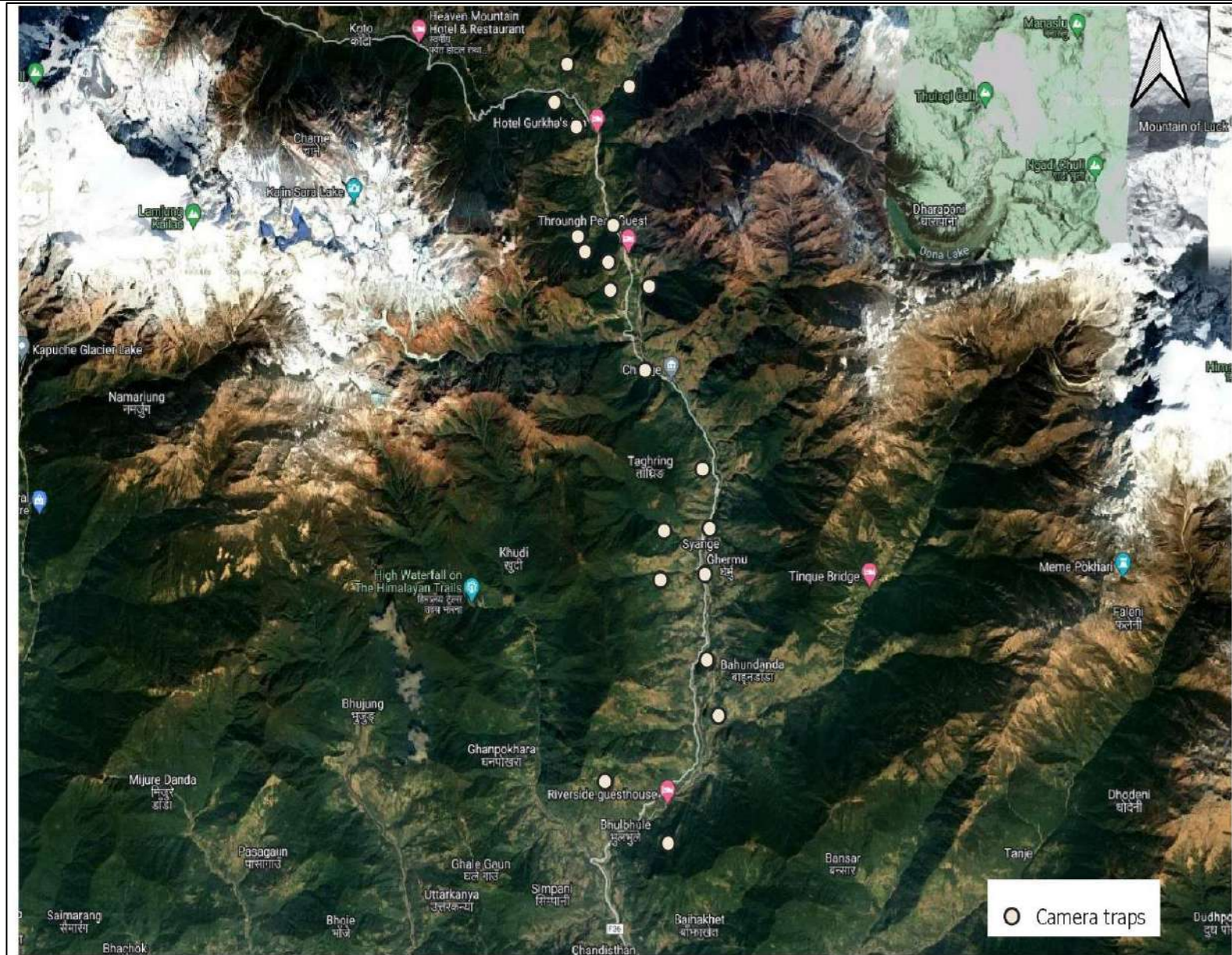


Figure 5: Camera Trap Station and Grids Overlaid for BIA in Second Season

2.2.2 Avi-fauna (Birds)

2.2.2.1 Vantage Point Count

A total of 71 vantage points were plotted along the proposed transmission line at a distance of 1.5 km interval. Minimum of 30 minutes was spent at these vantage points to carry out survey of birds. Additionally, bird survey was carried out in 5 substations and surrounding areas, as well. The section of transmission line and number of vantage points included for the survey of birds is given in Table 2.

2.2.2.2 Data Collection and Analysis

The collected data of the birds was categorized and analysed based on the following criteria;

- 1) IUCN red list – both global and national threatened status (critically endangered, endangered, vulnerable),
- 2) CITES list,
- 3) Restricted Range species,
- 4) Biome Restricted species,
- 5) presence of nest colonies
- 6) Migratory Species and
- 7) Habitat Status of the Bird Species (residential and migratory species).

The habitats important for birds were also identified during the survey. “Birds of Nepal: An Official Checklist” published in 2018 by Department of National Parks and Wildlife Conservation and Bird Conservation Nepal were followed to prepare and/or verify the list of bird species recorded in the project site.

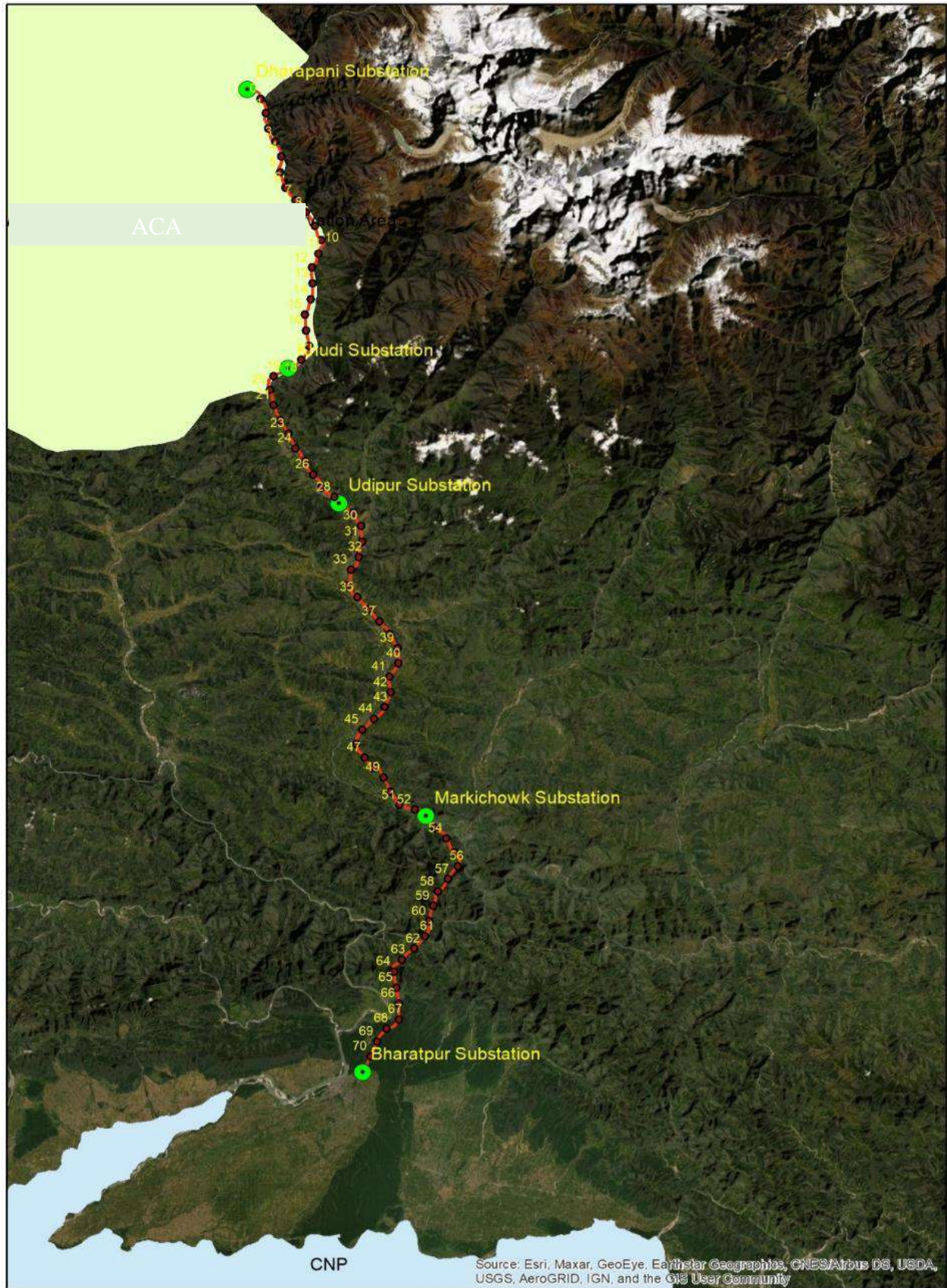


Figure 6: Location of Vantage Point

2.2.3 Flora/Vegetation

2.2.3.1 Study Area Mapping

The project area was divided into four strata namely Manang Khudi, Khudi Udipur, Udipur Markichowk and Markichowk Bharatpur Sections. The project area was surveyed with 120 nested plots. The number of sample plots was determined with the help of graph showing cumulative number of species and number of plots. The size of plot was 20m x 25m for tree, 10m x 10m for pole, 5m x 5m for sapling and 5m x 2m for seedling including herbs and medicinal plants ([ENREF 32](#) DoF, 2003).

Table 1: Number of plots allocated in the section

S.N.	Section	No of plots	Remarks
1	Manang Khudi Section	8×4=32	Nested plots
2	Khudi Udipur Section	8×4=32	
3	Udipur Markichowk Section	11×4=44	
4	Markichowk Bharatpur Section	8×4=32	
	Total Sample Plots	35×4=120	

2.2.3.2 Data Collection and Analysis

Data Collection

The diameter at breast height and height of plants were measured in the plot, their species were noted. The tree, pole and regeneration species found in the plots were recorded in check list (Appendix C). Similar process was applied to list out the herbs, shrubs and grass species found in the plot. In addition, the interaction with local people, community forest users' group and authority personnel were conducted during field visit. The first field visit was done from January to February, 2022 and second visit was done in May.

Moreover, the secondary data were collected from different source. The sources are environment impact assessment reports of i. Marsyangdi Corridor (Manang – Udipur) 2020kv Transmission Line Project and ii. Initial environmental examination Marsyangdi Corridor (Udipur – New Bharatpur) 220kV double circuit transmission line. Moreover, policy document and related published and unpublished papers were collected and desktop review was done.

Analysis of biophysical data: The data analysis was focused on to calculate a. biodiversity index, b. Importance value index, c. protection status c. conservation status of vegetation and flora. The biodiversity indexes were calculated using Shannon - Wiener diversity Index, Simpson Index of Diversity and Evenness. The importance Value Index (IVI) was calculated estimation of relative density, frequency and dominance. In addition, the conservation status of the flora and vegetation was analyzed comparing with the list of species according to Government of Nepal, Forest Act 2019, National Parks and Wildlife Conservation Act 1973, International Union for Conservation of Nature (IUCN) Red list, Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Annex I, II, III) (Marshall et al., 2020, Al-Namazi et al., 2021).

Species diversity calculation:

Alpha, Beta, Gamma diversity was also calculated

Shannon Wiener index (H') = $-\sum P_i \log p_i$(i)

Simpson's diversity, (D) = $1 - \sum P_i^2$ (ii)

Evenness E = $H / \log (N)$ (iii)

Where,

P_i is the relative abundance of each species, i.e., the proportion of individuals of a given species relative to the total no. of individual in the community (Baumgartner, 2002).

Importance Value Index (IVI)

Importance Value Index is sum of relative frequency, relative density and relative dominance.

IVI= Relative Frequency+ Relative Density+ Relative Dominance

Frequency, Density and Dominance

Frequency: Frequency of individual species will be calculated by using standard method (Zobel et al. 1987) as follows:

Frequency (F) = $\frac{\text{No. of plots with individual species}}{\text{Total no. of plots studied}}$

Relative Frequency (F) = $\frac{\text{No. of plots with individual species}}{\text{Total no. of plots studied}} \times 100$

Density (D) = $\frac{\text{Total no. of species in all sample plots}}{\text{Total no. of sample plots studied}}$

$\frac{\text{Total no. of species in all sample plots} \times 100}{\text{Total no. of sample plots studied}}$

Dominance: Degree of predominance of one or a few species in an ecological community.

Dominance = $\frac{\pi D^2}{4}$

Relative Dominance = $\frac{\text{Dominance} \times 100}{\text{Total dominance}}$

a) **Analysis of potential impact:** The descriptive analysis was done to show the potential impacts caused by Marsyangdi Transmission Line Corridor.

b) Social survey

Focus Group Discussion (FGD) and Key Informant Interviews (KIIs) was conducted with local communities and key stakeholders in the project area to supplement the data collected from camera traps and live trapping. The key informants was identified in the field with the help of government officials, elected representatives and local communities.

c) Impact Identification

Based on the data collected, likely impacts of a project on the biological environment of ACAP site was predicted. It was carried out within a structured and systematic framework and completed as objectively as possible.

2.3 Public Consultation and Information Disclosure

The draft report of BIA along with its executive summary prepared in Nepali language was disclosed through the official webpage of NEA (www.nea.org.np). A public notice was published in the *Gorkhapatra* National Daily on 17th December, 2022 (Poush 2, 2079) which informed the concerned stakeholders about accessing of the BIA draft report through NEA webpage and further requested to provide the comments/suggestions on the draft (Appendix D). The public notice was affixed in all the project affected local levels (RM, Municipality, MC), affected wards and places of people congregation. The public deeds (*Muchulka*) of notice are presented in Appendix D of CIA report.

As a major part of the public disclosure, district level workshop was carried out in all the project affected districts. The objective of such workshop was to present the findings of the BIA and collected the relevant concerns/suggestions from the stakeholders. A brochure/summary report of BIA prepared in Nepali language was distributed to the participants. The list of participants and the suggestions received from the district level workshops are presented in Appendix D .

District Level Workshop

SN	Date	Venue/DISTRICT	No. of Participants
1.	Jan 3, 2023 (2079-9-19)	Dharapani, Nasong RM, MANANG	45
2.	Jan 5, 2023 (2079-9-21)	Besishahar -7, LAMJUNG	60
3.	Jan 4, 2023 (2079-9-20)	Thatipokhari, Palungtar-5, GORKHA	45
4.	Jan 6, 2023 (2079-9-22)	Anbukhaireni RM-3, TANAHUN	56
5.	Jan 8, 2023 (2079-9-24)	Bharatpur MC-29, CHITWAN	52
Total			258

After the completion of the district level workshops, a central level information disclosure and workshop was organized on February 2, 2023 at Kathmandu. Request letters were sent to major stakeholders to attend the workshop. A total of 80 participants were present in the workshop (Appendix D of CIA). Senior management level staffs of NEA (including the Managing Director, Deputy Managing Directors and Directors) were present in the workshop.

2.4 Limitation of the Study

- I. Since wildlife and camera trap studies are better when the camera traps are left for longer durations in the study area, we recommend a longer time frame for future studies. As the trap sites and number of days decrease, the detection probability decreases. This decrease sometimes results in data that are unusable for occupancy analysis. In other words, the confidence intervals are so large that they do not have any practical importance.
- II. Vandalism and theft of our camera trap units in three camera trap stations during the first phase survey resulted in loss of some data for that time period.
 - a. At station ESSD05-42C, the camera trap unit ESSD05 was missing when we went to collect it. When we asked the local villagers, we discovered that a village child had taken it. It was later recovered safely.

- b. At station ESSD14-49D, the camera trap unit ESSD14 was vandalized and stolen by breaking the safety iron chain. We were later successful in recovering the camera trap unit from the police station at Bhulbhule. The strap was missing and the external housing case of the unit was partly damaged.
 - c. At station ESSD14-43D, the camera trap was vandalized. Someone had cut the strap and tied it to the camera trap unit covering the camera lens.
- III. This bird survey covered mainly the bird species of two seasons (Autumn and Winter). This survey has mostly covered the residential and some winter migratory birds. The study team chooses the late winter time for the second survey aiming to cover the winter migratory birds those returned through the Marsyangdi corridor to their breeding sites in the northern hemisphere. There is still need of additional 1 survey (summer) to cover more migratory bird species as well.

3 BASELINE CONDITION OF THE BIOLOGICAL ENVIRONMENT

3.1 Wildlife

3.1.1 Mammals recorded during the first season

We set up 41 camera trap stations for the BIA in ACAP and near ACAP with minimum number of camera trap nights being 2 and maximum number of camera trap nights being 10. The camera traps were deployed from 7 March 2022 to 4 April 2022. In total, the camera traps were able to capture 14 species of mammals excluding rodents and unidentified species. Apart from the camera traps, we also used interviews and FGD to collect information about wildlife in the area.

Table 2: Mammals recorded in the project area

S. N.	Common Name	Scientific Name	National Status	Global Status	National Legal Status	Evidence*
1	Assamese Macaque	<i>Macaca assamensis</i>	Vulnerable	Near Threatened	Protected	DS, CT, IN
2	Barking Deer	<i>Muntiacus vaginalis</i>	Vulnerable	Least Concern		CT, IN
3	Bat					DS, IN
4	Ferret Badger	<i>Melogale sps</i>	Data Deficient	Least Concern		CT
5	Jungle Cat	<i>Felis chaus</i>	Least Concern	Least Concern		CT
6	Langur	<i>Semnopithecus schistaceus</i>	Least Concern	Least Concern		CT, IN
7	Large Indian Civet	<i>Viverra zibetha</i>	Near Threatened	Least Concern		CT
8	Leopard	<i>Panthera pardus</i>	Vulnerable	Vulnerable		CT, IN
9	Leopard Cat	<i>Prionailurus bengalensis</i>	Vulnerable	Least Concern	Protected	CT
10	Malayan Porcupine	<i>Hystrix brachyura</i>	Data Deficient	Least Concern		CT, IN
11	Masked Palm Civet	<i>Paguma larvata</i>	Least Concern	Least Concern		CT
12	Rhesus Macaque	<i>Macaca mulatta</i>	Least Concern	Least Concern		DS, CT, IN
13	Rodents					CT
14	Squirrel					CT
15	Yellow Throated Marten	<i>Martes flavigula</i>	Least Concern	Least Concern		CT, IN
16	Himalayan Black Bear	<i>Ursus thibetanus</i>	Endangered	Vulnerable		CT (ACAP), IN
17	Himalayan Goral	<i>Naemorhedus goral</i>	Near Threatened	Near Threatened		CT (ACAP), IN
18	Himalayan Serow	<i>Capricornis sumatraensis</i>	Data Deficient	Vulnerable		CT (ACAP), IN
19	Musk Deer	<i>Moschus sps</i>		Endangered	Protected	CT (ACAP), IN
20	Flying Squirrel					IN
21	Red Fox	<i>Vulpes vulpes</i>	Data Deficient	Least Concern		IN

S. N.	Common Name	Scientific Name	National Status	Global Status	National Legal Status	Evidence*
22	Lynx	<i>Lynx lynx</i>	Vulnerable	Least Concern	Protected	IN
23	Golden Jackal	<i>Canis aureus</i>	Least Concern	Least Concern		IN
24	Yellow-bellied Weasel	<i>Mustela kathiah</i>	Data Deficient	Least Concern		DS, IN
25	Himalayan Tahr	<i>Hemitragus jemlahicus</i>	Near Threatened	Near Threatened		IN

* Note: CT = Camera trap, IN = Interview, LT = Literature, DS = Direct sighting, CT (ACAP) = Camera trap set by ACAP

In the camera traps, Masked Palm Civet was captured in most independent captures (n=38) followed by Leopard Cat (n = 22). Humans were captured in all of the camera trap stations showing that almost all of the area within 2km of the transmission line has some anthropogenic disturbance. Livestock was also captured in 25 of the stations.

Table 3: Species captured with Total Number of Independent Photographs and Number of Stations Captured

S.N.	Species	Independent Captures	No. of Stations Captured
1	Assamese Macaque	4	2
2	Barking Deer	11	5
3	Birds	46	21
4	Ferret Badger	3	2
5	Humans	259	41
6	Jungle Cat	2	1
7	Langur	3	2
8	Large Indian Civet	8	6
9	Leopard	5	5
10	Leopard Cat	22	10
11	Livestocks	104	25
12	Malayan Porcupine	2	1
13	Masked Palm Civet	38	15
14	Rhesus Macaque	2	1
15	Rodents	17	9
16	Squirrel	1	1
17	Unidentified	15	12
18	Yellow Throated Marten	5	5

Total number of stations considered for this table is 41. Although it seems that the southern part of the project area (Lamjung district) from the naive species richness map (Figure 2), we suggest precaution in interpreting this as such. Our trap nights were not more than 10 in any of the camera trap stations, we think that the camera trap stations in Manang might have missed a lot of potential high importance species such as Himalayan Black Bear, Himalayan Serow.

3.1.2 Mammals recorded during the second season

We set up 20 camera trap stations for the second survey season of BIA in ACAP. The camera traps were deployed from 19 May 2022 to 9 June 2022. In total, the camera traps were able to capture 9 species of mammals excluding rodents and unidentified species (Table 4).

Table 4: Mammals recorded in the Project Area

S.N.	Common Name	Scientific Name	National Status	Global Status	National Legal Status	Evidence*
1	Barking Deer	<i>Muntiacus vaginalis</i>	Vulnerable	Least Concern		CT
2	Langur	<i>Semnopithecus schistaceus</i>	Least Concern	Least Concern		CT
3	Large Indian Civet	<i>Viverra zibetha</i>	Near Threatened	Least Concern		CT
4	Leopard Cat	<i>Prionailurus bengalensis</i>	Vulnerable	Least Concern	Protected	CT
5	Malayan Porcupine	<i>Hystrix brachyura</i>	Data Deficient	Least Concern		CT
6	Masked Palm Civet	<i>Paguma larvata</i>	Least Concern	Least Concern		CT
7	Rodents					CT
8	Yellow Throated Marten	<i>Martes flavigula</i>	Least Concern	Least Concern		CT
9	Himalayan Goral	<i>Naemorhedus goral</i>	Near Threatened	Near Threatened		CT
10	Yellow-bellied Weasel	<i>Mustela kathiah</i>	Data Deficient	Least Concern		CT
11	Golden Jackal	<i>Canis aureus</i>	Least Concern	Least Concern		DS
12	Mongoose	<i>Herpestes sps.</i>				DS
13	Assamese Macaque	<i>Macaca assamensis</i>	Vulnerable	Near Threatened	Protected	DS

* Note: CT = Camera trap, IN = Interview, LT = Literature, DS = Direct sighting, CT (ACAP) = Camera trap set by ACAP

In the camera traps, Masked Palm Civet was captured in most independent captures (n=53) followed by Leopard Cat (n = 38).

Table 5: Species captured with Total number of Independent Photographs and Number of Stations Captured

S.N.	Species	Independent captures	Number of stations captured
1	Barking Deer	9	5
2	Goral	1	1
3	Langur	4	3
4	Large Indian Civet	9	3
5	Leopard Cat	38	11
6	Malayan Porcupine	1	1

S.N.	Species	Independent captures	Number of stations captured
7	Masked Palm Civet	53	17
8	Rodents	29	13
9	Yellow Bellied Weasel	1	1
10	Yellow Throated Marten	13	9

Total number of stations considered for this table is 20.

3.1.3 Noteworthy species

We present some of the species from our camera trap study that we think should be paid more attention.

Assamese Macaque: Assamese Macaque are listed as Vulnerable in National Red List and are also protected species under the National Parks and Wildlife Conservation Act, 1973. A major concern for this species will be conflict with local farmers and electrocution from the transmission lines.

Ferret Badger: Although the global status in IUCN Red List of this species in Least Concern, there are very few records of the species from the country. This lack of data makes this species a Data Deficient species for the country.

Leopard Cat: Leopard Cat is a protected species under the National Parks and Wildlife Conservation Act 1973. It is also listed as Vulnerable species in the National Red List.

Leopard: Leopard is classified as Vulnerable in both National and Global IUCN Red List making it a species of concern for the project area. However, it doesn't have any special legal protection under the National Parks and Wildlife Conservation Act 1973. This big cat is also one of the most problematic species due to livestock depredation.

3.1.4 Status of wildlife in different Clusters of ACAP

Cluster A: Bagarchhap, Dharapani, Odar periphery (Manang)

From 9 camera trap stations in cluster A in Manang, we captured 7 different species including rodents that could not be identified to species level. Apart from the camera trapping, we also directly sighted Yellow-bellied Weasel (below Odar) in this cluster.

Table 6: Species were captured in cluster A

S.N.	Species	Independent capture
1	Goral	1
2	Humans	112
3	Langur	2
4	Leopard	1
5	Leopard Cat	11
6	Livestock	85
7	Masked Palm Civet	21
8	Rodents	1
9	Yellow Throated Marten	8

People with guns at night were also captured from this cluster which points out that hunting is common in this cluster. Participants in the FGDs were also concerned about hunting in this area.

Cluster B: Taal, Khotro (Manang), Chyamche (Lamjung) periphery

Nine species were recorded from 14 camera trap stations in this cluster. A Golden Jackal (near Gherang) was also directly sighted in this cluster.

Table 7: Species captured from cluster B

S.N.	Species	Independent
1	Barking Deer	3
2	Ferret Badger	2
3	Humans	104
4	Langur	3
5	Leopard	3
6	Leopard Cat	10
7	Livestock	78
8	Masked Palm Civet	20
9	Rodents	7
10	Yellow Bellied Weasel	1
11	Yellow Throated Marten	4

Alternative trekking route has also been opened through this section.

Cluster C: Jagat, Syange, Ghermu, Taghrin (Lamjung)

Nine species were captured from 10 camera trap stations in this cluster. Mongoose (Taghrin) and Assamese Macaque (Syange) were also sighted directly from this cluster.

Table 8: Species Captured from 10 stations in cluster C

S.N.	Species	Independent captures
1	Barking Deer	2
2	Ferret Badger	1
3	Humans	124
4	Jungle Cat	2
5	Langur	2
6	Large Indian Civet	14
7	Leopard Cat	17
8	Livestock	48
9	Masked Palm Civet	15
10	Rodents	19
11	Yellow Throated Marten	3

Cluster D: Bhulbhule, Khudi, Kalaghirin, Bahundanda, Bhusme (Lamjung)

This was the richest cluster in terms of naive species richness in all of our camera trap clusters. Eleven species were captured in 12 camera trap stations.

Table 9: Species captured from cluster D

S.N	Species	Independent captures
1	Assamese Macaque	4
2	Barking Deer	15
3	Humans	158
4	Large Indian Civet	3
5	Leopard	1
6	Leopard Cat	22
7	Livestock	52
8	Malayan Porcupine	3
9	Masked Palm Civet	35
10	Rhesus Macaque	2
11	Rodents	19
12	Squirrel	1
13	Yellow Throated Marten	3

3.1.5 Species Richness of Camera Trap Sites

Although it seems that the southern part of the project area (Lamjung district) from the native species richness map (Figure 6), we suggest precaution in interpreting this as such. Our trap nights were not more than 10 in any of the camera trap stations in the first season. In the second season the camera traps were left for 15-16 days. These are not significant efforts to capture all the species in the project site.

The cumulative species richness of northern sites with Cluster A and B combined is 10 different species compared to 13 species in the southern sites with Cluster C and D combined. For the trap efforts we put, this cannot distinguish which sites were more biodiverse.

We think that the camera trap stations in Manang might have missed a lot of potential high importance species such as Himalayan Black Bear and Himalayan Serow. The habitats in the northern part were also less disturbed compared to the northern sites. This also is an important factor to take into account as most of the species in the southern sites are species tolerant to slight to mid-level human disturbances. Barking deer, macaques, langur, marten, and Malayan porcupine don't suffer as much as Gorals, Himalayan Black Bear, Musk deer and Himalayan Serow in comparison. We suspect that the northern sites might have more elusive core-species in our camera traps but were reported in our FGDs.

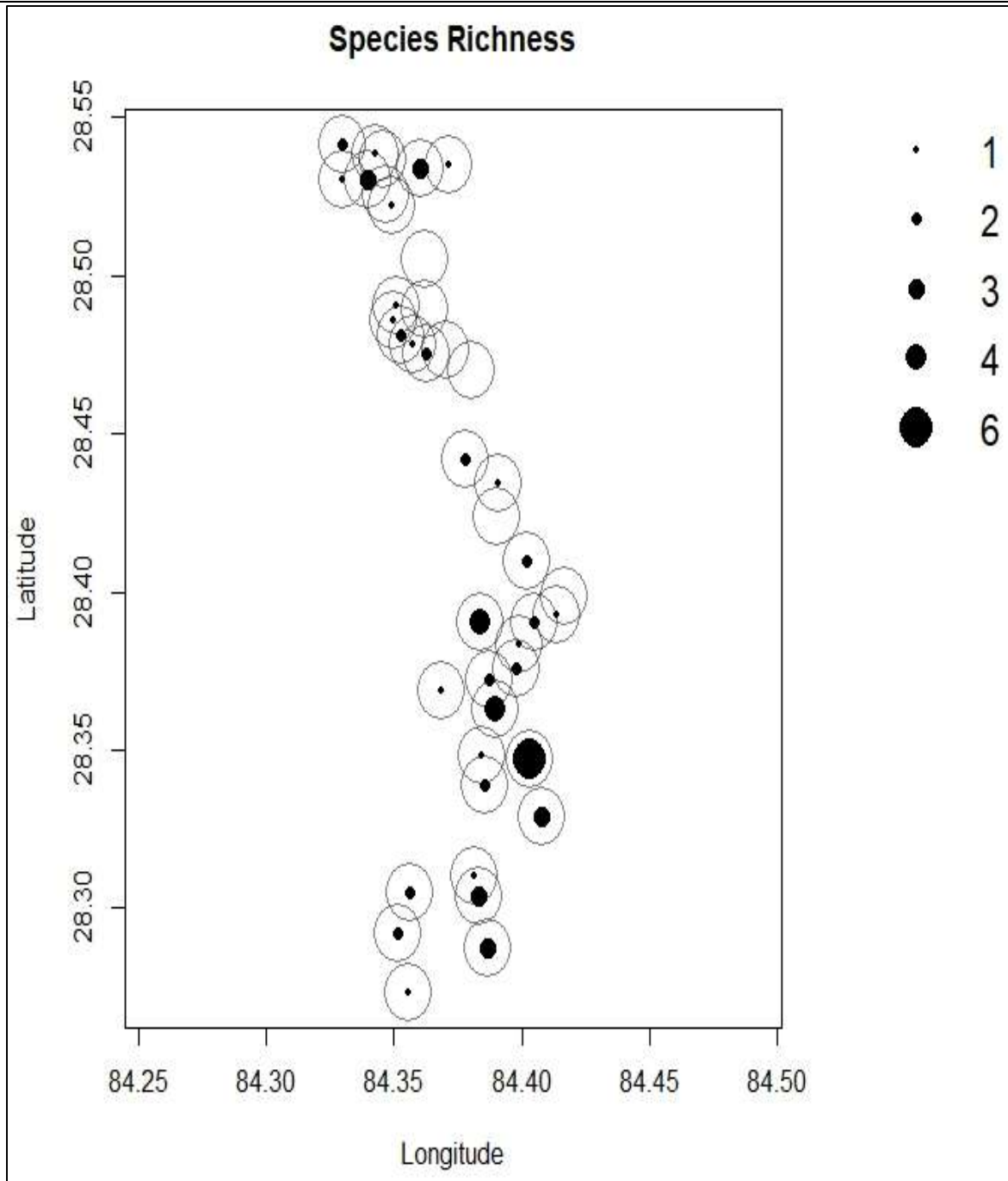


Figure 7: Species richness from the camera trap images for the first season.

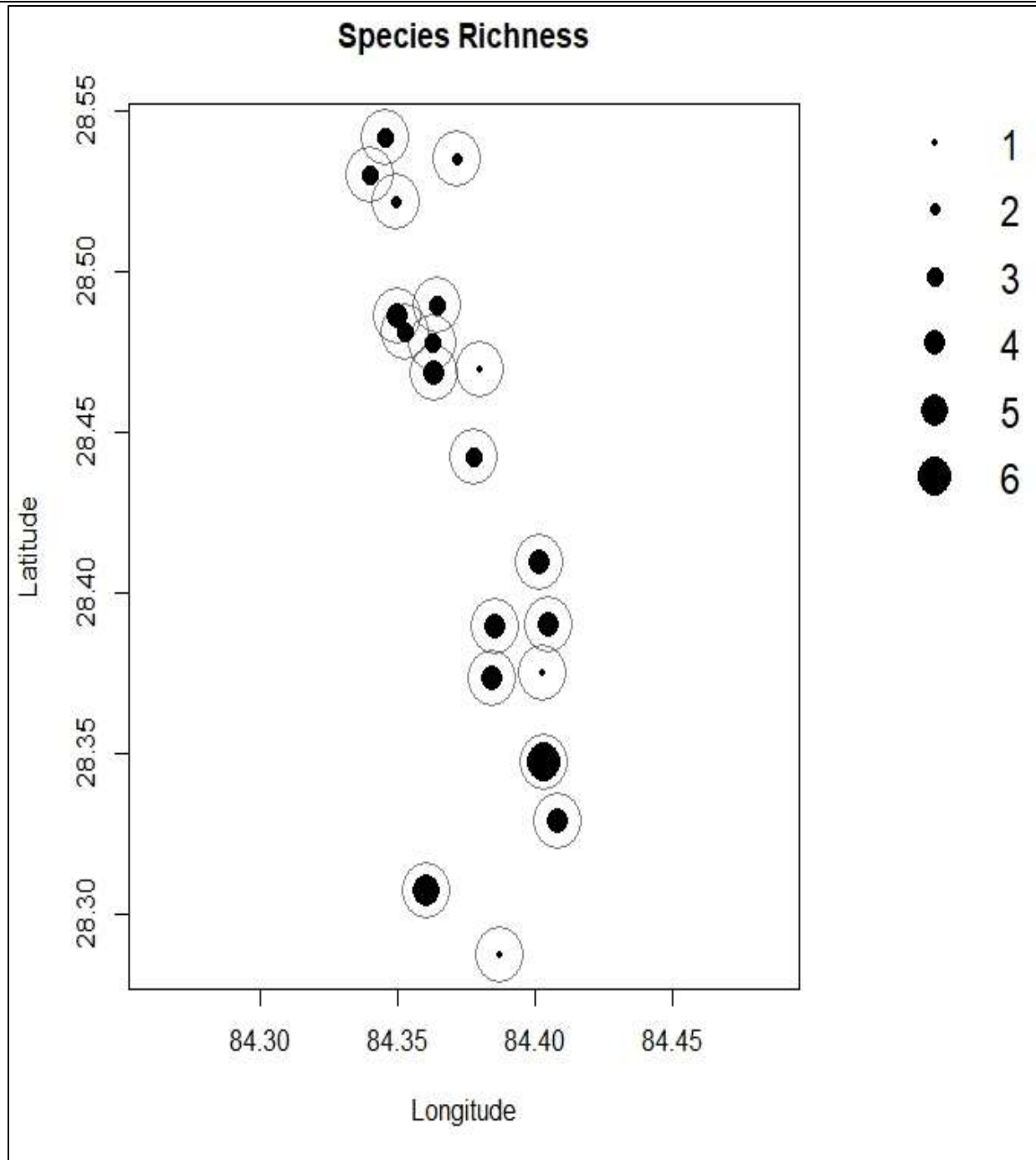


Figure 8: Species richness from the camera trap images for the second season

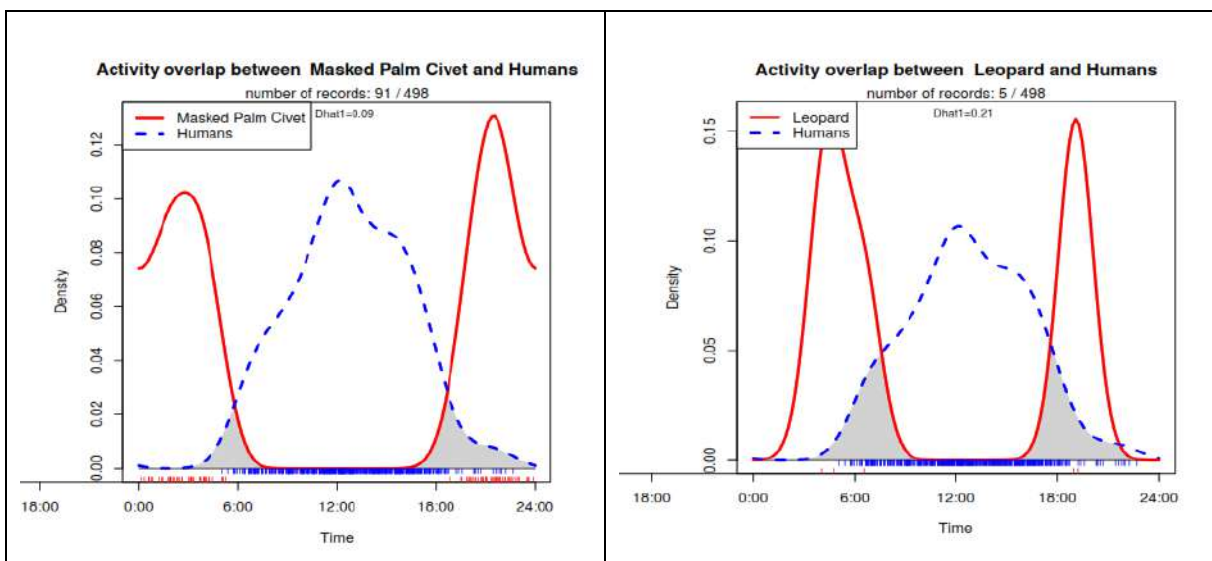
3.1.6 Temporal Activity of the species

Apart from space use, it is also crucial that the temporal impact of the project was taken into consideration to formulate effective mitigation measures. We used activity plots and activity overlap plots with humans from our camera trap images to assess the potential impacts of the project on the wildlife species of the project site.

We plotted activity overlap plots for seven species with humans (Figure 8), 1. Masked Palm Civet, 2. Leopard, 3. Leopard Cat, 4. Yellow-throated Marten, 5. Langur, 6. Barking Deer and 7. Large Indian Civet. Rest of the species were ignored due to low detection number (less than 5). Four species, Masked Palm Civet, Leopard, Leopard Cat and Large Indian Civet had distinct temporal avoidance with humans. These species are nocturnal. Due to their activity pattern, they won't have much direct encounters with the construction crew. However, the risk is that if the crew is working on their crucial habitat sites, they might highly disturb these species without even knowing because they are active at night.

On the other hand, Yellow-throated Marten and Langur had high temporal overlap with humans. Barking Deer had overlap during dusk and dawn and avoided peak human activity time. These species have higher chances of having direct encounters with the construction crew. That might lead to three negative consequences:

1. Killing of species to avoid threats to workers: The construction crews might take these species as a threat to the safety of their crews and opt for eradicating them from their site. These species can also end up in their temporary or permanent structures being a nuisance for the crew.
2. Killing of species as bushmeat and medicine: With increased encounters, the crew will have knowledge on where these species can be caught/trapped. Since a lot of communities in Nepal hunt and use bushmeat for medicine, this can happen with these species too.
3. Habituation of the wildlife with human presence: Although this can seem harmless, it will cause problems in future increasing conflict with local communities in future. The crew might feed the wildlife they encounter frequently. In some cases, the species can become bolder with increased exposure to human presence. In both cases, after the crew leaves, the wildlife habituated with humans can raid human settlements for food, avoid human presence and cause nuisances for locals even after the construction has been completed.



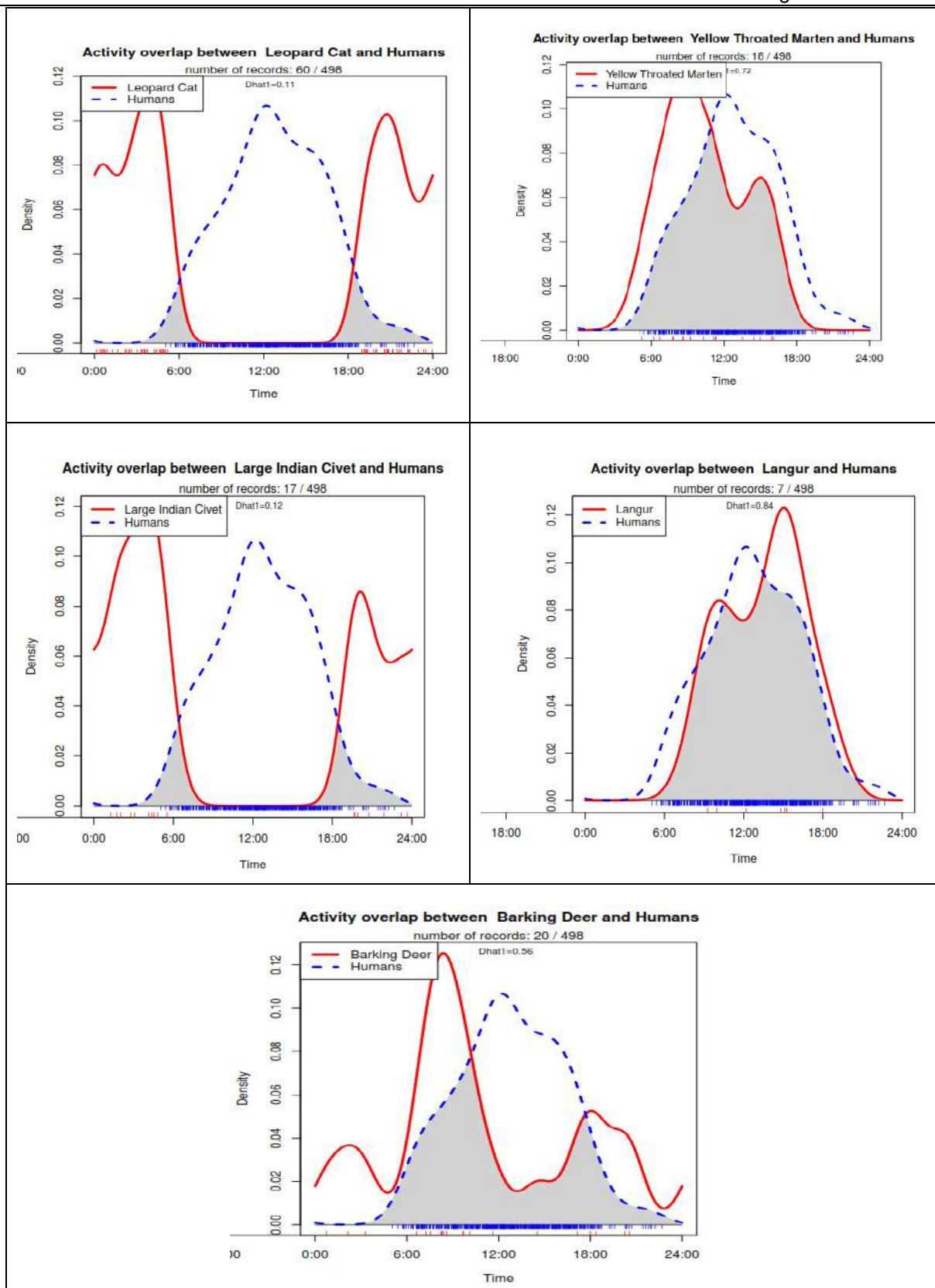


Figure 9: Activity overlap of wildlife species with human activity in the project area from both season data. Species with low independent detections ($n < 5$) have been ignored for this graph.



Figure 10: Wildlife Captured in Camera Trap

3.2 Avi-fauna (Birds)

There are 886 bird species recorded in Nepal (DNPWC and BCN 2018). The survey carried out from 15 – 24 May 2022, a total of 183 species of birds were recorded that belong to 16 orders and 55 families. 3 species of globally threatened birds (Egyptian Vulture, Red-headed Vulture and White-rumped Vulture) and 9 species of nationally threatened birds (Satyr Tragopan, Barred Cuckoo-dove, Bearded Vulture, Egyptian Vulture, Red-headed Vulture, Himalayan Griffon, White-rumped Vulture, Yellow-rumped Honeyguide and Red-breasted Parakeet) were recorded.

In the bird survey carried out in winter season from 2-13 March 2022, 171 species of birds were recorded that belong to 14 orders and 47 families. 5 species of globally threatened birds (Common Pochard, Egyptian Vulture, Red-headed Vulture, White-rumped Vulture and Steppe Eagle) and 9 species of nationally threatened birds (Bearded Vulture Egyptian Vulture, Red-headed Vulture, Himalayan Griffon, White-rumped Vulture, Cinereous Vulture, Steppe Eagle, Yellow-bellied Warbler and Hume's Bush-warbler) were recorded. Nepal's endemic bird species Spiny Babbler was also recorded during the survey.

Similarly, in the bird survey carried out in autumn season from 19 – 31 October 2021, 142 species of birds were recorded that belong to 16 orders and 47 families. 4 species of globally threatened birds (Egyptian Vulture, Red-headed Vulture, Greater Spotted Eagle and Steppe Eagle) and 7 species of nationally threatened birds (Bearded Vulture, Egyptian Vulture, Red-headed Vulture, Himalayan Griffon, Greater Spotted Eagle, Steppe Eagle and Hume's Bush-warbler) were recorded.

Combining the result of first, second and third bird survey, there are a total of 256 bird species recorded from the project sites. The detail list of the birds recorded in the three season surveys is given in Appendix B.

Birds of prey, also known as raptors, include species of bird that primarily hunt and feed on vertebrates that are small to large. Additionally, they have keen eyesight for detecting food at a distance or during flight, strong feet equipped with talons for grasping or killing prey, and powerful, curved beaks for tearing flesh. They can fly high, fast. Raptors recorded during the survey are given in the table below:

Table 10: Raptors Recorded in Surveys

SN	English Name	Scientific Name	Nepali	GTS	NTS	Migration	1 st Survey	2 nd Survey	3 rd Survey
1.	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	मधुहा			R/PM	2		2
2.	Crested Serpent-eagle	<i>Spilornis cheela</i>	काकाकुल			R		10	10
3.	Bearded Vulture	<i>Gypaetus barbatus</i>	हाडफोर		VU	R	2	2	3
4.	Egyptian Vulture	<i>Neophron percnopterus</i>	सेतो गिद्ध	EN	VU	R	1	3	9
5.	Red-headed Vulture	<i>Sarcogyps calvus</i>	सुन गिद्ध	CR	EN	R	3	6	5
6.	Himalayan Griffon	<i>Gyps himalayensis</i>	हिमाली गिद्ध		VU	R	4	73	23
7.	White-rumped Vulture	<i>Gyps bengalensis</i>	डंगर गिद्ध	CR	CR	R		2	1
8.	Cinereous Vulture	<i>Aegypius monachus</i>	राजगिद्ध		EN	PM/WV		1	
9.	Mountain Hawk-eagle	<i>Nisaetus nipalensis</i>	पहाडी शदलचील			R/WV	1	1	2
10.	Black Eagle	<i>Ictinaetus malaiensis</i>	द्रोणक चील			R	3	1	
11.	Greater Spotted Eagle	<i>Clanga clanga</i>	जीवाहार महाचील	VU	VU	WV	1		
12.	Steppe Eagle	<i>Aquila nipalensis</i>	गोमायु महाचील	EN	VU	PM/WV	10	14	
13.	Bonelli's Eagle	<i>Aquila fasciata</i>	मोरङ्गी चील			R	8	3	4
14.	Booted Eagle	<i>Hieraaetus pennatus</i>	काँधचन्द्र चील			R/PM/WV	1	1	
15.	Shikra	<i>Accipiter badius</i>	शिक्रा			R	1		4
16.	Besra	<i>Accipiter virgatus</i>	बेसरा			R	1		
17.	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	बनबाज			R/PM/WV	1		2
18.	Northern Goshawk	<i>Accipiter gentilis</i>	बलाकाक्षवनबाज			R			1
19.	Black Kite	<i>Milvus migrans</i>	कालो चील			R/PM	42	46	47
20.	Himalayan Buzzard	<i>Buteo refectus</i>	शयेनबाज			PM/WV	7	6	
21.	Long-legged Buzzard	<i>Buteo rufinus</i>	लामखुट्टे शयेनबाज			PM/WV	2	1	
22.	Upland Buzzard	<i>Buteo hemilasius</i>	पहाडी शयेनबाज		DD	R/WV	2	1	
23.	Collared Falconet	<i>Microhierax caerulescens</i>	पौरी बाज		NT	R	2		
24.	Lesser Kestrel	<i>Falco naumanni</i>	सानो बौडाइ		NT	PM/WV	1		
25.	Common Kestrel	<i>Falco tinnunculus</i>	बौडाइ			R/PM/WV	10	11	14
26.	Peregrine Falcon	<i>Falco peregrinus</i>	शाहीबाज			R/PM/WV	2	1	2

Note: GTS-Globally Threatened Species, NTS-Nationally Threatened Species, EN-Endangered, CR-Critically Endangered, VU-Vulnerable, R-Residential, AL-Altitudinal Migrant, WV-Winter Visitor, PM-Passage Migrant.

Similarly, birds of wetlands and associated habitat were also recorded during the survey. That includes, waterfowl, egrets and herons, cormorants, waders. The list of birds from wetland and associated habitats with their migratory status are given in the table below:

Table 11: Birds of wetlands and associated habitat recorded (Autumn-1st Survey, Winter 2nd Survey and Summer 3rd Survey)

SN	English name	Scientific name	Nepali	GTS	NTS	Migration	1 st Survey	2 nd Survey	3 rd Survey
1.	Goosander	<i>Mergus merganser</i>	मणितुण्डक			WV		1	
2.	Ruddy Shelduck	<i>Tadornaferruginea</i>	चखेवाचखेवी		NT	WV		8	
3.	Common Pochard	<i>Aythya ferina</i>	कैलोटाउके हाँस	VU	NT	PM/WV		1	
4.	Tufted Duck	<i>Aythya fuligula</i>	कालीजुरे हाँस			PM/WV	2		1
5.	Gadwall	<i>Mareca strepera</i>	खडखडे हाँस			PM/WV	8	4	
6.	Eurasian Wigeon	<i>Marecapenelope</i>	सिन्दुरे हाँस			PM/WV	1		
7.	White-breasted Waterhen	<i>Amaurornisphoenicurus</i>	सिमकुखुरा			R			2
8.	Indian Pond-heron	<i>Ardeolagravii</i>	आसकोटे बकुल्ला			R	4	14	23
9.	Cattle Egret	<i>Bubulcus ibis</i>	बस्तु बकुल्ला			R	29	107	190
10.	Little Egret	<i>Egretta garzetta</i>	सानो सेतोबकुल्ला			R	5	4	4
11.	River Lapwing	<i>Vanellus duvaucelii</i>	खोले हटिट्याउ		NT	R			2
12.	Red-wattled Lapwing	<i>Vanellus indicus</i>	हटिट्याउँ			R			2
13.	Great Cormorant	<i>Phalacrocorax carbo</i>	जलेवा		NT	WV	2	111	
14.	Common Sandpiper	<i>Actitis hypoleucos</i>	चञ्चले सुडसुडिया			PM/WV	1		
15.	Green Sandpiper	<i>Tringa ochropus</i>	रुख सुडसुडिया			PM/WV	1		
16.	Common Kingfisher	<i>Alcedo atthis</i>	सानो माटीकोरे			R		1	2
17.	Crested Kingfisher	<i>Megaceryle lugubris</i>	ठूलो छिरबिरे माटीकोरे			R		2	
18.	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	सेतो कण्ठे माटीकोरे			R	11	7	23
19.	Brown Dipper	<i>Cinclus pallasii</i>	खैरो बञ्जूल			R		2	
20.	Little Forktail	<i>Enicurus scouleri</i>	गंगाखोलेघोविनी			R	5	2	3
21.	Slaty-backed Forktail	<i>Enicurus schistaceus</i>	फुस्रोढाडे खोलेघोविनी			R		2	
22.	Black-backed Forktail	<i>Enicurus immaculatus</i>	कालोढाडे खोलेघोविनी			R	1		1
23.	White-capped Water-redstart	<i>Phoenicurus leucocephalus</i>	सेतोटाउके जलखञ्जरी			R	7	8	5
24.	Plumbeous Water-redstart	<i>Phoenicurus fuliginosus</i>	नीलाम्बर जलखञ्जरी			R	11	13	11
25.	Grey Wagtail	<i>Motacilla cinerea</i>	फुस्रो टिकटिके			WV	14	2	
26.	White-browed Wagtail	<i>Motacilla maderaspatensis</i>	खोले टिकटिके			R	1	6	
27.	White Wagtail	<i>Motacilla alba</i>	फुस्रो टिकटिके			PM/WV	10	21	

3.2.1 Status of Birds and Habitat in the TL Project Area

3.2.1.1 Dharapani Substation – Khudi Substation

A total of 109 bird species were recorded in summer survey from 20 vantage points present between Dharapani Substation and Khudi Substation section while there was a record of 55 species in autumn survey and 78 species in the winter survey. Almost all the species recorded in this section of the project sites were residential except some species mainly cuckoos.

There were 8 raptor species recorded in this section: Crested Serpent-eagle (from vantage points 14 and 16), Bearded Vulture (from vantage points 1 and 2), Himalayan Griffon (from vantage points 'Dharapani', 0,1 and 2), Mountain Hawk-eagle (from vantage points 11), Bonelli's Eagle (from vantage points 6 and 11), Eurasian Sparrow hawk (from vantage points 'Dharapani' and 12), Northern Goshawk (from vantage point 11), Black Kite (from vantage points 10 and 14), Common Kestrel (from vantage points 1,7,10 and 14) and Peregrine Falcon (from vantage point 6).

Nesting colonies of Himalayan Griffon was observed in the cliff present at vantage point 1. Further, no more nesting colonies of the raptors were noticed during the survey. The weather partially sunny most of the time. There is forested area, small patch of grassland (close to vantage point 16), rocky cliffs in this section of the proposed transmission line. Existing transmission lines are also running along.

In the summer bird survey, diversity of bird species was recorded high from vantage point of Dharapani SS (25 species) which was followed by vantage points 12, 10 and 17 (21 bird species in an average). Because of the mixed forest and diverse habitat type, number of bird species were found high in these areas. In this section, there are presence of rocky cliffs and the bird diversity is comparatively less in such places. Below figure shows the bird diversity of 3 seasons.

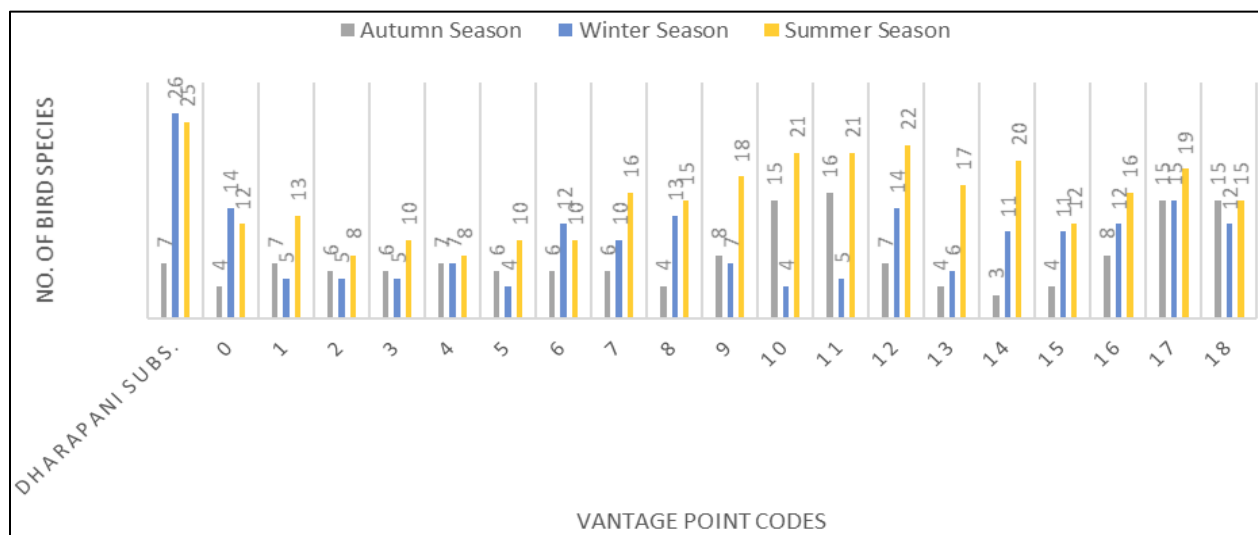


Figure 11: Number of bird species recorded from each vantage points (Dharapani – Khudi Substation section)

3.2.1.2 Khudi Substation – Udipur Substation

A total of 68 bird species were recorded in summer season from 11 vantage points present in between Khudi Substation and Udipur Substation section. Raptor species: Egyptian Vulture (from vantage points 21 and 26), Shikra (from vantage point 21), Crested Serpent-eagle (from vantage points 20,21 and 25), Himalayan Griffon (from vantage points 20,21 and 22), Black Kite (from

vantage points 'Khudi', 20, 21, 24 and 27) and Common Kestrel (from vantage points 20 and 21). These birds were sighted soaring up in the sky.

Comparatively, more raptors were observed from vantage points 20 and 21. However, no nesting colonies of raptors were observed during the survey.

At Khudi substation, the habitat was found disturbed due to construction work so a smaller number of bird species were recorded. Areas in between vantage points 22 and Khudi SS, has been found important for raptor species. There are rocky cliffs in the east which are potential sites for roosting and nesting of raptors. Near to the vantage point 21 (place name: Simalchaur), there are number of *Bombax ceiba* trees which are considered important for vultures.

A migratory wetland bird 'Tufted Duck' was observed at vantage point 28. The site is a reservoir created by a Dam near to Udipur SS.

In the summer season, diversity of bird species was recorded high from the vantage points 25 and 27 (24 bird species in an average). Because of the mixed forest and diverse habitat type, number of bird species were found high in these areas. Below figure shows the bird diversity of 3 seasons.

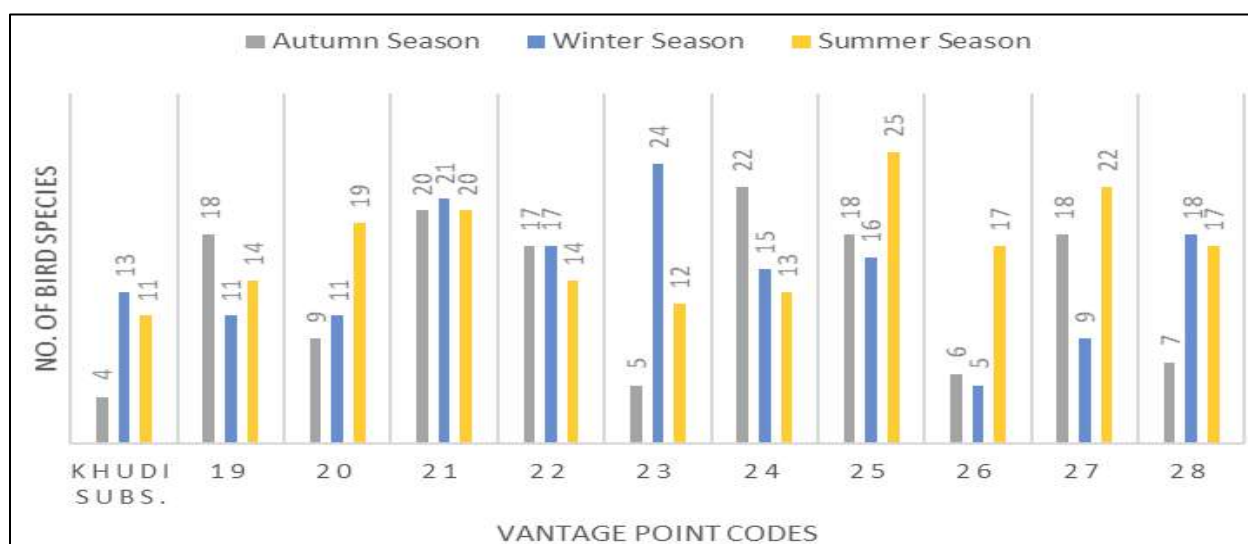


Figure 12: Number of bird species recorded from each vantage points (Khudi – Udipur Substation section)

3.2.1.3 Udipur Substation – Markichowk Substation

A total of 79 species of birds were recorded in summer season from 14 vantage points present in between Udipur substation and Markichowk substation section. In this section of the project site, bird survey was carried out from each alternative vantage points. A globally threatened bird species was also recorded from this section of the transmission line: Red-headed Vulture (from vantage point 49).

Additionally, 5 other raptor species were recorded in this section: Crested Serpent-eagle (from vantage points 'Udipur' and 42), Himalayan Griffon (from vantage point 'Udipur'), Black Kite (from vantage points 'Udipur', 29,31,35,41,49,51 and 52), Common Kestrel (from vantage points 29, 31 and 45), Peregrine Falcon (from vantage point 29). Lower region of this section of the project site is mostly plain with some forest patches. The raptors were found soaring high up in the sky however no nesting colonies were recorded during the survey.

In the summer season, diversity of bird species was recorded high from the vantage point 35 followed by the vantage points 39, 43 and 49) (30 bird species in an average). Because of the mixed forest and diverse habitat type, number of bird species were found high in these areas. Below figure shows the bird diversity of 3 seasons.

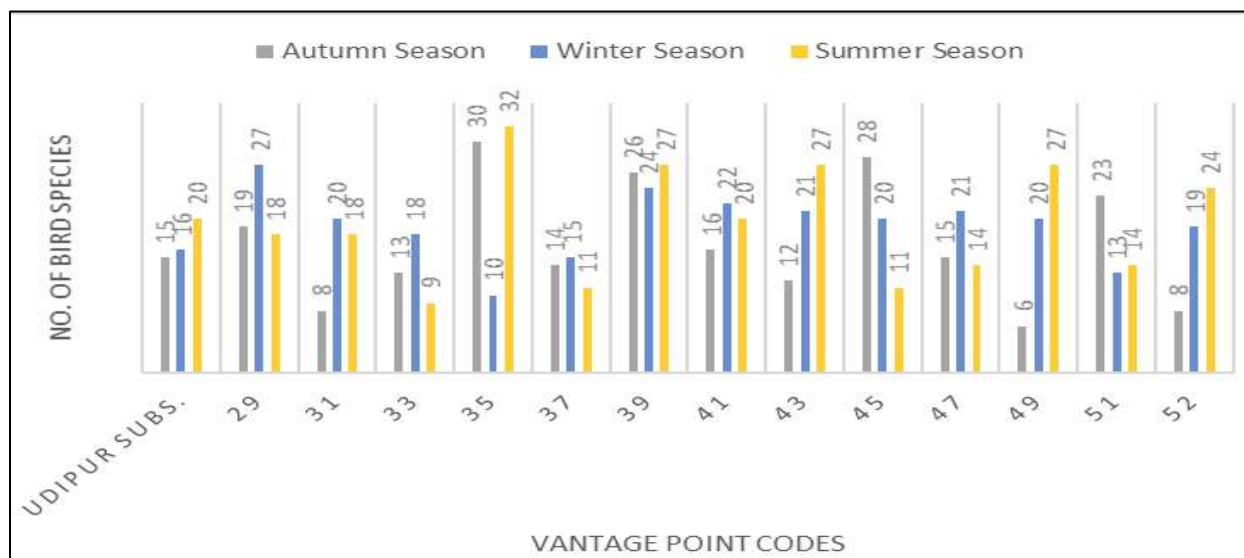


Figure 13: Number of bird species recorded from each vantage points (Udipur - Markichowk Substation section)

3.2.1.4 Markichowk Substation – Bharatpur Substation

A total of 110 species of birds were recorded in summer season from 20 vantage points present in between Markichowk substation and Bharatpur substation section. Globally threatened bird species: Egyptian Vulture (Endangered), Red-headed Vulture (Critically Endangered) and White-rumped Vulture (Critically Endangered) were recorded from 5 vantage points.

Additionally, 7 other raptor species were recorded in this section: Shikra (from vantage points 53,59 and 70), Crested Serpent-eagle (from vantage point 55 and 58), Himalayan Griffon (from vantage point 64), Black Kite (from 8 different vantage points), Common Kestrel (from vantage point 55, 57, 58, 59 and 60), Oriental Honey-buzzard (from vantage point 57 and 58) and Mountain Hawk-eagle (from vantage point 55).

Mostly, raptors were found soaring up in the sky from the vantage point 58 and 59. There is also a place located at the top of the hill with open area that has vantage points 64 and 65 that shows potential for raptor soaring. Just south to it is the plain lowland. This area is found to be good to the raptors for soaring high up because of thermals. There is also a ridge which act as passage for migratory birds. However, during the survey, because of the bad weather (drizzle and rain), soaring of the raptors was not observed.

In the summer season, diversity of bird species was recorded high from the vantage points 'Bharatpur SS' followed by the vantage points 'Markichowk SS' and 59. (30 bird species in an average). Because of the diverse habitat type, number of bird species were found high in these areas. Below table shows the bird diversity of 3 seasons.

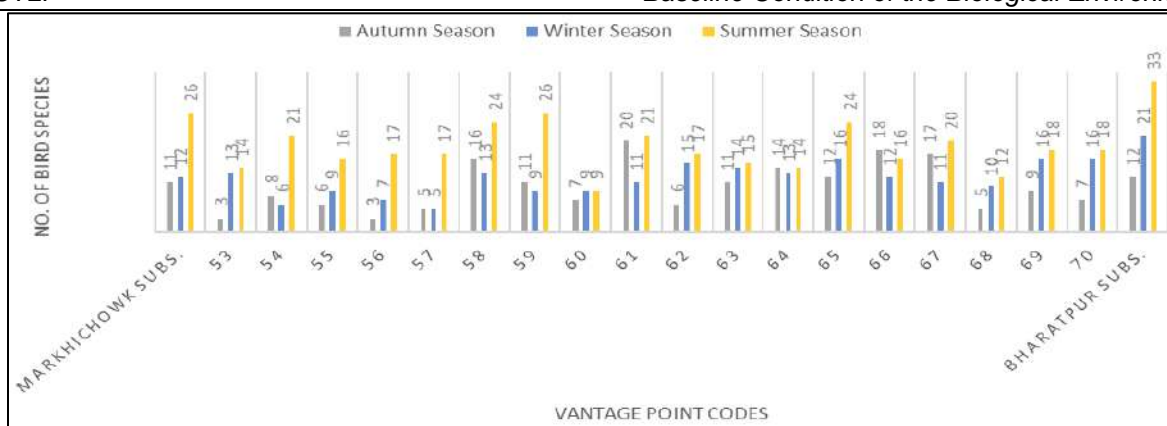


Figure 14: Number of bird species recorded from each vantage points (Markichowk - Bharatpur Substation section)

3.3 Flora/Vegetation

3.3.1 Floral Biodiversity in Khudi Manang Section

There was not any difference in biodiversity at tree, pole and sapling staged tree species. The second time observation showed that, seedling staged tree species were regenerated in the plot. In addition, noticeable difference was observed in herbs and shrubs species.

3.3.1.1 Tree Species diversity

The floral diversity can be divided into three subsections of Khudi Manang Section of the project. These are Upper section, mid -section and lower section.

Upper section: Only two species are recorded at upper part of this section. These species were *Pinus wallichiana* (Gobre Salla) and *Anlus nepalensis* (Uttish).

Middle section: There was not any tree species in the mid part of Khudi Manang transmission line section. The mid part of this section was covered with *Himalayacalamus asper* (Stapleton). The average diameter of this 5.5 cm and height of this species is 3.5m. This species was common in south east aspect; altitudinal variation was 1500-1600m. Ghumre nigalo and Malinge nigalo are very common in this area. This species is very rare in Nepal particularly in hilly area. This species is socially and economically very important because, local people use this species to weave the basket. The basket is source of income of the local people.

Lower section: Importance value index of tree species was estimated to show the species density, frequency and dominance of different staged plants in lower part of Khudi Manang section. The estimated importance value index of *Pinus wallichiana* was the highest of tree staged plant of lower part of this section with 90.77 while this value was the lowest of other species with 15.12. Other species includes *Acer sp.*, *Abies sp.*, *Rhododendron sp.*

Table 12: Tree species in upper part of Khudi Manang Section

Species	Scientific Name	Relative Density	Relative frequency	Relative Dominance	IVI
Gobre salla	<i>Pinus wallichiana</i>	50	50	61.9048	60
Uttish	<i>Anlus nepalensis</i>	50	50	38.0952	60

Note: There is no any pole and regeneration in this part

Table 13: Tree species in lower part of Khudi Manang Section

Local name	Scientific name	Tree staged plants				Pole staged plants				Sapling staged plants			
		RD	RF	RA	IVI	RD	RF	RA	IVI	RD	RF	RA	IVI
Gobre Sallo	<i>Pinus wallichiana</i>	38.10	14.29	38.39	90.77	6.98	4.76	32.04	43.78	-	-	-	-
Uttish	<i>Alnus nepalensis</i>	14.29	21.43	10.84	46.56	30.23	9.52	25.89	65.64	-	-	-	-
Mahuwa	<i>Madhuca longifolia</i>	4.76	7.14	5.48	17.38	2.33	4.76	0.47	7.56	7.69	14.29	2.70	24.68
Khirro	<i>Sapium insigne</i>	4.76	7.14	3.60	15.50	2.33	4.76	2.95	10.04	-	-	-	-
Chilaune	<i>Schima wallichii</i>	9.52	7.14	7.52	24.18	6.98	14.29	7.75	29.01	7.69	14.29	6.07	28.05
Simal	<i>Bombax ceiba</i>	14.29	21.43	17.66	53.37	4.65	9.52	3.75	17.92	-	-	-	-
Kaphal	<i>Myrica</i> sp.	4.76	7.14	6.08	17.98	4.65	4.76	4.92	14.33	15.38	14.29	16.65	46.32
Siris	<i>Albiliz</i> sp.	4.76	7.14	7.23	19.14	4.65	4.76	2.85	12.26	-	-	-	-
Faledo	<i>Erythrina</i> sp.	-	-	-	-	13.95	9.52	5.98	29.46	38.46	14.29	54.46	107.21
Guyalo	<i>Callicarpa macrophylla</i>	-	-	-	-	9.30	4.76	5.23	19.30	-	-	-	-
Makaranga	<i>Macaranga pustulata</i>	-	-	-	-	2.33	4.76	1.10	8.19	-	-	-	-
Bayar	<i>Zizypus maurititiana</i>	-	-	-	-	2.33	4.76	1.87	8.96	15.38	14.29	11.34	41.01
Kyamun	<i>Cleistocalyx operculata</i>	-	-	-	-	2.33	4.76	0.79	7.88	-	-	-	-
Khanayu	<i>Ficus semicordata</i>	-	-	-	-	2.33	4.76	0.97	8.06	-	-	-	-
Sindhure	<i>Mallotus philipinensis</i>	-	-	-	-	2.33	4.76	0.91	8.00	7.69	14.29	6.07	28.05
Khagreto	<i>Phyllanthus parvifolius</i>	-	-	-	-	-	-	-	-	7.69	14.29	2.70	24.68
Others		4.76	7.14	3.21	15.12	2.33	4.76	2.51	9.60	-	-	-	-
Total		100	100	100	300	100	100	100	300	100	100	100	300

Note: RD = relative dominance, RF= Relative Frequency, RA= Relative Abundance, IVI- Importance Value Index.

3.3.1.2 Biodiversity index of Tree species (Lower part)

The biodiversity index value was calculated of different stage of the plant of lower part of this section. The highest Shannon - wiener diversity index was recorded of pole staged plant with 0.94 while it was the lowest of tree staged plants. Similarly, the Simpson index of diversity was the highest of pole staged with 0.55 and lowest of tree staged plants with 0.44.

Table 14: Tree species biodiversity indexes in lower part of Khudi Manang Section

Biodiversity indexes	Tree species	Pole species	Sapling
Shannon - wiener diversity index	0.77	0.94	0.84
Simpson index of diversity	0.44	0.55	0.53
Evenness Index	0.89	0.86	0.93

B. Comparison of tree species biodiversity in Khudi Manang Section in summer season

There was no any change in tree, pole and sapling staged plant species in summer season. However, the early rain favours seedling to grow in this section. Seedling of some tree species was recorded in some plots. These species were *Schima wallichii*, *Sauraria nepaulense*, *Macaranga patulata* and *Alnus Nepalensis*.

3.3.1.3 Herbs, Shrubs and Grass species in winter season

The relative density, relative frequency and relative coverage of herbs, shrubs and grasses were varied according to species and their IVI was also varied. The highest IVI was recorded of *Ageratum conyzoides* L. with 24.68 and the lowest value of IVI was 5.56 of some species like *Ocimum gratissimum*, *Urtica dioica*, *Maesa indica*, *Daphne papyracea* etc.

Table 15: Herbs, Shrubs and Grass species in Khudi Manang Section in winter season

S N	Local Name	Botanical Name	Relative Density	Relative Frequency	Relative Coverage	IVI
1	Titepati	<i>Artemisia indica</i>	3.85	1.79	2.78	8.41
2	Kalo kuro	<i>Bidens pilosa</i>	3.85	5.36	4.63	13.83
3	Kanike Kuro	<i>Cynoglossum zeylanicum</i>	9.62	1.79	5.56	16.96
4	Ban Tulashi	<i>Ocimum gratissimum</i>	1.92	1.79	1.85	5.56
5	Kan Sinko	<i>Adiantum edgeworthii</i>	1.92	5.36	3.70	10.98
6	Phapar jhar	<i>Polygonum barbatum</i>	1.92	10.71	6.48	19.12
7	Kans	<i>Commelina nudiflora</i>	3.85	10.71	7.41	21.97
8	Gande Jhar	<i>Ageratum conyzoides</i> L.	3.85	12.50	8.33	24.68
9	Kalo Banmara	<i>Ageratina adenophora</i>	7.69	3.57	5.56	16.82
10	Pani Amala	<i>Nephrolepis cordifolia</i>	5.77	3.57	4.63	13.97
11	Sisno	<i>Urtica dioica</i>	1.92	1.79	1.85	5.56
12	Bilaune	<i>Maesa indica</i>	1.92	1.79	1.85	5.56
13	Sikhano	<i>Thysanolaena</i>	3.85	3.57	3.70	11.12
14	Dhursil	<i>Colebrookea oppositifolia</i>	7.69	3.57	5.56	16.82
15	Banse ghash	<i>Panicum</i> sp.	1.92	3.57	2.78	8.27
17	Datiun	<i>Achyranthes aspera</i>	1.92	5.36	3.70	10.98
18	Unyu	<i>Arthromeris wallichiana</i>	9.62	1.79	5.56	16.96

S N	Local Name	Botanical Name	Relative Density	Relative Frequency	Relative Coverage	IVI
19	Fren plant	<i>Dryopteris</i> sp.	1.92	1.79	1.85	5.56
20	Mothe	<i>Tridax procumbens</i>	1.92	1.79	1.85	5.56
21	Sano jai (wild)	<i>Avena</i> sp.	5.77	3.57	4.63	13.97
22	Fern	<i>Tracheophyta</i> sp.	1.92	3.57	2.78	8.27
23	Tree fern	<i>Cyathea</i> sp	7.69	1.79	4.63	14.11
24	Pipla	<i>Ficus religiosa</i>	1.92	1.79	1.85	5.56
25	Dudhe jhar	<i>Euphorbia hirta</i> L	1.92	1.79	1.85	5.56
26	Climber	<i>Smilax</i> sp.	1.92	3.57	2.78	8.27
27	Lokta	<i>Daphne papyracea</i>	1.92	1.79	1.85	5.56
28	Amriso	<i>Thysanolaena maxima</i>	3.85	1.79	2.78	8.41
29	Aiselu	<i>Rubus ellipticus</i>	3.85	5.36	4.63	13.83
30	Jaluka	<i>Remusatia vivipara</i>	9.62	1.79	5.56	16.96
31	Gurjo	<i>Tinospora cordifolia</i>	1.92	1.79	1.85	5.56
32	Kaulo	<i>Machilus odoratissima</i>	1.92	5.36	3.70	10.98
33	Ban Haldi	<i>Curcuma aromatica</i>	1.92	10.71	6.48	19.12
34	Apamarga	<i>Achyranthes aspera</i>	3.85	10.71	7.41	21.97

3.3.1.4 Status of Herbs, Shrubs and Grass species in summer season

There was total 42 species of small plants (herbs, shrubs and grasses) in Khudi Manag Section. The importance value of some species was very high in this section. The estimated highest IVI was 41.42 of *Oplismenus* sp., it was followed by *Artemisia vulgaris* with 32.9 and *Oxalis corniculata* with 23.2 while the lowest IVI was recorded of *Solanum* sp. with 1.43 (Table 16). There was no any change in tree species at tree, pole and sapling stage.

Table 16: Relative frequency, density, coverage and IVI of small plants in summer seasons

S. N.	Scientific name	Relative Frequency	Relative Density	Relative coverage	IVI
1	<i>Oplismenus</i> sp.	8.33	17.53	15.55	41.42
2	<i>Artemisia vulgaris</i>	7.29	7.04	18.56	32.9
3	<i>Oxalis corniculata</i>	7.29	10.89	5.02	23.2
4	<i>Gonostegia</i> sp.	5.21	7.97	5.52	18.7
5	<i>Biden pilosa</i>	4.17	5.98	2.51	12.65
6	<i>Ageratina adenophora</i>	4.17	2.92	5.02	12.11
7	<i>Cynodon dactylon</i>	3.13	5.58	2.51	11.21
8	<i>Equisetum</i> sp.	1.04	3.98	5.02	10.04
9	<i>Stellaria</i> sp.	2.08	4.25	3.01	9.34
10	<i>Persicaria</i> sp.	3.13	2.12	3.01	8.26
11	<i>Cyperus rotundus</i>	3.13	3.32	1.25	7.7
12	<i>Helichrysum</i> sp.	3.13	2.92	1.51	7.55
13	<i>Urnea lobata</i>	3.13	1.33	3.01	7.46
14	<i>Viola</i> sp.	2.08	1.99	3.26	7.34

S. N.	Scientific name	Relative Frequency	Relative Density	Relative coverage	IVI
15	<i>Desmodium sp.</i>	3.13	1.33	1.76	6.21
16	<i>persicaria chinensis</i>	3.13	1.46	1.61	6.19
17	<i>Fragaria sp.</i>	2.08	2.52	1.51	6.11
18	<i>Persicaria capitata</i>	2.08	0.93	2.11	5.12
19	<i>Rumex Nepalensis</i>	2.08	1.46	1.51	5.05
20	<i>Scutellaria sp.</i>	1.04	1.33	2.01	4.38
21	<i>Imperata cylindrica</i>	1.04	1.99	1	4.04
22	<i>Rubus sp.</i>	2.08	0.4	1.51	3.99
23	<i>Asteraceae</i>	2.08	0.93	0.8	3.82
24	<i>Vitis sp.</i>	2.08	0.53	1	3.62
25	<i>Dioscorea sp.</i>	2.08	0.53	1	3.62
26	<i>Canabis sp.</i>	2.08	1.06	0.35	3.5
27	<i>Casia tora</i>	2.08	0.4	1	3.49
28	<i>Hypoxis sp.</i>	1.04	0.93	1	2.97
29	<i>Ranunculus sp</i>	1.04	0.66	1	2.71
30	<i>Sida rhambifolia</i>	1.04	0.53	1	2.58
31	<i>Saccharum spontaneum</i>	1.04	0.93	0.5	2.47
32	<i>Lygodium sp.</i>	1.04	0.4	1	2.44
33	<i>Acanthaceae</i>	1.04	0.66	0.25	1.96
34	<i>Oplismenus sp.</i>	1.04	0.66	0.25	1.96
35	<i>Mumosa pudica</i>	1.04	0.4	0.5	1.94
36	<i>Melostoma sp.</i>	1.04	0.27	0.5	1.81
37	<i>Kyllinga sp.</i>	1.04	0.66	0.1	1.81
38	<i>Maesia chiesia</i>	1.04	0.27	0.5	1.81
39	<i>Plantago major</i>	1.04	0.53	0.2	1.77
40	<i>Coolebrokia oppositifolia</i>	1.04	0.13	0.5	1.68
41	<i>Urtica dioica</i>	1.04	0.13	0.5	1.68
42	<i>Solanum sp.</i>	1.04	0.13	0.25	1.43

E. Comparison of Herbs, Shrubs and Grass species between winter and summer season: Some plants species were differed in winter and summer seasons. Total plant species was 35 in winter season while 42 species were observed in summer season. The IVI was of *Ageratum conyzoides* in winter season while this was highest IVI of *Oplismenus sp.* This indicates that the relative density, relative frequency and relative coverage and IVI of herbs, shrubs and grass species were differed according to seasons

3.3.1.5 Biodiversity hot spot in Khudi Manang section

The mid-section of Khudi Manang section is biodiversity hotspot. This lies in Chaymche in Marsyangdi Rural Municipality. The areas are rocky and covered some very valuable species like *Trachycarpus sp.*, *Berginia ciliate* and *Himalayacalamus asper* (Nigalo forest) (Table 17).

Table 17 : Hotspot in Khudi Manang Section

SN	Location	Location detail	Speciality of hot spots
1	Mid-section of Khudi Manang section	Marsyangdi RM, Chaymche	Species Diversity includes
			1 <i>Trachycarpus</i> sp.
			2 <i>Berginia ciliate</i>
			3. Nigalo forest
			Rocky slope and more vulnerable

3.3.1.6 Ethnobotany use of Medicinal plants

There are several uses of plants to treat the disease. Local people have been using the plants and their parts for different purposes particularly to treat several types of disease. Total 53 plant species were used by the local people for different purposes. For example, they use *Berginia ciliata* to treat piles and abdominal mass, *Biden pilosa* to treat ear infections and kidney (Table 18).

Table 18: Ethnobotanical use of plants (Manang Khudi Section)

S N	Local name	Scientific name	Family	Use
1	Pakhanbed	<i>Berginia ciliate</i>	Saxifragaceae	Piles, abdominal mass
2	Kuro	<i>Biden pilosa</i>	Asteraceae	Ear infections, kidney problems
3	Chari Amilo	<i>Oxalis corniculata</i>	Oxalidaceae	Abdominal Disorder
4	Buki	<i>Blumea</i>	Asteraceae	Fodder
5		<i>Plantago major</i>	Plantaginaceae	eye irritation and inflammation of mouth and throat
6	Bhui kafal	<i>Fragaria</i> sp.	Rosaeae	Food
7	Ganja	<i>Canabis</i> sp.	Canabaceae	constipation, some types of pain, epilepsy, anxiety
8		<i>persicaria chinensis</i>	Polygonaceae	Fodder
9	Phapare ghas	<i>Persicaria capitata</i>	Polygonaceae	Fodder
10	Kalo Banmara	<i>Ageratina adenophora</i>	Asteraceae	Wound treatment
11		<i>Vitis</i> sp.	Vitaceae	Skin disease
12		<i>Lygodium</i> sp.	Lygodiaceae	Fodder
13	Base ghas	<i>Oplismenus</i> sp.	Poaceae	Fodder
14	Sim jhar	<i>Ranunculus</i> sp.	Ranunculaceae	Rubefacient, and to treat intermittent fever
15	Aiselu	<i>Rubus</i> sp	Rosaeae	Food
16		<i>Hypoxis</i> sp	Hypoxidaceae	Diabetes
17	Halhale	<i>Rumex Nepalensis</i>	Polygonaceae	Vegetables
18		<i>Pteris vitata</i>	Pteridaceae	Fodder

S N	Local name	Scientific name	Family	Use
19	Ljawati	<i>Mumosa pudica</i>	Fabaceae	piles, dysentery, sinus, and also applied on wounds
20	Motthe	<i>Cyperus rotundus</i>	Cyperaceae	Fodder
21	Kanthakari	<i>Solanum virginianum</i>	Solanaceae	cough, chest pain, against vomiting, hair fall, leprosy, itching scabies
22		<i>Desmodium sp.</i>	Fabaceae	Fodder
23		<i>Urnea lobate</i>	Malvaceae	Treating fractures, wounds, mastitis and snake bites.
24	Kali Angeri	<i>Melostoma sp.</i>	Melostomataceae	Decorative
25	Dubo	<i>Cynodon dactylon</i>	Poaceae	Fodder, expectorant, carminative and as a brain and heart tonic.
26	Dhasure	<i>Coolebrokia oppositifolia</i>	Lamiaceae	peptic ulcers, Fodder
27	Patpate	<i>Casia tora</i>	Fabaceae	liver tonic, cardio-tonic and expectorant
28	Tarul	<i>Dioscorea sp.</i>	Dioscoreaceae	Food
29		<i>Barleria sp.</i>	Acanthaceae	Fodder
30	Balu	<i>Sida rhombifolia</i>	Malvaceae	Skin disease
31	Muse khari	<i>Pogonatherum paniceum</i>	Poaceae	fodder
32	Khar	<i>Saccharum spontaneum</i>	Poaceae	Fodder, fiber
33	Batulpate	<i>Stephania sp.</i>	Menispermaceae	Skin disease
34		<i>Tridax procumbens</i>	Asteraceae	Fodder
35	Tite pati	<i>Artemisia vulgaris</i>	Asteraceae	Skin disease
36		<i>Kyllinga nemoralis</i>	Cyperaceae	Fodder
37		<i>Stellaria sp.</i>	Caryophyllaceae	Cosmetic
38		<i>Persicaria sp.</i>	Polygonaceae	Fodder
39		<i>Equisetum sp.</i>	Equisetaceae	Fodder
40	Tulasi jhar	<i>Scutellaria sp.</i>	Lamiaceae	Perfumery
41	Bilaune	<i>Maesa chisia</i>	Primulaceae	Fodder
42	Siru	<i>Imperata cylindrical</i>	Dioscoreaceae	Fodder
43	Sisnoo	<i>Urtica diocea</i>	Urticaceae	Food, anti-diabetic
44		<i>Pyrrosia sp.</i>	Polypodiaceae	Bronchitis
45	Sunakhari	<i>Bulbophyllum sp.</i>	Orchidaceae	Decorative
46		<i>Selaginella sp.</i>	Sellaginaceae	Fodder

S N	Local name	Scientific name	Family	Use
47	Kurilo	<i>Asparagus racemosus</i>	Asparagaceae	Upset stomach (dyspepsia), constipation, stomach spasms, and stomach ulcers.
48	Pani amala	<i>Nephrolepis</i> sp.	polypodiaceae	Food, Fodder
49	Pipla	<i>Piper</i> sp.	Piperaceae	flavoring of soups, meat, fish, eggs, salads, and sauces
50	Koiralo	<i>Bahunia variegata</i>	Fabaceae	Food
51	Gurjo	<i>Tinospora</i> sp.	Menispermaceae	cough, fever
52	Rudilo	<i>Pogostemon Benghalensis</i>	Lamiaceae	cough, fever
53	Ban besar	<i>Curcuma</i> sp.	Zingiberaceae	Flavoring, antibacterial

Moreover, *Cyathea spinulosa* tree fern was also found in the sample plot taken nearby Marsyangdi River.

3.3.2 Floral Biodiversity in Khudi Udipur Section

There was not any difference in tree stage, pole staged and sapling staged tree species according to seasons. However, more seedlings were observed in summer season. Herbs, shrubs and grass species were more in summer season in comparison to winter season.

3.3.2.1 Tree Species diversity

Importance value index was varying according to different stage of the plant species. It was the highest of *Albizia procera* with 82.06 of tree staged plant; it was followed by *Bombax ceiba* with 52.68. The lowest importance value index was *Ficus benghalensis* with 7.62. Similarly, the highest importance value index was of *Schima wallichii* with 60.76 of pole staged plant and lowest value was 5.27 of *Cedrella toona* (Tooni). The highest importance value index of sapling staged plant was 50.26 of *Mallotus philippinensis* (Table 19).

Table 19: Importance Value Index of Tree species in Khudi Udipur Section

Local Name	Scientific name	Tree				Pole				Sapling			
		RD	RF	RA	IVI	RD	RF	RA	IVI	RD	RF	RA	IVI
Khanyu	<i>Ficus semecordata</i>	2.33	3.57	1.86	7.76	3.39	5.88	3.78	13.05	8.70	11.76	10.23	30.69
Siris	<i>Albizia</i> sp.	23.26	25.00	33.81	82.06	1.69	2.94	2.34	6.98	4.35	5.88	5.12	15.35
Mauwa	<i>Engelhardtia spicata</i>	6.98	10.71	8.39	26.08	8.47	8.82	12.42	29.71	8.70	5.88	7.29	21.87
Simal	<i>Bombex ceiba</i>	18.60	14.29	19.79	52.68	3.39	2.94	2.29	8.62			0.00	0.00
Tooni	<i>Cedrella toona</i>	4.65	7.14	4.91	16.70							0.00	0.00
Khirro	<i>Sapium insigne</i>	6.98	7.14	5.64	19.76	1.69	2.94	2.54	7.17	4.35	5.88	5.12	15.35
Khote Salla	<i>Pinus roxburghii</i>	13.95	7.14	8.49	29.59	15.25	5.88	17.77	38.91	4.35	5.88	5.12	15.35
Chilaune	<i>Schima wallichii</i>	11.63	14.29	9.04	34.95	22.03	14.71	24.02	60.76	4.35	5.88	5.12	15.35
Sal	<i>Shorea robusta</i>	6.98	3.57	3.68	14.23	3.39	2.94	3.85	10.18	13.04	5.88	9.46	28.39
Amaro	<i>Spondias pinnata</i>	2.33	3.57	2.67	8.57							0.00	0.00
Bar	<i>Ficus benghalensis</i>	2.33	3.57	1.72	7.62							0.00	0.00
Faledo	<i>Erythrina</i> sp.					3.39	2.94	0.74	7.07			0.00	0.00
Sindhure	<i>Mallotus philippinensis</i>					8.47	8.82	4.30	21.60	21.74	11.76	16.75	50.26
Maledo	<i>Macaranga indica</i>					1.69	2.94	0.63	5.27			0.00	0.00
Kalikath	<i>Miliusa velutina</i>					5.08	8.82	4.80	18.71	4.35	5.88	5.12	15.35
Tooni	<i>Cedrella toona</i>					1.69	2.94	0.63	5.27			0.00	0.00
Tiju	<i>Choerospondias axillaris</i> ,					1.69	2.94	0.74	5.37			0.00	0.00
Bayar	<i>Ziziphus mauritiana</i>					1.69	2.94	1.00	5.63	4.35	5.88	5.12	15.35
Kattush	<i>Castonopsis indica</i>					5.08	5.88	3.28	14.25	4.35	5.88	5.12	15.35
Lakuri	<i>Fraxinus floribunda</i>					1.69	2.94	2.07	6.71			0.00	0.00
Jamun	<i>Syzygium cumini</i>					1.69	2.94	2.94	7.58	4.35	5.88	5.12	15.35
Badahar	<i>Artocarpus lakoocha</i>					3.39	2.94	2.30	8.63			0.00	0.00
Sissoo	<i>Dalbergia sissoo</i>					3.39	2.94	5.03	11.37			0.00	0.00
Saj	<i>Terminalia alata</i>					1.69	2.94	2.54	7.17			0.00	0.00
Dhunge										4.35	5.88	5.12	15.35
Katikath	<i>Miliusa velutina</i>									4.35	5.88	5.12	15.35
Amala	<i>Phyllanthus emblica</i>									4.35	5.88	5.12	15.35

3.3.2.2 Biodiversity index of Tree species: Tree, Pole & Regeneration

The biodiversity indexes of plants were varying according to stage of the plant. Shannon-Weiner index was the highest of regeneration staged plants with 1.75 and it was the least of pole staged plant with 0.77. The Simpson index was the highest of regeneration staged plants with 1.16 and it was the least of tree staged plants with 0.55 (Table 20).

Table 20: Tree species diversity in Khudi Udipur Section

Biodiversity Index	Tree	Pole	Regeneration
Shannon-Weiner	0.93	0.77	1.75
Simpson	0.55	0.60	1.16
Species richness	0.90	0.76	1.83

C. Comparison of seedling staged tree biodiversity in Khudi Udipur Section according to season: Some regeneration of seedling of tree species were recorded in second time observation. The seedlings of the species were *Macaranga patulata*, *Schima wallichii*, *Dalbergia sissoo* and *Mallotus philippensis*.

3.3.2.3 Importance Value Index of Herbs Shrubs and Grass species in Winter Season

The relative density, relative frequency and relative coverage were varying according to herbs, shrubs and grass and the importance value index accordingly. The highest importance value index was recorded 22.5 of two species name *Arthromeris wallichiana* and *Ageratina adenophora* while the lowest importance value was recorded (Table 21).

Table 21: Herbs, Shrubs and Grass species in Khudi-Udipur Section in Winter Season

SN	Species	Scientific name	Relative density	Relative Frequency	Relative Coverage	IVI
1	Unyu	<i>Arthromeris wallichiana</i>	4	11	7.5	22.5
2	Arari Kanda	<i>Mimosa himalayana</i>	1	4	2.5	7.5
3	Asuro	<i>Justicia adhatoda</i>	4	4	4	12
4	Banse Ghas	<i>Panicum sp.</i>	3	4	3.5	10.5
5	Khar	<i>Saccharum spontaneum</i>	3	2	2.5	7.5
6	Dubo	<i>Cynodon dactylon</i>	7	4	5.5	16.5
7	Bhimsen pati	<i>Buddleja asiatica</i>	1	2	1.5	4.5
8	Ghod Tapre	<i>Centella asiatica</i>	3	1	2	6
9	Dhursilo	<i>Colebrookea oppositifolia</i>	2	13	7.5	22.5
10	Titepati	<i>Artemisa carvifolia</i>	1	2	1.5	4.5
11	Kanthakari	<i>Solanum xanthocarpum</i>	1	2	1.5	4.5
12	Banmara	<i>Ageratina adenophora</i>	6	9	7.5	22.5
13	Lalupate	<i>Euphorbia pulcherrima</i>	1	2	1.5	4.5
14	Bamboo	<i>Bambusa vulgaris</i>	1	2	1.5	4.5
15	Raju Kanda	<i>Xeromphis sp.</i>	1	2	1.5	4.5
16	Mothe	<i>Cyperus sp.</i>	4	2	3	9
17	Chari Amilo	<i>Oxalis corniculata</i>	9	5	7	21
18	Sarpaghandha	<i>Rauvolfia serpentina</i>	1	2	1.5	4.5

SN	Species	Scientific name	Relative density	Relative Frequency	Relative Coverage	IVI
19	Batul Pate	<i>Stephania sp.</i>	1	2	1.5	4.5
20	Mothe	<i>Cyperus rotundus</i>	1	2	1.5	4.5
21	Kewara	<i>Pandunus sp.</i>	1	2	1.5	4.5
22	Dhagero	<i>Woodfordia fructicosa</i>	1	2	1.5	4.5
23	Farke Ghas		17	5	11	33
24	Seto Banmara	<i>Chromolaena odorata</i>	9	4	6.5	19.5
25	Dudhe Jhar	<i>Euphorbia hirta</i>	3	2	2.5	7.5
26	Gai Tihare	<i>Inula cappa</i>	5	2	3.5	10.5
27	Kanike Kuro	<i>Cynoglossum zeylanicum</i>	1	2	1.5	4.5
28	Gandhe Jhar	<i>Ageratum haustonianum</i>	7	2	4.5	13.5
29	Aishelu	<i>Rubus ellipticus</i>	1	2	1.5	4.5

E. Importance Value Index of Herbs Shrubs and Grass species in Summer Season

The varying relative frequency, density and coverage of plan species have cumulative effects on importance value index. Total there were 41 species of herbs, shrubs and grass species in the forest of Khudi – Udipur section. The highest importance value index (IVI) was of *Oplismenus sp.* With 45.59 while the very low importance value index was found of some species namely *Smilax sp.*, *Thysolaena americana* and *Inula sp.* with same value that was 1.52 (Table 22).

Table 22: IVI of herbs, shrubs and grass in Khudi Udipur Section in Summer Season

S. N.	Scientific Name	Relative frequency	Relative Density	Relative coverage	IVI
1	<i>Artemissia vulgaris</i>	4.35	4.48	7.24	16.06
2	<i>Oplismenus sp.</i>	8.70	23.02	13.87	45.59
3	<i>Desmodium sp.</i>	4.35	3.32	2.71	10.39
4	<i>Saccharum sp.</i>	1.09	1.92	1.81	4.81
5	<i>Cyperus sp.</i>	3.26	1.28	1.81	6.35
6	<i>Sida rhombifolia</i>	2.17	0.51	1.21	3.89
7	<i>Cyperus brevifolius</i>	1.09	1.92	0.60	3.61
8	<i>Gonostegia sp.</i>	4.35	2.94	4.52	11.81
9	<i>Sida sp.</i>	2.17	0.64	1.21	4.02
10	Lamiaceae	4.35	2.56	3.32	10.22
11	<i>Urnea lobata</i>	2.17	0.77	1.21	4.15
12	<i>Biden pilosa</i>	4.35	4.60	5.73	14.68
13	<i>Oxalis corniculata</i>	3.26	4.09	1.81	9.16
14	<i>Alternanthera sp.</i>	2.17	3.45	1.21	6.83
15	<i>Dioscorea sp.</i>	1.09	0.38	0.60	2.07
16	<i>Smilax sp.</i>	1.09	0.13	0.30	1.52
17	<i>Mumosa sp.</i>	3.26	1.79	1.51	6.56
18	<i>Pyrrosia sp.</i>	1.09	0.64	1.21	2.93
19	<i>Thysolaena Americana</i>	1.09	0.13	0.30	1.52

S. N.	Scientific Name	Relative frequency	Relative Density	Relative coverage	IVI
20	<i>Casia</i> sp.	3.26	0.90	1.51	5.66
21	<i>Clerodendron</i> sp.	2.17	1.53	7.24	10.95
22	<i>Cynodon Dactylon</i>	4.35	7.67	3.32	15.34
23	<i>Saccharum spontaneum</i>	2.17	2.17	4.22	8.57
24	<i>Ageratum haustonianum</i>	4.35	6.65	8.44	19.44
25	<i>Persicaria</i> sp.	1.09	0.90	1.21	3.19
26	<i>Stephania Japonica</i>	3.26	0.64	1.09	4.99
27	<i>Persicaria chinensis</i>	1.09	0.64	0.60	2.33
28	<i>Acyranthus aspera</i>	2.17	1.53	1.21	4.91
29	<i>Blumea</i> sp.	1.09	0.26	0.30	1.64
30	<i>Imperata cylindrica</i>	2.17	8.31	7.84	18.33
31	<i>Nephrolepsis</i> sp.	1.09	2.56	1.21	4.85
32	<i>Acanthaceae</i>	4.35	2.94	4.22	11.51
33	<i>Cromolaena odorata</i>	2.17	0.51	1.21	3.89
34	<i>Inula</i> sp.	1.09	0.13	0.30	1.52
35	<i>Dryopteris</i> sp	1.09	0.90	0.60	2.59
36	<i>Euphorbia hirta</i>	1.09	0.90	0.60	2.59
37	<i>Evolvulus</i> sp.	1.09	0.38	0.60	2.07
38	<i>Centella asiatica</i>	1.09	0.26	0.30	1.64
39	<i>Vitis</i> sp.	2.17	0.26	0.60	3.03
40	<i>Lygodium</i> sp.	1.09	0.13	0.60	1.82
41	<i>Justicia</i> sp.	1.09	1.28	0.60	2.97

F. Comparison of herbs, shrubs and grasses species in Khudi-Udipur Section: Only total 29 plants species of herbs, shrubs and grass in this section in the winter season. However, total 41 species were recorded of herbs, shrubs and grass in summer season (second observation).

3.3.2.4 Ethnobotanical use of plants

Many species of herbs, shrubs and grasses are used for medicinal and aromatic purposes. Some of the important species are *Milletia extensa*, *Artemissia vulgaris*, *Oplismenus* sp., *Desmodium* sp., *Saccharum* sp., *Cyperus* sp., *Sida rhambifolia*, *Cyperus brevifolius*, *Gonostegia* sp., *Sida* sp., *Scutellaria* sp., *Urnea lobate*, *Biden pilosa*, *Oxalis corniculata*, *Pogonatherum paniceum*, *Dioscorea* sp., *Smilax* sp., *Mumosa* sp., *Pyrrosia* sp., *Thysanolaena maxima*, *Casia* sp., *Clerodendrum* sp., *Cynodon dactylon*, *Saccharum spontaneum*, *Ageratum haustonianum*, *Persicaria* sp., *Stephania Japonica*, *Persicaria chinensis* etc. *Artemissia vulgaris* is used to treat against the skin disease. Similarly, *Sida rhambifolia* is used to control the cough disease. *Biden pilosa* is used for treating the infection in ear (Table 23).

Table 23: Ethno-botanical use of Plant Species (Khudi-Udipur Section)

S N	Local/Nepali name	Scientific Name	Family	Use Value
1	Gaujo	<i>Milletia extensa</i>	Fabaceae	Fodder
2	Tite pati	<i>Artemissia vulgaris</i>	Asteraceae	Skin disease use as external problem
3	Base ghas	<i>Oplismenus</i> sp.	Poaceae	Fodder
4		<i>Desmodium</i> sp.	Fabaceae	Fodder
5		<i>Saccharum</i> sp.	Poaceae	Fodder
6		<i>Cyperus</i> sp.	Cyperaceae	Fodder
7	Balu jhar	<i>Sida rhambifolia</i>	Malvaceae	cough /wheezing, urinary tract infection
8		<i>Cyperus brevifolius</i>	Cyperaceae	Fodder
9		<i>Gonostegia</i> sp.	Urticaceae	Fodder
10		<i>Sida</i> sp.	Malvaceae	cough
11		<i>Scutellaria</i> sp.	Lamiaceae	Skin problem
12		<i>Urnea lobate</i>	Malvaceae	treating fractures, wounds, mastitis and snake bites
13	Kalo kuro	<i>Biden pilosa</i>	Asteraceae	Ear infections, kidney problems
14	Chari amilo	<i>Oxalis corniculata</i>	Oxalidaceae	traumatic injuries, sprains and poisonous snake bites
15	Musekhari	<i>Pogonatherum paniceum</i>	Poaceae	Fodder
16	Tarul	<i>Dioscorea</i> sp.	Dioscoreaceae	Food value
17	Kukurdaino	<i>Smilax</i> sp.	Smilacaceae	skin diseases
18	Lajawati	<i>Mumosa</i> sp.	Fabaceae	piles, dysentery, sinus, and also applied on wounds
19		<i>Pyrrosia</i> sp.	Polypodaceae	bronchitis
20	Amriso	<i>Thysanolaena maxima</i>	Poaceae	treatment of eye infection
21		<i>casia</i> sp.	Fabaceae	Fodder
22	Bhati	<i>Clerodendrum</i> sp.	Lamiaceae	skin disease treatment
23	Dubo	<i>Cynodon Dactylon</i>	Poaceae	Fodder, expectorant, carminative and as a brain and heart tonic.
24	Kash	<i>Saccharum spontaneum</i>	Poaceae	Fodder, fiber
25	Nilo gandhe	<i>Ageratum haustonianum</i>	Asteraceae	Use is to cure wounds and burns
26		<i>Persicaria</i> sp.	Polygonaceae	Fodder
27	Batulpate	<i>Stephania Japonica</i>	Menispermaceae	Abdominal relief
28		<i>Persicaria chinensis</i>	Polygonaceae	Fodder
29	Datiwan	<i>Achyranthus aspera</i>	Acanthaceae	used in the treatment of boils, asthma, in facilitating delivery, bleeding
30	Buki	<i>Blumea</i> sp.	Asteraceae	Fodder
31	siru	<i>Imperata cylindrical</i>	Poaceae	Fodder
32	Pani amala	<i>Nephrolepsis</i> sp.	Polypodaceae	Food, Fodder

S N	Local/Nepali name	Scientific Name	Family	Use Value
33		<i>Barleria</i> sp.	Acanthaceae	Fodder
34	Gandhe	<i>Cromolaena odorata</i>	Asteraceae	used to treat wounds, burns, and skin infections
35		<i>Inula</i> sp.	Asteraceae	Treatment of wound
36	Uniu	<i>Dryopteris</i> sp.	Pteridaceae	Food
37	Dudhe jhar	<i>Euphorbia hirta</i>	Euphorbiaceae	worm infestations in children, dysentery, jaundice, pimples, gonorrhoea, digestive problems, and tumors
38		<i>Evolvulus</i> sp.	Convulvulaceae	Fodder
39	Ghod tapre	<i>Centella asiatica</i>	Apiaceae	heal wounds, improve mental clarity, and treat skin conditions
40		<i>Vitis</i> sp.	Vitaceae	cure of Skin problem
41	Uniu	<i>Lygodium</i> sp.	Lygodiaceae	Fodder
42		<i>Justicia</i> sp.	Acanthaceae	Fodder
43	Marauthi	<i>Acmella</i> sp.	Asteraceae	food and medicine, and as an insecticide
44	Sissoo	<i>Dalbergia sissoo</i>	Fabaceae	Timber, wound healing
45	Kurilo	<i>Asparagus racemosus</i>	Asparagaceae	Upset stomach (dyspepsia), constipation, stomach spasms, and stomach ulcers.
46	Sindhure, raini	<i>Mallotus philippensis</i>	Euphorbiaceae	relieve excessive irritation, scabies
47	Bayar	<i>Ziziphus mauritianus</i>	Rhamnaceae	Food, Fodder
48	Bilauni	<i>Maesia chisia</i>	Primulaceae	Fodder
49	Kali angeri	<i>Melostoma</i> sp.	Melostomataceae	Decorative
50	Simal	<i>Bombax ceiba</i>	Malvaceae	timber, Fiber and
51	Bhimsen pati	<i>Buddleja asiatica</i>	Buddlejaceae	Skin cure
52	Bharla	<i>Bahunia vali</i>	Fabaceae	Fodder
53	Barro	<i>Terminalia belerica</i>	Combretaceae	Protect the liver and to treat respiratory conditions
54	Harro	<i>Terminalia chebula</i>	Combretaceae	Ingestive disorders, including both diarrhoea and constipation, and indigestion
55	Amala	<i>Phyllanthus emblica</i>	Phyllanthaceae	Tonic to build up lost vitality and vigor.
56	Niguro	<i>Tectaria</i> sp.	Polypodaceae	Food
57	Simali	<i>Vitex negundo</i>	Verbenaceae	Skin problem treatment
58	Asuro	<i>Justicia adhtoda</i>	Acanthaceae	treatments of cough, colds, asthma
59		<i>Ficus</i> sp.	Moraceae	Skin problem
60	Khaneu, Nimaro	<i>Ficus semecordata</i>	Moraceae	food, Fodder
61	Pehuli	<i>Reinwardtia indica</i>	Linaceae	Decorative, fodder
62	Koiralo	<i>Bauhinia variegata</i>	Fabaceae	Food, fodder
63		<i>Fimbristylis</i> sp.	Cyperaceae	Fodder
64		<i>Huperzia</i> sp.	Lycopodiaceae	treatment of contusions, strains, swelling

S N	Local/Nepali name	Scientific Name	Family	Use Value
65	Dumri	<i>Ficus racemose</i>	Moraceae	Fodder
66	Bihi	<i>Solanum</i> sp.	Solanaceae	Fodder
67		<i>Kyllinga nemoralis</i>	Cyperaceae	Fodder
68	Utis	<i>Alnus Nepalensis</i>	Betulaceae	Timber
69	Dhasure	<i>Coolebrookia oppositifolia</i>	Lamiaceae	peptic ulcers, Fodder

3.3.3 Floral Biodiversity in Udipur-Markichowk Section

There were differences in the tree species biodiversity of tree, pole and sapling staged plant species. However, there was some changes in seedlings and herbs, shrubs and grass species.

3.3.3.1 Importance Value Index of Tree Species

The importance value index of different plant species was varying according to tree, pole and sapling staged plants. The highest importance value index was recorded 102.4 of *Schima wallichii* and it was followed by *Albizia odoratissima* (L. f.) Benth with 76.27 of tree staged plant. Similarly, the highest importance value index was *Shorea robusta* of pole staged plant with 65.1 and it was followed by *Schima wallichii* with 64.07. The highest importance index was 91.35 of *Shorea robusta* of regeneration staged plants and it was followed *Schima wallichii* with 69.53 (Table 24).

Table 24: Importance Value Index of Tree Species in Udupur Markichowk Section

Local Name	Scientific Name	Tree				Pole				Sapling			
		RD	RF	RA	IVI	RD	RF	RA	IVI	RD	RF	RA	IVI
Sal	<i>Shorea robusta</i>	14	5.88	22.0	41.93	23.44	13.79	27.86	65.1	24	15.00	52.35	91.35
Chilaune	<i>Schima walichii</i>	42	23.53	36.8	102.4	20.31	20.69	23.07	64.07	24	25.00	20.53	69.53
Sissoo	<i>Dalbergia sissoo</i>	2	5.88	1.02	8.91	-	-	-	-	-	-	-	-
Bakaino	<i>Melia azedarach</i>	2	5.88	3.72	11.61	-	-	-	-	-	-	-	-
Botdhagero	<i>Lagerstroemia parviflora</i>	4	5.88	2.26	12.15	21.88	20.69	19.9	62.54	8.00	10.00	2.39	20.39
Tiju	<i>Pierasma javanica</i>	2	5.88	3.98	11.87	-	3.448	0.95	5.968	4.00	5.00	0.29	9.29
Padke	<i>Albizia odoratissima</i>	24	29.41	22.8	76.27	10.9	13.79	13.34	38.07	8.00	5.00	2.77	15.77
Bel	<i>Aegle marmelos</i>	2	5.88	1.60	9.48	3.12	3.448	1.93	8.50	4.00	5.00	0.36	9.36
Siris	<i>ALbizia sps</i>	2	5.88	1.47	9.35	-	-	-	-	4.00	5.00	0.87	9.87
Khair	<i>Acacia catechu</i>	6	5.88	4.16	16.04	4.68	3.448	3.38	11.52	-	-	-	-
Ankhitare	<i>Trichilia connaroides</i>	-	-	-	-	1.56	3.448	1.90	6.91	-	-	-	-
Tiju	<i>Choerospondias axillaris,</i>	-	-	-	-	1.56	-	-	-	-	-	-	-
Simal	<i>Bombex ceiba</i>	-	-	-	-	1.56	3.448	0.33	5.34	-	-	-	-
Lakuri	<i>Fraxinus floribunda</i>	-	-	-	-	3.12	3.448	1.92	8.49	-	-	-	-
Mahuwa	<i>Engelhardtia spicata</i>	-	-	-	-	3.12	3.448	0.87	7.45	4.00	5.00	0.07	9.07
Kattush	<i>Castonopsis indica</i>	-	-	-	-	1.56	3.448	2.63	7.64				
Khirro	<i>Sapium insigne</i>	-	-	-	-	3.12	3.448	1.80	8.38	4.00	5.00	1.58	10.58
Rajbrikshya	<i>Cassia fistula</i>	-	-	-	-	-	-	-	-	4.00	5.00	17.15	26.15
Sindure	<i>Mallotus philippensis</i>	-	-	-	-	-	-	-	-	8.00	10.00	1.57	19.57
Kalikath	<i>Miliusa velutina</i>	-	-	-	-	-	-	-	-	4.00	5.00	0.07	9.07
Total		100	100	100	300	100	100	100	300	100	100	100	300

Note: RD = relative dominance, RF= Relative Frequency, RA= Relative Abundance, IVI- Importance Value Index.

3.3.3.2 Biodiversity index in Tree species

The Shannon - wiener diversity index was the highest of regeneration staged plant with 1.15. This was the least of tree staged plant. The Simpson index was the highest 0.63 of regeneration staged plant while it was the lowest 0.49 of tree staged plant (Table 25).

Table 25: Tree species diversity in Udipur Markichowk Section

Biodiversity Index	Tree	Pole	Regeneration
Shannon - wiener diversity index	0.78	1.00	1.15
Simpson index of diversity	0.49	0.60	0.63
Evenness Index	0.88	0.90	0.96

3.3.3.3 Importance Value Index of Herbs, Shrubs and Grass species in winter season

The relative density, frequency and coverage of herb, shrubs and grass species were varying in winter season and its varying the importance value index accordingly. The highest importance value index was recorded of *Arthromeris wallichiana* with 21 while the least value of IVI was recorded of species like *Buddleja asiatica*, *Lyonia ovalifolia*, *Bambusa vulgaris*, *Justicia adhatoda*, *Jatropha curcus*, *Lyonia ovalifolia*, *Cyperus rotundus* and *Cyanotis cristata* (Table 26).

Table 26: Herbs, Shrubs and Grass species in Udipur Markichowk Section

SN	Species	Scientific name	Relative density	Relative Frequency	Relative Coverage	IVI
1	Unyu	<i>Arthromeris wallichiana</i>	4	10	7	21
2	Chari Amilo	<i>Oxalis articulate</i>	10	2	6	18
3	Bhati	<i>Clerodendrum infortunatum</i>	4	8	6	18
4	Kalo Banmara	<i>Ageratina adenophora</i>	8	4	6	18
5	Dhursilo	<i>Colebrookea oppositifolia</i>	2	9	5.5	16.5
6	Gande jhar	<i>Ageratum conyzoides</i>	7	4	5.5	16.5
7	Dubo	<i>Cynodon dactylon</i>	9	2	5.5	16.5
8	Banmara	<i>Eupatorium cannabinum</i>	6	4	5	15
9	Banse Ghas	<i>Panicum sp</i>	4	5	4.5	13.5
10	Titepati	<i>Artemisa carvifolia</i>	2	7	4.5	13.5
11	Seto banmara	<i>Chromolaena odorata</i>	5	4	4.5	13.5
12	Pani amala	<i>Nephrolepis cordifolia</i>	7	2	4.5	13.5
13	Ban Tulashi	<i>Ocimum gratissimum</i>	4	4	4	12
14	Bilaune	<i>Maesa indica</i>	2	5	3.5	10.5
15	Sisnu	<i>Urtica dioica</i>	4	2	3	9
16	Apamarga	<i>Achyranthes aspera</i>	2	4	3	9
17	Raju Kandha	<i>Xeromphis sp.</i>	2	4	3	9
18	Kurilo	<i>Asparagus racemosus</i>	2	4	3	9
19	Bhimshen Pati	<i>Buddleja asiatica</i>	2	2	2	6
20	Angeri	<i>Lyonia ovalifolia</i>	2	2	2	6

SN	Species	Scientific name	Relative density	Relative Frequency	Relative Coverage	IVI
21	Bamboo	<i>Bambusa vulgaris</i>	2	2	2	6
22	Ashuro	<i>Justicia adhatoda</i>	2	2	2	6
23	Sajiwani	<i>Jatropha curcus</i>	2	2	2	6
24	Angeri	<i>Lyonia ovalifolia</i>	2	2	2	6
25	Mothe	<i>Cyperus rotundus</i>	2	2	2	6
26	Kane jhar	<i>Cyanotis cristata</i>	2	2	2	6

3.3.3.4 Importance Value Index of Herbs, Shrubs and Grass species in summer season

The relative frequency, density and coverage of herbs, shrubs and grass species were varying so the importance value index was also varying. The highest importance index was of *Oplismenus* sp. with 35.89 while this value was the least of *Onychium* sp. with 0.91 (Table 27).

Table 27: IVI of Herbs, Shrubs and Grass sp. in Udipur Markichowk Section in Summer Season

S	Scientific name	Relative	Relative	Relative	IVI
1	<i>Pogonatherum panicum</i>	3.52	18.83	11.33	33.6
2	<i>Urnea lobata</i>	4.23	1.36	2.12	7.71
3	<i>Oplismenus</i> sp.	5.63	20.91	9.35	35.8
4	<i>Saccharum spontaneum</i>	2.11	3.77	2.55	8.43
5	<i>Casia tora</i>	2.82	1.04	1.27	5.13
6	<i>Nephrolepsis</i> sp.	0.70	1.30	0.85	2.85
7	<i>Alocasia</i> sp.	0.70	0.32	0.57	1.60
8	<i>Imperata cylindrica</i>	2.11	6.49	3.12	11.7
9	<i>Cynodon dactylon</i>	6.34	6.43	2.86	15.6
10	<i>Desmodium</i> sp.	4.23	4.74	3.96	12.9
11	<i>Sida</i> sp.	1.41	0.71	0.99	3.11
12	<i>Blumea</i> sp.	3.52	0.91	0.85	5.28
13	<i>Centella asiatica</i>	2.82	1.43	2.27	6.51
14	<i>Smilax</i> sp.	1.41	0.19	0.71	2.31
15	<i>Vitis</i> sp.	1.41	0.65	1.42	3.47
16	<i>Artemissia vulgaris</i>	3.52	2.08	5.66	11.2
17	<i>Scutellaria</i> sp.	0.70	0.97	0.28	1.96
18	<i>Gonostegia</i> sp.	2.11	0.39	0.71	3.21
19	<i>Clerodendrum</i> sp.	4.93	2.27	7.36	14.5
20	<i>Ageratina adenophora</i>	1.41	0.65	1.70	3.76
21	<i>Persicaria</i> sp.	2.11	1.10	0.99	4.21
22	<i>Cyperus rotundus</i>	2.11	0.84	0.57	3.52
23	<i>Biden pilosa</i>	2.11	1.56	1.13	4.80
24	<i>Ageratum haustonianum</i>	4.93	3.57	6.51	15.0
25	<i>Justicia</i> sp.	1.41	0.71	1.42	3.54
26	<i>Cromolaena dorata</i>	3.52	0.39	2.27	6.18
27	<i>Barleria</i> sp.	2.11	3.38	3.96	9.45

S	Scientific name	Relative	Relative	Relative	IVI
28	<i>Onychium sp.</i>	0.70	0.06	0.14	0.91
29	<i>Dioscorea sp.</i>	0.70	0.13	0.14	0.98
30	<i>Mumosa sp.</i>	1.41	0.52	0.85	2.78
31	<i>Evolvulus sp.</i>	0.70	1.95	2.27	4.92
32	<i>Justicia adhatoda</i>	2.11	0.71	1.98	4.81
33	<i>Dryopteris sp.</i>	2.11	1.69	5.10	8.90
34	<i>Oxalis corniculata</i>	2.11	2.40	1.70	6.21
35	<i>Solanum sp.</i>	2.82	0.65	1.98	5.45
36	<i>Parthenium</i>	1.41	1.10	1.42	3.93
37	<i>Tectaria sp.</i>	0.70	0.13	0.57	1.40
38	<i>Rorippa sp.</i>	0.70	0.19	0.28	1.18
39	<i>Piper sp.</i>	0.70	0.19	0.28	1.18
40	<i>Kyllinga brevifolia</i>	0.70	0.97	0.57	2.24
41	<i>Phyllanthus sp.</i>	0.70	0.13	0.14	0.98
42	<i>Fimbristylis sp.</i>	0.70	0.19	0.28	1.18
43	<i>Lygodium sp.</i>	1.41	0.45	0.85	2.71
44	<i>Ichnocarpus sp.</i>	1.41	0.32	0.85	2.58
45	<i>Barleria cristata</i>	0.70	0.06	0.28	1.05
46	<i>Murrya koenigi</i>	0.70	0.13	1.13	1.97
47	<i>Acyranthes aspera</i>	1.41	0.39	1.27	3.07
48	<i>Adiantum sp.</i>	0.70	0.45	0.28	1.44
49	<i>Asparagus sp.</i>	0.70	0.06	0.28	1.05
50	<i>Eleusine sp.</i>	0.70	0.06	0.57	1.34

3.3.3.5 Comparison of Importance value index of herbs, shrubs and grass species between winter and summer season

The number species of herbs, shrubs and grass were varying according to season. Total 26 species of herbs, shrubs and grass species were found in this section in winter season. The importance value index was also varied according to season in this section. Total 50 species of herbs, shrubs and grasses were recorded in summer season.

3.3.3.6 Ethno-botanical use of plants (Udipur-Markichowk)

Some plants species and their ethno-botanical uses are described in the table 18. Total 75 species of plants were recorded in this section. Local people have been using these species for different purposes. For instance, *Urnea lobate* is used for treating fractures, wound and snake bites. Similarly, *Clerodendrum sp.* is used for treating the skin disorder and healing the wound. *Murrya koenigi* is used for treating piles, inflammation, itching, fresh cuts, dysentery. Moreover, *Acyranthes aspera* is used for abdominal relief (Table 28).

Table 28: Ethno botanical use of plant species ((Udipur-Markichok Section)

SN	Local name	Scientific name	Family	Use Value
1		<i>Pteris vitata</i>	Pteridaceae	Fodder
2	Musekhari	<i>Pogonatherum paniceum</i>	Poaceae	Fodder
3		<i>Urnea lobata</i>	Malvaceae	treating fractures, wounds, mastitis and snake bites
4	Base ghas	<i>Oplismenus</i> sp.	Poaceae	Fodder
5	kash	<i>Saccharum spontaneum</i>	Poaceae	Fodder, Fibre
6	Patpate	<i>Casia tora</i>	Fabaceae	Fodder
7	pani amala	<i>Nephrolepsis</i> sp.	Polypodaceae	Food
8	jaluka	<i>Alocasia</i> sp.	Araceae	Food
9	siru	<i>Imperata cylindrical</i>	Poaceae	Fodder
10	Dubo	<i>Cynodon dactylon</i>	Poaceae	Fodder
11		<i>Desmodium</i> sp	Fabaceae	Fodder
12	Balu jhar	<i>Sida</i> sp.	Malvaceae	To treat asthma, tuberculosis, the common cold, flu, headaches
13	Buki	<i>Blumea</i> sp.	Asteraceae	Fodder
14	Ghodtapre	<i>Centella asiatica</i>	Apiaceae	used to heal wounds, improve mental clarity
15	Kukurdaino	<i>Smilax</i> sp.	Smilacaceae	Very used as a diuretic, purifying, vulnerary
16		<i>Vitis</i> sp.	Vitaceae	Fodder
17	Tite pati	<i>Artemissia vulgaris</i>	Asteraceae	Skin disease, fever
18		<i>Scutellaria</i> sp.	Lamiaceae	Perfumery
19		<i>Gonostegia</i> sp.	Urticaceae	Food
20	Bhaati	<i>Clerodendrum</i> sp.	Lamiaceae	Skin disorder, wound healing
21	Nilo ghandhe	<i>Ageratina adenophora</i>	Asteraceae	used for treatment such as wound, itching, measles, skin diseases
22		<i>Persicaria</i> sp.	polygonaceae	Fodder
23	Mothe	<i>Cyperus rotundus</i>	Cyperaceae	Fodder
24	Kalo kuro	<i>Biden pilosa</i>	Asteraceae	Fever, wound healing
25	Banmara	<i>Ageratum haustonianum</i>	Asteraceae	Use is to cure wounds and burns
26		<i>Justicia</i> sp.	Acanthaceae	Fodder
27	Seto manmara	<i>Cromolaena dorata</i>	Asteraceae	Treat wounds, burns, and skin infections
28		<i>Barleria</i> sp.	Acanthaceae	Fodder
29	Sindhure	<i>Onychium</i> sp.	Pteridaceae	Fodder

SN	Local name	Scientific name	Family	Use Value
30	Tarul	<i>Dioscorea</i> sp.	Dioscoreaceae	Food
31		<i>Mumosa</i> sp.	Fabaceae	Fodder
32		<i>Evolvulus</i> sp.	convolvulaceae	to treat fever and expel intestinal worms
33	Asuro	<i>Justicia adhatoda</i>	Acanthaceae	Use to relief from abdominal pain
34	Uniu	<i>Dryopteris</i> sp.	Dryopteridaceae	Food
35	Chari amilo	<i>Oxalis corniculata</i>	Oxalidaceae	Used in the treatment of influenza, fever, urinary tract infections
36	Bihi	<i>Solanum</i> sp.	Solanaceae	Fodder
37	Pati jhar	<i>Parthenium hysterophorus</i>	Asteraceae	remedy for skin inflammation, rheumatic pain, diarrhoea
38	Niguro	<i>Tectaria</i> sp.	Tectariaceae	Food
39		<i>Rorippa</i> sp.	Brassicaceae	Food
40	Pipla	<i>Piper</i> sp.	Piperaceae	Spices, flavouring
41		<i>Kyllinga brevifolia</i>	Cyperaceae	Fodder
42		<i>Phyllanthus</i> sp.	Phyllanthaceae	Cough
43		<i>Fimbristylis</i> sp.	Cyperaceae	Fodder
44		<i>Lygodium</i> sp.	Lygodiaceae	Fodder
45	Dudhe	<i>Ichnocarpus</i> sp.	Apocynaceae	Fodder
46		<i>Barlaria cristata</i>	Acanthaceae	Fodder
47	Mitho nim	<i>Murraya koenigi</i>	Rutaceae	Used in treating piles, inflammation, itching, fresh cuts, dysentery
48	Datiwan	<i>Acyranthes aspera</i>	Acanthaceae	Abdominal relief
49		<i>Adiantum</i> sp.	Pteridaceae	Decorative
50	Kurilo	<i>Asparagus</i> sp.	Asparagaceae	
51		<i>Eleusine</i> sp	Poaceae	
52	Bel	<i>Egle marmelos</i>	Rutaceae	food, heat relief
53	Pehuli	<i>Reinwardtia indica</i>	linaceae	Decorative
54	Bilauni	<i>Maesia chisia</i>	Primulaceae	Fodder
55	Aiselu	<i>Rubus ellipticus</i>	Rosaceae	Food
56	Khayar	<i>Acacia catechu</i>	Fabaceae	Khatha & Cutch
57		<i>Pyrrosia</i> sp.	Polypodiaceae	treatment of nephritis and bronchitis
58	Khaneu/ Nimaro	<i>Ficus semecordata</i>	Moraceae	Fodder
59	Dhasure	<i>Colebrookia oppositifolia</i>	Lamiaceae	To treat peptic ulcers.
60		<i>Sida cordifolia</i>	Malvaceae	Fodder
61	Amala	<i>Phyllanthus emblica</i>	Phyllanthaceae	Used both as a medicine and as a tonic to build up lost vitality and vigor

SN	Local name	Scientific name	Family	Use Value
62	harro	<i>Terminalia chebula</i>	Combretaceae	To treat high cholesterol and digestive disorders, including both diarrhea and constipation, and indigestion
63	Kali angeri	<i>Melostoma sp.</i>	Melostomataceae	Decorative, fodder
64	Batulpate	<i>Stephania japonica</i>	Menispermaceae	Cancer, bone fracture and fever.
65		<i>Plantago major</i>	Plantaginaceae	To treat skin diseases, eye irritation and inflammation of mouth and throat
66	Siris	<i>Albizia sp.</i>	Fabaceae	To treat cough, boils, lung problems, flu
67	Chilaune	<i>Schima wallichii</i>	Thiaceae	Antimicrobial, anticoagulant, and antioxidant
68	Bhorla	<i>Bahunia vali</i>	Fabaceae	Leaf plate, tonic and aphrodisiac
69	Koiralo	<i>Bahunia variegata</i>	Fabaceae	Peacle
70	Bhalayo	<i>Semecarpus anacardium</i>	Anacardiaceae	Anti-atherogenic, anti-inflammatory, antioxidant
71	Sajh	<i>Terminalia alata</i>	Combretaceae	Antibacterial, antifungal, antiprotozoal, antiviral
72	Kabro	<i>Ficus lacor</i>	Moraceae	Fodder, treatment of bleeding disorders, herpes, wounds, mouth ulcers
73	Dudhe jhar	<i>Euphorbia hirta</i>	Euphorbiaceae	To treat cough, coryza, bronchitis, and asthma
74	Bayar	<i>Ziziphus jujuba</i>	Rhamnaceae	To treat asthma, cough, and laryngitis
75	Kadam	<i>Anthocephalus cadamba</i>	Rubiaceae	Religious purpose, fever, uterine complaints, skin diseases

3.3.4 Vegetation Biodiversity Markichok-Bharatpur Section

A. Importance Value Index of Tree species

The importance value index of tree species was varying according to different stage of the plants. The highest record of importance value index was 216.4 of *Shorea robusta* and it was followed by *Terminalia chebula* Retz. With 37.23 of tree staged plants. The highest importance value index was 92.29 of *Shorea robusta* of pole staged plants and it was lowest of two species *Madhuca latifolia* (Roxb.) and *Castonopsis spp* with 6.315. The highest importance value index was 44.77 of *Lagerstroemia parviflora* and it was followed by *Mallotus philippensis* with 42.82 (Table 29).

Table 29: Importance Value Index of Tree Species in Markichok-Bharatpur Section

Local Name	Scientific Name	Tree				Pole				Sapling			
		RD	RF	RA	IVI	RD	RF	RA	IVI	RD	RF	RA	IVI
Sal	<i>Shorea robusta</i>	79.1	79.1	54.55	216.4	37.68	13.04	41.57	92.29	20	14	1	35
Bel	<i>Aegle marmelos</i>	4.16	4.16	9.091	14.29	-	-	-	-	-	-	-	-
Harro	<i>Terminalia chebula</i>	8.33	8.33	18.18	37.23	-	-	-	-	-	-	-	-
Mauwa	<i>Engelhardtia spicata</i>	4.67	4.16	9.091	14.97	1.449	4.348	0.518	6.315	-	-	-	-
Saj	<i>Terminalia alata</i>	4.16	4.16	9.091	17.15	-	-	-	-	2.857	5	2.82	10.68
Chilaune	<i>Schima walichii</i>	-	-	-	-	24.64	17.39	25.96	67.99	11.43	5	20.92	37.34
Kaphal	<i>Myreca esculenta</i>	-	-	-	-	4.348	4.348	2.167	10.86	5.714	5	1.833	12.55
Kattush	<i>Castonopsis indica</i>	-	-	-	-	1.449	4.348	0.518	6.315	-	-	-	-
Guhelo	<i>Callicarpa macrophylla</i>	-	-	-	-	7.246	4.348	8.576	20.17	-	-	-	-
Padeli	<i>Stereospermum sp</i>	-	-	-	-	1.449	4.348	1.123	6.921	-	-	-	-
Rajbrikshya	<i>Cassia fistula</i>	-	-	-	-	1.449	4.348	2.894	8.691	5.714	10	5.668	21.38
Tiju	<i>Pierasma javanica</i>	-	-	-	-	2.899	4.348	1.712	8.959	-	-	-	-
Bhalayo	<i>Semecarpus anacardium</i>	-	-	-	-	2.899	4.348	4.394	11.64	-	-	-	-
Botdhagero	<i>Lagerstroemia parviflora</i>	-	-	-	-	5.797	17.39	2.958	26.15	11.43	15	18.34	44.77
Khirro	<i>Sapium insigne</i>	-	-	-	-	2.899	4.348	3.209	10.46	2.857	5	10.18	18.04
Sindhure	<i>Mallotus philippensis</i>	-	-	-	-	4.348	8.696	2.08	15.12	17.14	10	15.68	42.82
Kyamun	<i>Cleistocalyx operculata</i>	-	-	-	-	1.449	4.348	2.324	8.121				
Jhigane	<i>Kydia calycina</i>	-	-	-	-	-	-	-	-	8.571	10	3.638	22.21
Tatari	<i>Acer tataricum,</i>	-	-	-	-	-	-	-	-	2.857	5	10.18	18.04
Jamun	<i>Syzygium cumini</i>	-	-	-	-	-	-	-	-	5.714	10	1.72	17.43
Kattush	<i>Castonopsis indica</i>	-	-	-	-	-	-	-	-	5.714	5	9.025	19.74

Note: RD = relative dominance, RF= Relative Frequency, RA= Relative Abundance, IVI- Importance Value Index.

3.3.4.1 Biodiversity Index of Tress species

The biodiversity index was varying according to stage of the plants. The highest Shannon - wiener diversity index was 0.87 of regeneration staged plants. The Simpson index of diversity was the highest of regeneration staged plants with 0.53 and lowest was of pole staged plants with 0.33 (Table 30).

Table 30: Tree biodiversity in Markichok-Bharatpur Section

Biodiversity Index	Tree	Pole	Regeneration
Shannon - wiener diversity index	0.60	0.60	0.87
Simpson index of diversity	0.36	0.33	0.53
Evenness Index	0.67	0.49	0.90

3.3.4.2 Importance Value Index of Herb, Shrub and Grass species found in Winter season

The specieswise value of relative density, frequency and coverage were varying and importance value index was differed accordingly in winter season. The highest value of importance of was recorded 27.00 of *Clerodendrum infortunatum* while the lowest value was 6.00 of some species like *Xeromphis* sp., *Achyranthes aspera*, *Mikania micrantha*, *Argemone Mexicana*, *Thysanolaena maxima* and *Cyperus rotundus* (Table 31).

Table 31: Herb, Shrub and Grass species in Markichok-Bharatpur section in Winter Season

SN	Species	Scientific name	Relative density	Relative Frequency	Relative coverage	IVI
1	Bhanti	<i>Clerodendrum infortunatum</i>	4	14	9	27.00
2	Seto Banmara	<i>Chromolaena odorata</i>	7	10	8.5	25.5
3	Kadi Patta	<i>Murraya koenigii</i>	7	8	7.5	22.5
4	Gande Jhar	<i>Ageratum conyzoides</i>	7	8	7.5	22.5
5	Unyu	<i>Dryopteris</i> sp.	8	6	7	21
6	Kalo Banmara	<i>Ageratina adenophora</i>	8	6	7	21
7	Ban Tulashi	<i>Ocimum gratissimum</i>	5	6	5.5	16.5
8	Titepati	<i>Artemisa carvifolia</i>	5	6	5.5	16.5
9	Dubo	<i>Cynodon dactylon</i>	7	2	4.5	13.5
10	Aishelu	<i>Rubus ellipticus</i>	5	4	4.5	13.5
11	Angeri	<i>Lyonia ovalifolia</i>	5	4	4.5	13.5
12	Banse Ghas	<i>Cyperous</i> sp.	6	3	4.5	13.5
13	Kande ful	<i>Lantana camera</i>	5	2	3.5	10.5
14	Dharselo	<i>Colebrookea oppositifolia</i>	5	2	3.5	10.5
15	Pailati	<i>Cipadessa baccifera</i>	2	4	3	9
16	Bansh	<i>Bambusa vulgaris</i>	3	2	2.5	7.5
17	Apamarga	<i>Achyranthes aspera</i>	2	2	2	6
18	Mikania	<i>Mikania micrantha</i>	2	2	2	6

SN	Species	Scientific name	Relative density	Relative Frequency	Relative coverage	IVI
19	Thakal	<i>Argemone mexicana</i>	2	2	2	6
20	Amriso	<i>Thysanolaena maxima</i>	2	2	2	6
21	Mothe	<i>Cyperus rotundus</i>	2	2	2	6
22	Raju kanda	<i>Xeromphis</i> sp.	2	2	2	6

D. Importance Value Index of Herbs, Shrub and Grass species in summer season

The importance value index was varying according species as relative frequency, density and coverage was varying according to plant species. The highest importance value index was 31.75 of *Imperata cylindrica* while this value was the lowest 1.32 of two plant species namely *Parthenium hysterophorus* and *Vitis* sp. (Table 32).

Table 32: IVI of herbs, shrub and Grass sp. in Markichowk-Baharatpur section in Summer Season

SN	Scientific Name	Relative frequency	Relative Density	Relative coverage	IVI
1	<i>Imperata cylindrica</i>	4.12	18.18	9.45	31.75
2	<i>Urnea lobata</i>	4.12	4.41	3.74	12.27
3	<i>Melostoma</i> sp.	0.00	0.81	3.15	3.96
4	<i>Evolvulus</i> sp.	2.06	1.89	0.79	4.74
5	<i>Desmodium</i> sp.	4.12	1.80	3.74	9.66
6	<i>Blumea</i> sp.	3.09	0.54	1.18	4.81
7	<i>Clerodendrum</i> sp.	2.06	0.63	2.36	5.05
8	<i>Cynodon dactylon</i>	4.12	6.30	2.76	13.18
9	<i>Ageratum haustonianum</i>	4.12	8.55	3.94	16.61
10	<i>Sida</i> sp.	4.12	0.90	1.38	6.40
11	<i>Pogonatherum paniceum</i>	4.12	9.45	4.92	18.50
12	<i>Oxalis corniculata</i>	3.09	4.05	1.57	8.72
13	<i>Oplismenus</i> sp.	4.12	16.38	7.48	27.99
14	<i>Hypoxis</i> sp.	1.03	1.35	0.79	3.17
15	<i>Barleria cristata</i>	1.03	0.18	1.97	3.18
16	<i>Artemissia vulgaris</i>	3.09	1.80	2.76	7.65
17	<i>Biden pilosa</i>	2.06	2.97	1.77	6.80
18	<i>Phyllanthus</i> sp.	5.15	1.98	4.72	11.86
19	<i>Persicaria</i> sp.	1.03	0.72	1.57	3.33
20	<i>Ageratina adinophora</i>	1.03	2.25	5.51	8.79
21	<i>Cyperus rotundus</i>	2.06	0.18	0.39	2.64
22	<i>Cromolaena odorata</i>	2.06	0.54	1.57	4.18
23	<i>Stephania japonica</i>	2.06	0.36	1.18	3.60
24	<i>Parthenium hysterophorus</i>	1.03	0.09	0.20	1.32
25	<i>Polypodium</i> sp.	3.09	0.72	5.51	9.32
26	<i>Saccharum</i> sp.	1.03	0.27	1.18	2.48

SN	Scientific Name	Relative frequency	Relative Density	Relative coverage	IVI
27	<i>Commelina</i> sp	1.03	0.27	0.39	1.69
28	<i>Lygodium</i> sp.	2.06	0.54	3.54	6.15
29	<i>Ichnocarpus</i> sp.	1.03	0.54	1.18	2.75
30	<i>Dryopteris</i> sp.	1.03	0.63	1.57	3.24
31	Lamiaceae	3.09	1.80	2.36	7.26
32	<i>Reinwardtia indica</i>	1.03	0.18	0.39	1.60
33	<i>Centella asiatica</i>	1.03	1.08	0.39	2.50
34	<i>Cyperus</i> sp.	3.09	0.99	0.98	5.07
35	<i>Saccharum spontaneum</i>	2.06	2.70	0.79	5.55
36	<i>Dioscorea</i> sp	2.06	0.27	0.79	3.12
37	<i>Rubus ellipticus</i>	1.03	0.27	1.57	2.88
38	<i>Micania micrantha</i>	1.03	1.26	4.33	6.62
39	<i>Cajanus</i> sp.	1.03	0.90	1.97	3.90
40	<i>Calotropis gigantea</i>	1.03	0.09	0.79	1.91
41	<i>Woodfordia fruticosa</i>	1.03	0.18	0.79	2.00
42	<i>Acaranthes aspera</i>	1.03	0.27	0.39	1.69
43	<i>Mallotus philippenensis</i>	1.03	0.27	0.39	1.69
44	<i>Vitis</i> sp.	1.03	0.09	0.20	1.32
45	<i>Cruculigo</i> sp.	1.03	0.27	0.39	1.69
46	<i>Pogostemon benghalensis</i>	1.03	0.09	1.18	2.30

Comparison of herbs, shrubs and grass species in Markichowk-Chitwan Section in winter and summer season: There were only 22 species of herbs, shrubs and grass in this section in winter season but it was 46 species in summer season.

3.3.4.3 Ethnobotany of Important Species

Some important plant species and their ethnobotanical uses are presented in table. *Clerodendrum* sp. is used for treating the skin disease. Similarly, *Oxalis corniculata* is used to treat traumatic injuries, sprains and poisonous snake bites. *Stephania japonica* is used for treating cancer, bone fracture and fever. *Hypoxis* sp. is used for treating Tuberculosis, arthritis, and a skin disease (Table 33).

Table 33: Ethnobotanical value of vegetation in Bharatpur Section

S N	Local name	Scientific name	Family	Use Value
1	Sal	<i>Shorea robusta</i>	Dipterocarpaceae	Timber
2	Siru	<i>Imperata cylindrica</i>	poaceae	Fodder
3		<i>Urnea lobata</i>	Malvaceae	Treating fractures, wounds, mastitis and snake bites.
4	Kali angeri	<i>Melostoma</i> sp.	Melostomataceae	Decorative

S N	Local name	Scientific name	Family	Use Value
5		<i>Evolvulus</i> sp.	Convulvulaceae	
6		<i>Desmodium</i> sp.	Fabaceae	Fodder
7	Buki	<i>Blumea</i> sp.	Asteraceae	Fodder
8	Bhati	<i>Clerodendrum</i> sp.	Lamiaceae	Skin disease treatment
9	Dubo	<i>Cynodon dactylon</i>	poaceae	Fodder
10	Nilo ghandhe	<i>Ageratum haustonianum</i>	Asteraceae	Use is to cure wounds and burns
11	Balu jhar	<i>Sida</i> sp.	Malvaceae	To treat cough
12	Musekhari	<i>Pogonatherum paniceum</i>	poaceae	Fodder
13	Chari amilo	<i>Oxalis corniculata</i>	Oxalidaceae	To treat traumatic injuries, sprains and poisonous snake bites
14	Base ghas	<i>Oplismenus</i> sp.	poaceae	Fodder
15		<i>Hypoxis</i> sp.	Hypoidaceae	Tuberculosis, arthritis, and a skin condition
16		<i>Barleria cristata</i>	Acanthaceae	Fodder
17	Tite pati	<i>Artemisia vulgaris</i>	Asteraceae	Skin disorder
18	Kalo kuro	<i>Biden pilosa</i>	Asteraceae	Ear infections, kidney problems
19		<i>Phyllanthus</i> sp.	Phyllanthaceae	stomach pain relief and cough
20		<i>Persicaria</i> sp.	Polygonaceae	Fodder
21	Banmara	<i>Ageratina adinophora</i>	Asteraceae	blood cogulation
22	Mothe	<i>Cyperus rotundus</i>	Cyperaceae	Fodder
23	Seto banmara	<i>Cromolaena odorata</i>	Asteraceae	Treat wounds, burns, and skin infections
24	Batulpate	<i>Stephania japonica</i>	Menispermaceae	cancer, bone fracture and fever
25	pati jhar	<i>Parthenium Hysterophorus</i>	Asteraceae	Rheumatic pain, diarrhoea, urinary tract infections
26		<i>Polypodium</i> sp.	Polypodiaceae	Fodder
27	Kash	<i>Saccharum</i> sp.	poaceae	Fodder
28	Kane jhar	<i>Commelina</i> sp.	Commelinaceae	Fodder
29		<i>Lygodium</i> sp.	Lygodiaceae	Fodder
30	Dudhe	<i>Ichnocarpus</i> sp.	Apocynaceae	Fodder
31	uniu	<i>Dryopteris</i> sp.	Dryopteridaceae	food, fodder
32	tulasi jhar	Lamiaceae	Lamiaceae	Aromatic
33	Pehuli	<i>Reinwardtia indica</i>	linaceae	Ornamental
34	Ghod tapre	<i>Centella asiatica</i>	Apiaceae	Heal wounds, improve mental clarity, and treat skin conditions such as leprosy

S N	Local name	Scientific name	Family	Use Value
35	mothe	<i>Cyperus</i> sp.	Cyperaceae	Fodder
36	khar	<i>Saccharum spontaneum</i>	poaceae	Fodder, Fiber
37	Tarul	<i>Dioscorea</i> sp	Dioscoreaceae	food, fodder
38	Aiselu	<i>Rubus ellipticus</i>	Rosaceae	Food
39	Manmara	<i>Micania micrantha</i>	Asteraceae	Briquettes fuel, fodder
40	Rahar ghas	<i>Cajanus</i> sp.	Fabaceae	Fodder
41	Ank	<i>Calotropis gigantea</i>	Apocynaceae	Treating skin, digestive, respiratory, circulatory and neurological disorders
42	Dhairo	<i>Woodfordia fruticosa</i>	Lythraceae	Dysentery, diarrhea, ulcer, and infections
43	Datiwan	<i>Achyranthes aspera</i>	Acanthaceae	Abdominal disorder, wound treatment
44	Sindhure, raini	<i>Mallotus philippensis</i>	Euphorbiaceae	kill intestinal worms
45		<i>Vitis</i> sp.	Vitaceae	To treat skin wound treatment
46	Rudilo	<i>Pogostemon benghalensis</i>	Lamiaceae	To treat cough
47		<i>Cruculigo</i> sp.	Amaryllidaceae	Treatment of impotence, limb limpness, arthritis of the lumbar and knee joints, and watery diarrhea

3.3.5 Hot spot of floral diversity

3.3.5.1 Hot Spot of floral diversity in Khudi Manang Section

Khudi Manang section was started from Dharapani Manang to Khudi. Altitude of Dharapani is 2400m while elevation of Khudi is 1200 m. The vegetation was diversified in this section. The upper section comprises temperate and sub temperate vegetation. The local people shared that *Morchella conica* (Guchi Chyau), *Valerina Jatamansi* (Sugandhwal), *Nardostachyas Jatamansi* (Jamanshi), *Neopicrorhiza scrophulariiflora* (Kutki), *Aconitum spicatum* (Atish Jara) are the major medicinal and aromatic plant species generally found in the forest of this section. The upper section contains Blue pine (Gobre Salla) and *Alnus* (Uttish) forest. *Himalayacalamus asper* (Nigalo) is dominant species in the midsection. The lower section comprises subtropical forest. *Cyatheales* spp (Tree fern), *Machilus odoratissima* (Kaulo) and *Piper longum* (Pipala) were the important species in the lower part of this section.

The mid section of Khudi Manang section can be considered as the biodiversity hotspot areas because of presence of important vegetation species and species diversity. This lies in Chaymche in Marsyangdi Rural Municipality. The area is rocky and covered some very valuable species like *Trachycarpus* sp., *Berginia ciliate* and *Himalayacalamus asper* (Nigalo forest) (Table 34).

Table 34: Biodiversity hot spot in Khudi Manang Section

Location	Location detail	Speciality of hot spots	Remarks
Mid-section of Khudi Manang section	Marsyangdi Rural Municipality, Chaymche	Species Diversity includes	<i>Cyatheales</i> spp (Tree fern), <i>Machilus odoratissima</i> (Kaulo) and <i>Piper longum</i> (Pipala) were the important species in moist area.
		1 <i>Trachycarpus</i> sp.	
		2 <i>Berginia ciliata</i>	
		3. Nigalo forest	
		Rocky slope that remarks to more vulnerable	

3.3.5.2 Hot Spot of floral diversity in Khudi Udipur Section

Khudi Udipur section starts from Khudi close to Bhulbhule Danda and ended at Udipur near to Beshi Shahar. The lower altitude of this section is 722m. So, dominant forest was sub-tropical. *Pinus roxburghii* (Khote Salla), *Schima wallichii* (Chilaune), *Castanopsis spp.* (Katus), *Albizia spp* (Siris), *Madhuca longifolia* (Mahuwa), *Phyllanthus emblica* (Amala) were major tree species in this section. *Shorea robusta* was also found in the lower part of the section. *Acacia catechu* (Khair), *Dalbergia sissoo* and *Bombax ceiba* (Semal) were found in the riverside. *Pandanus odorifer* (Kewara) was found near to the Mid Marshymagdi hydropower station dam). Some important medicinal and aromatic plant species were *Cynodon dactylon* (Dubo), *Buddleja tibetica* (Bhimsen pati), *Centella asiatica* (Ghod Tapre) found close to riverside. *Arthromeris wallichiana* (Unyu), *Justicia adhatoda* (Asuro), *Solanum xanthocarpum* (Kantkari), *Bambusa vulgaris* (Bamboo) were importantly found in this section.

A site close to AP 4 in Khudi – Udipur section is very important for biodiversity conservation. This site is located close to Besisahar. The important plant species were *Pandanus sp.*, *Schima wallichii*, *Clerodendrum sp*, *Dominant Smilax sp.* and *Asparagus racemosus*. So, this site needs to conserve as biodiversity hot spot (Table 35).

Table 35: Biodiversity Hot spot in Khudi Udipur section

Location	Location detail	Speciality of hit spots	Remarks
Khudi - Udipur section, near to AP 4	Besisahar municipality, Lamjung	Species Richness:	Moist area (<i>Smilax sp.</i> is the dominant plants in this area)
		1. <i>Pandanus</i> sp.	
		2. <i>Schima wallichii</i>	
		3. <i>Clerodendrum</i> sp	
		4. <i>Smilax</i> sp.	
		5. <i>Asparagus racemosus</i>	

3.3.5.3 Hot spot of floral diversity in Udipur Markichowk Section

This section is started from Udipur and ended at Markichowk. The endpoint elevation is 372m which possesses subtropical and tropical climate. The species were generally varying according to the altitudinal and climatic variation of the section. Riverain species like *Acacia catechu* (Khair) and *Bombax ceiba* (Simal) were found in this section. In addition, this section was dominated by *Schima wallichii* (Chilauene) and *Castanopsis spp* (Katush) Forest. The altitude of Dhuwakot village is 463 m and aspect is South East. The tree species composition in the forest was very

unique. The species were *Myrica esculanta* (Kafal), *Schima wallichii* (Chilauene), *Castanopsis* sp.), *Shorea robusta* (Sal), *Aegle marmelos* (Bael) and *Albizia* sp. (Siris). *Anaphalis contorta* (Bukiphool), *Cyperus rotundus* (Mothe), *Curcuma* sp. (Kalo Haledo), *Asparagus* sp. (Kurilo), *Dioscorea bulbifera* (Githa), *Oxalis corniculata* (Chari Amilo), *Phyllanthus niruri* (Bhuin Amala), *Trapa bispinosa* (Semal Kande) are some important medicinal and aromatic plant species in the forest.

The location between AP 38 and 39 at Rainash municipality-8, Harrabot Lamjung is very rich in biodiversity. This site was covered by *Albizia* sp., *Lagerstomia parviflora*, *Phyllanthus emblica* and *Rauvolfia serpentina*. Local people shared that, this site is famous habitat for *Rauvolfia serpentina* but these days, it is at high risk and hence this site needs to conserve as biodiversity hot spot (Table 36).

Table 36: Biodiversity hotspot in Udipur Markichowk Section

Location	Location detail	Speciality of hotspots	Remarks
Between AP38-AP39	Rainas municipality-8, Harrabot Lamjung	Species: 1. <i>Albizia</i> sp., 2. <i>Lagerstomia parviflora</i> , 3. <i>Phyllanthus emblica</i> and 4. <i>Rauvolfia serpentina</i>	at high risk of locally extinction of Sarpagandha

3.3.5.4 Hot spot of floral diversity in Markichowk Bharatpur Section

This section lies in the lower part having altitude from 221 to 372 m (Narayangadh). Generally subtropical forest species were found in this section. *Shorea robusta* (Sal) in Teria Sal Forest, Hill Sal Forest in Chure area and Riverain *Bombax ceiba* (Simal) in Terai and Chure area were found in this section. *Abrus precatorius* (Ratigedi), *Abelmoschus moschatus* (Ban Kapas), *Achyranthes aspera* (Datiwan), *Allium sativum* (Ban Lasun), *Acorus calamus* (Bojho), *Aegle marmelos* (Bael), *Alstonia scholaris* (Chhatiwan), *Alternanthera sessilis* are important medicinal and aromatic plant species in the forest of this section.

Importantly, the location near to AP 14 of **Markichowk** -Bharatpur Section is very important for biodiversity hotspot. The location situated at Abukhaireni-4, Chimkesari Dada is hotspot for biodiversity. The major plant species were 1. *Myrica esculenta*, 2. *Shorea robusta*, 3. *Schima wallichii* and 4. *Macaranga patulata*. This site is highly prone to erosion. Therefore, this area needs to conserve because of high biodiversity (Table 37).

Table 37: Biodiversity hot spot in Markichowk Bharatpur Section

SN	Location	Location detail	Speciality of hot spots	Remarks
1	Near to AP 14 point of Markichowk-Bharatpur Section	Abukhaireni-4, Chimkesari Dada	Ecotone area for: 1. <i>Myrica esculenta</i> 2. <i>Shorea robusta</i> 3. <i>Schima wallichii</i> 4. <i>Macaranga patulata</i>	Highly prone to erosion area

3.3.6 Conservation status of plant species

Some species are very important in these sections of Marsyangdi river hydro electricity transmission line project. Government of Nepal, Convention" means the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and International Union for Conservation of Nature (IUCN) have listed as the protected species in Nepal according to their current status.

3.3.6.1 List of species and its protection status at Khudi-Manang Section

Some plant species found in the forest and its vicinity of Khudi-Manang transmission line project is listed under different protection status. Though *Juglans regia* was not samples in this section, this species was found nearby forest. *Juglans regia* is protected by the government of Nepal. *Dactylorhiza hatagirea* (Panchaunle) was not found in the sample plot but local people shared that this species is very common in nearby forest; this species is also protected under government of Nepal (Table 38).

Table 38: Protection Status of Species Khudi Manang

Local name	Scientific name	Protection status (GoN)	CITES Appendixes	IUCN Red list
Okhar	<i>Juglans regia</i>	Protected		
Panchaunle	<i>Dactylorhiza hatagirea</i>			
Kutki	<i>Neopyrorhiza scrophulariiflora</i>		II	
Jatamanshi	<i>Valeriana jatamansii</i>		II	
Orchid	<i>Calanthe alpina</i> Hook. f. ex Lindl.		II	
Ban Aduwa	<i>Calanthe plantaginea</i> Lindl.		II	
HarJor	<i>Cymbidium aloifolium</i>			
Bhote Lahara	<i>Gnetum montanum</i> Markgr.			Endangered

3.3.6.2 List of species and its protection status at Khudi Udipur Section

Some plant species found in this section are listed under the protected categories. *Dendrobium ensiflorum* Lindl, *Cyathea brunoniana*, *Vanda cristata* Wall. ex Lindl and *Gnetum montanum* were found in this section was protected under Appendix II of CITES (Table 39).

Table 39: Protection Status of Species at Khudi Udipur section

Local name	Scientific name	Protection status (GoN)	CITES Appendix	IUCN Red list
Sungava	<i>Dendrobium densiflorum</i> Lindl.		II	
Tree Fern	<i>Cyathea brunoniana</i>		II	
Bhyagute phul.	<i>Vanda cristata</i> Wall. ex Lindl.		II	
Bhote Lahara	<i>Gnetum montanum</i> Markgr.		II	

3.3.6.3 List of species and its protection status at Udipur Markichowk Section

Euphorbia royleana, *Euphorbia prostrata*, *Rauvolfia serpentina* and *Dioscorea deltoidea* are major faunal species which are protected under CITES Appendixes. *Rauvolfia serpentina* and *Dioscorea deltoidea* are protected under Endangered and Threatened respectively under IUCN Red list (Table 40).

Table 40: Protection Status of Species at Udipur Markichowk

Local name	Scientific name	Protection status (GoN)	CITES Appendix	IUCN Red list
Siundee	<i>Euphorbia royleana</i>		II	
Kanike Ghans	<i>Euphorbia prostrata</i>		II	
Sarp Gandha	<i>Rauvolfia serpentina</i>		II	Endangered
Kukur Tarul	<i>Dioscorea deltoidea</i>		II	Threatened

3.3.6.4 List of species and its protection status at Markichowk Bharatpur Section

Some floral species found in this section are protected under Government of Nepal, CITES and IUCN Red list. Some examples of this were *Alstonia scholaris* is protected under IUCN Red list as rare species. *Acacia catechu* is protected under the government of Nepal and CITES Appendix II. *Rauvolfia serpentina* and *Cycas pectinata* both species are protected under CITES Appendix II and Endangered species in IUCN red list (Table 41).

Table 41: Protection Status of Species at Markichowk Bharatpur

Local name	Scientific name	Protection status (GoN)	CITES Appendix	IUCN Red list
Chatiwan	<i>Alstonia scholaris</i>			Rare
Khair	<i>Acacia catechu</i>	Protected		Threatened
Sal	<i>Shorea robusta</i>	Protected		
Sissoo	<i>Dalbergia sissoo Roxb. ex DC.</i>	Protected	II	
Satisal	<i>Dalbergia latifolia</i>	Protected	II	Vulnerable
Kanike Ghans	<i>Euphorbia prostrata</i>		II	
Sarp Gandha	<i>Rauvolfia serpentina</i>		II	Endangered
Thakal	<i>Cycas pectinata</i>		II	Endangered
Kukur Tarul	<i>Dioscorea deltoidea</i>		II	Threatened
Tate Bari	<i>Dalbergia stipulacea</i>		II	
Orchid	<i>Ascocentrum ampullaceum</i>		II	

4 OUTCOMES OF THE FOCAL GROUP DISCUSSION (FGD)

Focus Group Discussion (FGD) and Key Informant Interviews (KII) conducted with local communities and key stakeholders in the project area brought forth an interesting conservation regarding the perspective of the local people regarding the project impact on wildlife. The key points from the six discussions have been listed below followed by the summaries of each FGD.

Key points expressed during FGDs regarding project impact on wildlife:

- i. There will be significant habitat loss for the wildlife as a result of clear cutting from the project.
- ii. There should be afforestation programs to compensate for the loss of trees to restore habitats.
- iii. Awareness programs should be given and periodic interaction should be conducted between the locals and project managers to discuss the impact of the project.
- iv. Compliance to the mitigation measures should be monitored with local participation.
- v. Key wildlife habitats should be left undisturbed.

The following summaries are direct feedback from the perspective of the participants without our interpretation:

4.1 Focal Group Discussion - Location: Tal village, Manang district

Summary of discussion: *Number of participants: 10, Date: 2078-12-02*

The tree clearing for the electrical transmission lines will result in habitat loss of wildlife in addition to other impacts. Direct loss of forest area, increase in cases of electrocution of vultures in transmission wires, and increase in the population of monkeys and leopards are some expected impacts. Bear conflicts need addressing in the region. The local people should be properly informed before starting the project. For every tree felled, 10 trees should be planted and authorities should put in more effort to combat cases of forest fires. Public awareness programs should be conducted, and compliance to rules and laws should be monitored. The TL wires should be kept away from settlement areas. The project managers should conduct periodic discussion, at least twice a year with the public to give updates on progress as well as receive public feedback. Using the local manpower should be prioritized wherever possible.

4.2 Focal Group Discussion - Location: Dharapani, Manang district

Summary of discussion: *Number of Participants: 4, Date: 2078-12-03*

The wildlife in the area will be displaced due to the construction of transmission line tower structures. There have been past incidents where construction work was done without proper agreement with the public. In recent years there has been an increase in conflict related to ghorals, bears, monkeys, and leopards. There are some cases of wildlife hunting by visitors and people who come from other areas for different work. They had heard that the high temperature in the transmission line structure can result in forest fires. Proper mitigation measures must be taken to minimise the impact of the project on wildlife and environment. There should also be some measures in place for compensation and insurance for loss or harm caused as a result of the project.

Local people should be prioritized for employment and should be consulted before implementing construction activities.

4.3 Focal Group Discussion - Location: Tachai village, Manang district

Summary of discussion: *Number of Participants: 10, Date: 2078-12-03*

Road construction, electrical transmission lines, and hydropower dams have large direct impacts on wildlife habitats. The river flow will be interrupted and will dry the upstream areas. During construction, the noise from activities will also stress out and disturb the wildlife. Measures to minimize these impacts should be implemented with consultation from experts. Alternate habitats should be built for the displaced wildlife and some important habitats should be left undisturbed. Plantation activities should be implemented, noise and air pollution should be minimized. Roads should be maintained to reduce pollution. The project managers should work closely with locals to implement these mitigation measures, and prioritize local people for job opportunities. While implementing the project, local culture should be respected and biodiversity should be protected.

4.4 Focal Group Discussion - Location: Tallo Chipla village, Lamjung district

Summary of discussion: *Number of Participants: 5, Date: 2078-12-13*

The project will make the rivers dry and affect the local climate making it hotter and displacing wildlife to other areas. There will be risk of electrocution cases from the transmission lines. Even smaller wildlife such as frogs will be impacted. Three mules had died in the past due to electrocution at Shreechaur. Landowners should be compensated properly in areas where the transmission line passes over their land. Plantation programs should be implemented to compensate for the loss of trees from clearcutting. Locals should be encouraged to use induction stoves instead of firewood to save trees. 25 trees should be planted in place of every tree felled. The locals should be provided with conservation awareness and capacity building training. Mitigation measures should be strictly implemented by the government in the affected regions within 2-5 years of project completion, through a joint collaboration of all affected parties.

4.5 Focal Group Discussion - Location: Syange, Lamjung district

Summary of discussion: *Number of Participants: 5, Date: 2078-12-13*

The main areas important for wildlife in the locality are - Sildhunga bhitta area, the Northern Mipra area, region around Syange River, Western Tagrin, and the Upper region of Rambazar and Jagat area around the border of Manang-Lamjung district. Noise and disturbance during project construction activities will scare the wildlife from the area, and workers might be involved in hunting activities. The fish population will decline due to dams, and cases of electrocution of domestic (mention of mules dying in past due to electrocution) and wild animals will increase. Locals should be assigned to monitor compliance, and proper rules and regulations should be enforced to minimize impacts of the project. Work should be done in agreement with local stakeholders.

4.6 Focal Group Discussion - Location: Jaldevi Community Forest, Bharatpur, Chitwan district

Summary of discussion: *Number of Participants: 2, Date: 2078-12-20*

The Barandabar corridor is very rich in biodiversity and is an important region for conservation. However, the area has been affected by a lot of activities with the major being the expansion of the highway, construction of landfill site resulting in chemical pollution, and military training which includes firing practice. Clearing forest and adding transmission lines will have a great adverse impact on the existing wildlife corridor. The large enclosed area of the substation in the forest will also affect the wildlife habitat. There is a need to make an underpass on the highway for animal crossing. The landfill should be moved to another area. Where possible the transmission lines should be made underground. The company should inform workers of the importance of biodiversity and enforce compliance with conservation rules. Small mitigation programs should be jointly implemented with the community forest and larger mitigation measures should be implemented by the government.

5 ENVIRONMENTAL IMPACTS

This chapter addresses the likely adverse impacts of the project on the biological environment of the area. In this report, impacts are identified based on the field study information. In order to minimize the predicted impacts, mitigation measures have also been proposed in this section. Predicted impacts and the mitigation measures on the different aspect of the biological environment in discussed below.

5.1 Wildlife

5.1.1 Wildlife habitat loss

This is going to be one of the major impacts on the local wildlife due to the project. 30m of clear cutting under the corridor is going to impact wildlife, especially small mammals and change their habitats drastically. The clearing can affect wildlife in both ways: positively for disturbance loving species such as Golden Jackal, and negatively for core species such as Himalayan Black Bears. This might also result in habitat fragmentation but we don't have enough data on movement of wildlife to verify this. There is also a high probability that the clearing will have barrier effects¹ for insects, reptiles, amphibians, small mammals and even some large mammals that avoid edges.

5.1.2 Illegal hunting of Wildlife

Illegal hunting is going to be one of the most prominent threats to the local wildlife during the construction phase. Since a lot of workers come from other parts of the country and the work provides them with some purchasing power, the workers might entice locals to sell them bushmeat. In some cases, they might even hunt the animals themselves. A similar incident with Red Panda was reported from the Manang area. Coupled with the forest clearings and road extensions, this can result in increased bushmeat and wildlife trade in the project site².



Photo 1. Snare found in Khudi, Lamjung (left). Probable hunters in Bagarchhap camera trap (right).

¹ William F. Laurance, Miriam Goosem, Susan G.W. Laurance, Impacts of roads and linear clearings on tropical forests, *Trends in Ecology & Evolution*, Volume 24, Issue 12, 2009, Pages 659-669, ISSN 0169-5347, <https://doi.org/10.1016/j.tree.2009.06.009>.

² William F. Laurance, Miriam Goosem, Susan G.W. Laurance, Impacts of roads and linear clearings on tropical forests, *Trends in Ecology & Evolution*, Volume 24, Issue 12, 2009, Pages 659-669, ISSN 0169-5347, <https://doi.org/10.1016/j.tree.2009.06.009>.

5.1.3 Accidental death of wildlife

Clear cutting as well as activities like transporting goods and setting infrastructures for the transmission lines is a massive undertaking which will drastically modify the land use of the area which could be sheltering wildlife, especially the small mammals and birds that take shelter in borrows and trees. Construction activities might inadvertently destroy wildlife shelters and also trigger landslides and rockslides that can cause unintentional death of wildlife.

5.1.4 Increased human-wildlife conflict

The construction of infrastructures in some scale disturbs the wildlife. In one particular hydropower station, there was a reported killing of a civet due to its presence in the hydropower building. The clearing under the transmission line can also act as a trail for conflict species such as Leopard, Himalayan Black Bear and Barking deer. Since this trail intersects with farmlands and villages, the incidents of encounter and crop depredation might increase which in turn increases conflict.

5.1.5 Inorganic waste in wildlife habitat

We observed improper disposal of inorganic waste throughout the project area and this was more severe in a particular hydropower station. Construction workers can leave inorganic waste such as plastics and metals in their working area without proper management. Leftover construction materials such as wires can act as unintentional snares.

5.1.6 Disturbances during fawning season of ungulates

Ungulates have been known to avoid areas where construction of transmission lines have been ongoing but the existence of power lines itself might not have much disturbance³. During the calving season, females avoid disturbances as much as possible for the sake of their calves. Hence, the construction phase of the transmission line can have a high impact on the breeding females.

5.1.7 Disruption in the natural activity pattern of wildlife

The activity overlap graphs (Figure 8) show that Masked Palm Civet, Leopard, Leopard Cat and Large Indian Civet are more active when there is less human activity. On the other hand, Yellow-throated Marten, Langur and Barking Deer overlap temporally with humans. Since these three are usually tolerant to human presence, we don't think there will be much disturbance for these species. However, if the constructions are conducted during night time as well, Civets, Leopard and Leopard Cat can suffer disturbances and can abruptly change their natural activity pattern.

5.1.8 Loss of access to water holes

During dry seasons, water holes will be the limiting resources for the wildlife. Work and infrastructure development near water holes can make the water holes inaccessible for the wildlife.

³ Colman, J.E., Tsegaye, D., Flydal, K. *et al.* High-voltage power lines near wild reindeer calving areas. *Eur J Wildl Res* **61**, 881–893 (2015). <https://doi.org/10.1007/s10344-015-0965-x>

5.1.9 Positive impacts on wildlife

While there are several short and long term that can cause potential harm to the wildlife in the area, some edge loving species will benefit in the long term as a result of the change. Species that are adapted to living in forest edges and disturbed areas, will thrive in the post project completion period. Sites that will recover secondary vegetation over time will provide new habitat for small mammals and act as a corridor for some larger mammals.

5.1.10 Local Community Involvement:

1. Locals can be hired for construction and other jobs in the field site. This will have two positive impacts.
 - a. Locals don't/won't increase the demand for bushmeat and won't set traps.
 - b. This will also change the perspective of locals into a positive outlook towards the project.

5.2 Avi-fauna (Birds)

1. Landfill sites close to transmission line are sometimes problematic. Similar site was observed near Besisahar, at the bank of Marsyangdi River, crows, kites and vultures are found in high number in the garbage site for food. These bird species attract bigger predatory and scavenging birds like eagles. There may be the chances of bird collisions in such area.
2. Some migratory bird species take the path of river and gorge area during the migration period. Existing as well as proposed electric transmission lines are found crossing the Marsyangdi River that flows from north to south. There may be the chances of bird collisions in such area.
3. During the surveys, habitats potential for raptors were found at Simalchaur area of Lamjung (vantage point 20 and 21), about 2 km north of Palungtar airport (vantage point 39), Chaukidanda of Chitwan (vantage point 64). These areas were found important for soaring of raptors. As the raptors take the height or cross the hill ridge, there could be chance of collision or electrocution.
4. The project site also contains good wetland habitat for migratory bird species. Migratory wetland birds were recorded in the wide Marsyangdi river area and dam-side area close to Markichowk substation and Udipur substation. There may be the chances of bird collisions in such area.
5. In the settlement areas raptors are attracted where people farm chicken and duck in an open space. There is chance of collision of the raptors with the transmission line passing close by the settlement area, as they dive to hunt the domesticated animals. There may be the chances of bird collisions in such area.
6. Existing transmission lines passing parallel to the proposed transmission line forms a wide barrier for the flying birds.
7. It was found that there is also a practice of hunting birds by Chepang community (place on the way to Chhimkeswori, vantage point 59). It is not directly related to transmission line but threats to birds might change their behavior.

5.3 Flora/Vegetation

5.3.1 Impact of project on Forest and Vegetation

5.3.1.1 Impact of project on forest and vegetation in Khudi Manang and Khudi Udipur Section

The impact of Marsyangdi Corridor Transmission Line Project can be categorized into two main categories. These are: i. Augmented impact and ii. Adverse Impacts

A. Augmented impact: More than 27.0385 ha forest area will be afforested as ex-situ conservation and same species will be planted in open areas of the forest. Total 315,050 seedlings will be planted in the ratio of 1:25. So, the biodiversity will be maintained in the nearby forest. The forest user will be aware about the merit of the project. In addition, felled trees will be handed over to the authority and users. They can use forest products for their own purpose. Thus, government of Nepal can generate the royalty from selling the timber and so as the forest users can. Local forest professionals will have opportunity to work in the forest and biodiversity conservation activities like, they will have employment to work in nursery, afforestation and protection. In addition, the afforested areas will be additional habitat for wildlife.

B. Adverse Impacts

The possible adverse impacts can be categorized into three main parts. These are area loss, tree loss and biodiversity and habitat loss.

Affected forest area and management types: The project permanently requires 27.0385 ha forest area. So, some parts of different types of forest management types will be affected due to this project in Manang (Khudi Manang section) and Lamjung (Khudi Udipur section) districts. Some parts of Annapurna Conservation Area (ACA) and government managed forest will be affected. Similarly, 8 community forests (7 community forests in Lamjung district and one community forest in Manag district) will be affected. Moreover, 3 leasehold forests will be affected in Lamjung district.

Affected Forest Tree species in Khudi Manang and Khudi Udipur section: Total 12602 trees of different species will be felled during the construction phase of the TL. These affected species are *Schima wallichii* (Chilaune), *Pinus Wallichiana* (Gobre salla), *Pinus oxburghii* (Khote Salla), *Shorea robusta* (Sal), *Alnus nepalensis* (Utis), *Dalbergia sissoo* (Sissoo), *Juglans regia* (Okhar), *Madhuca Longifolia* (Mahuwa), *Michelia champaca* (Chanp), *Fraxinus floribunda* (Lankuri), *Semecarpus anacardium* (Bhalayo), *Myrica esculenta* (Kafal), *Albizia* sp. (Siris), *Catonopsis indica* (Katus) and *Litsea monopelata* (Kutmiro),

Moreover, there may be the probability of illegal extraction of forest products like fuel wood collection for workers working in the project. They may burn the forest and illegally hunt the wildlife. The extraction of forest product may affect the Non-timber Forest Products (NTFPs) in specific site.

Loss of trees in Private Forest: Total 985 number of trees and pole will be cut. Out of these 364 stems were tree staged and 621 stems were pole staged. In addition, 75 bamboo clumps and 400

clumps of Nigalo will be cut. Major affected species were *Pinus Wallichiana* (Gobre salla), *Malus pumila* (Apple), *Jugland regia* (Okhar), *Prunus persica* (Peach), *Pinus roxburghii* (Khote salla), *Michelia champaca* (Chanp), *Albizia* sp. (Siris), *Bombax cieba* (Semal), *Schima wallichii* (Chilauene), *Cedrela toona* (Tooni), *Syzygium cumini* (Jamun), *Terminalia chebula* (Harro), *Bauhinia purpurea* (Tanki) etc. (Table 42).

The envisaged impacts will be medium in magnitude, local in extent and long-term duration.

Table 42: Forest management types and affected areas Khudi Manang and Khudi Udipur section

Forest Management Types	District	Number	Affected Area ha	Number of trees to be felled
ACA	Manang	Some parts	2.7625 (10.22%)	8051
	Lamjung	Some parts	14.5145 (53.68%)	
Gov. Managed Forest	Manang	Some parts	0	194
	Lamjung	Some parts	0.4135 (1.53%)	
Community forest	Manang	1	0.480 (1.78%)	3110
	Lamjung	7	6.192 (22.9%)	
Leasehold forest	Manang	-	0	1247
	Lamjung	3	2.676 (9.9%)	
Total			27.0385	12602

Source: NEA, 2018

Note: ACA: Annapurna Conservation, Government management forest, CF: Community Forest, LF: Leasehold Forest, PF: Private Forest

5.3.1.2 Impact of project on Biodiversity in Udipur-Markichowk and Markichowk-Bharatpur Section

A. Augmented impact: Approximately, 90.65ha forest area will be afforested as ex-situ conservation in these sections. Moreover, maintaining the ratio of 1:25, total 315,200 seedlings and saplings shall be planted as a compensatory plantation. This will be ex-situ conservation nearby the project area. Moreover, the government authority (division forest office) will have positive support to Nepal Electricity Authority. In addition, community forest and leasehold forest users will have more planted forest. Furthermore, felling of trees in government managed forest, community and leasehold forest will create the opportunity to generate the royalty selling the products. The users can use the timber and firewood after harvesting of these trees including poles. Local people can engage in harvesting, nursery techniques, plantation and protection activities so this will be employment opportunity for them. Ultimately, the afforested areas will provide the better habitat for wildlife.

B. Adverse Impact: There are three major forest management types in these sections namely Udipur-Markichowk and Markichowk-Bharatpur. These forest management types are government management, community forest and lease hold forest. Total 43.5 ha government managed forest will be affected because of this TL in four districts namely Lamjung, Gorkha, Tanahu and Chitwan. Total 2,492 trees will be felled during construction phase of this project. Similarly, total 20 community forests will be affected because of this TL project. So, total 43.8325 ha community forest area will be affected and hence 2985 trees including pole will be harvested during

construction phase of this project. Moreover, 3 leasehold forests (1 in Chitwan and 2 in Gorkha district) will be affected because of this TL project. Thus, 3.31 ha leasehold forest will be affected and hence 42 trees (24 pole and 18 trees) will be cut for this project. In addition, some sapling sized plants also will be harvested during construction phase of this project. Therefore, total 90.6425ha forest area will be affected because of this project and 5519 trees will be harvested (Table 43).

Table 43: Forest management types and affected areas in Udipur-Markichowk and Markichowk-Bharatpur section

Forest Management Types	District	No.	Affected Area ha	Number of trees to be felled (Tree+ pole)
Government Managed Forest	Lamjung	1	4.17 (4.6%)	47
	Gorkha	6	2.30 (2.54%)	147
	Tanahu	5	12.76 (14.08)	281
	Chitwan	4	24.27 (26.78%)	2017
	Sub total	16	43.5 (47.99%)	2492
Community Forest	Lamjung	9	18.93 (20.88%)	768
	Gorkha	7	13.41(14.79%)	1261
	Tanahu	2	4.93 (5.44%)	74
	Chitwan	2	6.5625 (7.24%)	882
	Sub total	20	43.8325 (48.36%)	2985
Leasehold forest	Lamjung	-	-	-
	Gorkha	2	2.62 (2.89%)	31
	Tanahu	-	-	-
	Chitwan	1	0.69 (0.76%)	11
	Sub total	3	3.31 (3.65%)	42
Total		39	90.6425	5519

The impacts will be medium in magnitude, local in extent and long-term duration.

Source: NEA, 2017

6 MITIGATION MEASURES

6.1 Wildlife

We recommend the following mitigation measures for the identified project impacts on wildlife:

6.1.1 Mitigation for wildlife habitat loss

There will be a significant habitat loss. Our camera trap study has verified the presence of a diverse variety of small and large mammals in the region. As clear cutting along the TL area will decrease habitable area for wildlife some measures have to be taken to minimize the impact of habitat loss.

- i. Where possible it is recommended that clearcutting should avoid fragmentation of contiguous forest, and instead narrow stretches of corridor should be left behind so mammals can use these to travel safely between adjacent habitats.
- ii. Trees and other wild vegetation plantation programs should be implemented through reforestation and forest restoration where feasible, in the surrounding areas.
- iii. It is recommended that the species selected for restoration should be selected based on expert recommendation to ensure that they are non-invasive and can adapt well to the local environmental conditions. The selected species should be diverse so that they can fulfil different ecological roles to help support wildlife and restore/reform the ecological balance in the area.

6.1.2 Mitigation for Illegal hunting of wildlife

Hunting/Poaching incidents might increase during project activities. The clear cutting will create clearings which will reduce cover for wildlife, thus leaving them more vulnerable and easier to spot for hunters.

- i. Awareness campaigns/training should be conducted for locals as well as workers and visitors involved in the construction project not to hunt them.
- ii. In addition, information and warning signs/boards to discourage hunting and for creating conservation awareness, should be placed along the construction sites.
- iii. Compliance to the no hunting/harming wildlife should be monitored by onsite supervisor during the project.
- iv. Road extension should be kept to a minimum. Roads should be extended only when absolutely necessary. For roads that won't be used in the long term, care should be taken that they can go back to their natural state.

6.1.3 Mitigation for human-wildlife conflict

There might be both a short and long-term increase in human-wildlife conflict cases. As a result of habitat loss, the carrying capacity of the local ecosystem will decrease which might cause some species to venture closer to human settlements and farm areas in search of food, resulting in an increase in human-wildlife conflict cases.

Also land use change and modification of existing habitat might chase away some species while attracting others depending on their habitat preferences. For some species this will disrupt their habituated trails and hunting/foraging spaces.

- i. We recommended that follow up study should be conducted to monitor conflict cases during construction and after project completion to identify the proper mitigation strategy for possible conflict scenarios.
- ii. Awareness campaigns/training should be conducted for locals as well as workers and visitors involved in the construction project on how to deal with animal encounters and how to avoid them.

6.1.4 Reducing accidental death of wildlife

Cases of accidental death of wildlife might increase. During clearing of vegetation and construction of the TL infrastructures, there is a high likelihood of accidental death of wildlife especially those that live on trees and borrows.

- i. Proper inspection of the area is recommended before clear cutting for nests and burrows so the wildlife will have time to escape to a safer location.
- ii. Making structures or leaving small patches of shrubs and bushes for small mammals to take cover in the open is recommended.
- iii. Some animals and birds might use the transmission infrastructure, for eg - Flying squirrels can climb the poles and use them as gliding platforms. It is recommended to use non harmful physical deterrent structures where possible like spikes and fences in high-risk sites so chances of wildlife approaching these areas decreases.

6.1.5 Control of Inorganic waste in wildlife habitat

Unmanaged waste in the project site can be hazardous to wildlife. In the post project completion period, some of these areas will retain vegetation and be habitable for species that live on forest edges.

- i. All inorganic waste produced as a result of construction activities should be properly collected and removed from the environment.
- ii. Any chemical wastes should be segregated and disposed properly so the local environment is not polluted.

6.1.6 Local Community Involvement

Locals can be hired for construction and other jobs in the field site. This will have several positive impacts.

- i. Locals don't/won't increase the demand for bushmeat and won't set traps and control hunting cases to some extent.
- ii. This will also change the perspective of locals into a positive outlook towards the project.
- iii. Seeing conservation steps implemented as a part of the project will help spread awareness among the local people on the value of biodiversity and need for assessment and mitigation measures for any future projects in the region.

6.1.7 Reducing activities at night time and avoiding unnecessary noise/gatherings

Loud noises and operation of heavy machinery coupled with the all-time presence of large numbers of humans in their habitat can have a negative impact on the activity pattern of some wildlife.

- i. Although heavy machineries will be required for the completion of the project, the use of heavy machinery should be kept to a minimum. We recommend that in forested areas, the use of heavy machinery should be done only during day time to reduce impact on wildlife.

6.1.8 Waterholes and streams consideration

Prior plans should be made while working at sites with all year-round waterholes and streams. This can be easily done. We also recommend making sure that these waterholes and streams are left in as natural a state as possible for future after construction is completed.

6.1.9 Enhancing the habitat restoration process

After the project completion, most of the areas will recover secondary vegetation with an increase in grassland and shrublands. This might create new living spaces for some smaller mammals and corridors for others to move across habitats. The project managers can help make plans and take steps to help in restoration of such areas.

- i. Clearcutting areas should be conducted in a way that minimizes disturbance to the physical topography of the site.
- ii. After project completion, these sites should be planted with vegetation that does not pose risk to the constructed infrastructures and at the same time help bring more biodiversity and ecological balance to the region.
- iii. Newly formed habitats can add more diversity to both flora and fauna in the long run.
- iv. Awareness campaigns should encourage participation from the local community so that it will enhance community knowledge on the wildlife in their area and the value of biodiversity thus contributing to long term wildlife conservation.

6.1.10 Potential positive impacts on the community

- i. Job opportunities from the project, increased income, and improved roads can help faster transition from fuelwood to alternative energy resources, thus making habitats sustainable in the long term.
- ii. Presence of government bodies and monitoring can reduce poaching and hunting.

Table 44: Summary of Mitigation Measures

Identified impacts	Mitigation of impacts
Habitat Loss	<ol style="list-style-type: none"> 1. Implement plantation programs and forest restoration where possible 2. Scientific selection of species for restoration purpose
Illegal Hunting/ Poaching	<ol style="list-style-type: none"> 1. Awareness programs for workers 2. Information and warning signs/boards should be placed to discourage such acts 3. Monitoring compliance
Human-Wildlife Conflict	<ol style="list-style-type: none"> 1. Awareness program for the workers and local people 2. Follow up study to observe change in conflict patterns to determine optimum conflict resolution measures
Accidental Deaths	<ol style="list-style-type: none"> 1. Inspect areas for nest and borrows before clearcutting or constructing

Identified impacts	Mitigation of impacts
	infrastructures 2. Make non harmful physical deterrent structures in high-risk structures/areas to reduce chances of animals approaching the site.
Hazardous Waste	1. All inorganic project waste should be collected and removed. 2. Chemical waste should be disposed of following proper regulations.
New Habitat Formation	1. Project activities should be conducted in a way that cause least impact to the physical terrain 2. Encourage plantation of non-invasive native vegetation in low-risk project sites after project completion.

6.2 Birds

- Three surveys of birds were carried out that covered Autumn, Winter and Summer seasons of a year. The survey has shown the present status of the bird. The status of the birds needs to be assessed even after the TL installation is completed, to monitor any unforeseen impacts to the birds by the TL.
- Either shifting of landfill sites or TL or placing of deflector devices in the TL is recommended.
- Use of deflector devices in river-crossed TL is recommended. Also recommended to minimize the multiple rivers crossing of TL.
- During the surveys, habitats potential for raptors were found at Simalchaur area of Lamjung (vantage point 20 and 21), about 2km north of Palungtar airport (vantage point 39), Chaukidanda of Chitwan (vantage point 64). These areas were found important for soaring of raptors. As the raptors take the height or cross the hill ridge, there could be chance of collision or electrocution. So, use of deflector devices in the TL of these area is recommended.
- The project site also contains good wetland habitat for migratory bird species. Migratory wetland birds were recorded in the wide Marsyangdi river area and dam-side area close to Markichowk substation and Udipur substation. Necessary techniques have to be applied in order to avoid collision and electrocution to arriving wetland birds including passage migrants in the winter season.
- Minimum clearance of the trees has to be done in the places rich in bird diversity as shown in above Figure 10,11,12 and 13.
- In the settlement areas raptors are attracted where people farm chicken and duck in an open space. There is chance of collision of the raptors with the TL passing close by the settlement area, as they dive to hunt the domesticated animals. It is recommended to train and aware local people to farm such animals within a closed space.
- Existing TLs passing parallel to the proposed TL forms a wide barrier for the flying birds. Necessary methods need to be adopted to avoid such barrier for the birds.
- It was found that there is also a practice of hunting birds by Chepang community (place on the way to Chhimkeswori, vantage point 59). It is not directly related to transmission line but threats to birds might change their behavior. So, awareness program is necessary for such community people.

- Disposal of animal flesh or carcasses need to be done far away from the TL passing area.

Below is a photo from Kaski district showing Vultures and Kites using TL tower to roost. So, it is very important to ensure bird safety on such transmission towers.



6.3 Flora/Vegetation

6.3.1 Mitigation Measures against impact of TL on forest and vegetation in Khudi Manang and Khudi Udipur Section

The mitigation measures against the impact of TL will be categorized into 6 parts. These are clearance of the site, acquisition of land, plantation and protection, coordination with the forest authority, private forest owner and forest users, aware the workers about the illegal activities in the forest, hot spot management for protected species.

A. Site clearance in the forest: Total 12,608 trees including poles will be felled from different management types of national forest and 985 (tree and poles) from private forest. So, the site clearance of felled trees and poles is very important. The site clearance includes the felling of affected trees including poles, logging and hand over process. The trees including pole shall be felled in such a way that neighbouring trees, pole and regeneration will not have affected and damaged or minimally affected and damaged. The care shall be taken whether the valuable (protected sp.) are damaged due during felling process of the tree including poles. Second step of site clearance is logging. After felling operation of affected trees, logging shall be proceeded which include the sectioning and transportation of logs at safe site. Next step of site clearance is hand

over process of the logs which was felled during the construction phase of the TL. Same process shall be followed for trees and poles felling in private forest as well.

B. Acquisition of land: It is very important to consider the percentage of areas affected because of the TL project. Total 27.0385ha of forest area will be permanently affected during the construction of the TL. According to government policy, land shall be purchased by the project and plantation shall be done of same species. Out of total affected forest area, about 63.9% i.e. 17.277 ha of land under Annapurna Conservation Area will be affected. Considering this fact, it is very important to maintain the affected conservation area through compensatory plantation.

C. Plantation and protection: The authority is responsible to afforest the plants (seedling & sapling) as a compensatory planation in the project area. The government policy emphasizes on the compensatory plantation in the ratio of 1:25 maintaining same species. Thus, total 315200 seedling and sapling shall be planted as a compensatory plantation. The plantations species shall be *Schima wallichii* (Chilaune), *Pinus Wallichiana* (Gobre salla), *Pinus oxburghii* (Khote Salla), *Shorea robusta* (Sal), *Alnus nepalensis* (Utis), *Dalbergia sissoo* (Sissoo), *Juglans regia* (Okhar), *Madhuca Longifolia* (Mahuwa), *Michelia champaca* (Chanp), *Fraxinus floribunda* (Lankuri), *Semecarpus anacardium* (Bhalayo), *Myrica esculenta* (Kafal), *Albizia* sp. (Siris), *Castonopsis indica* (Katus), *Litsea monopelata* (Kutmiro) in order to assure the ex-situ conservation. The government policy emphasizes on the protection of plantation for five years. The project needs to protect the planted forest and hand over the plantation area to the forest authority. Same mitigation measures shall be applied for affected trees in the private forest as well.

D. Coordination with forest authority: The TL of both sections affect Annapurna conservation area, government managed forest, community forest, lease hold forest and private forest. The project shall coordinate with the stakeholders like forest users, forest and conservation area authority as well as private forest owner. The project authority shall arrange the regular meeting, interaction and workshop with the stakeholders. Moreover, the authority shall provide the opportunity of employment in construction work as well as provide financial help to their development activities. The project needs to emphasize on the social harmony of the people in project area.

E. Aware the worker about the illegal activities in the forest: The project identified some illegal activities may be caused by workers during the construction of the TL. In this context, the workers shall be oriented about the illegal activities in the forest or minimize the damage in the forest. The orientation shall be focused on the illegal activities in the forest. It includes;

- i. avoid the collection and use of firewood and small wood without permission of users and authority for cooking and heating
 - ii. poaching (hunting and killing) of wild life
 - iii. Activities that cause soil erosion like excavation, and collection of non-timber forest product.
- Thus, the project authority needs to provide the alternative source of energy for cooking and heating for workers.

F. Hot spot management for protected species: There are two major hot spots in Khudi Manang and Khudi Udipur section of the TL project.

Hot spot management in Khudi Manang section: The upper part Khudi Manang section of possesses *Pinus wallichian* (Blue pine: Gobre Salla) and *Alnus* (Uttish) forest while *Himalayacalamus asper* (Nigalo) is dominant species in the midsection and *Cyatheales spp* (Tree fern), *Machilus odoratissima* (Kaulo) and *Piper longum* (Pipala) were the important species in the lower part of this section. In addition, upper part of Khudi Manang section is rich with medicinal and aromatic plant species *Morchella conica* (Guchi Chyau), *Valerina Jatamansi* (Sugandhwal), *Nardostachyas Jatamansi* (Jamanshi), *Neopicrorhiza scrophulariiflora* (Kutki), *Aconitum spicatum* (Atish Jara). These areas shall be given the priority to protect these important species considering their conservation status. The plant species like *Juglans regia*, *Dactylorhiza hatagirea*, *Neopycorhiza scrophulariiflora*, *Valeriana jatamansii*, *Calanthe alpina Hook. f. ex Lindl.*, *Calanthe plantaginea Lindl.*, *Cymbidium aloifolium* and *Gnetum montanum Markg* found in this section are protected by Government of Nepal, CITES Appendixes and IUCN Red list. Thus, these species shall be given high priority to conserve especially in hot spot area.

Hot Spot of floral diversity in Khudi Udipur Section: The dominant forest in this section was sub-tropical having important species like *Pinus roxburghii* (Khote Salla), *Schima wallichii* (Chilaune), *Castanopsis sp.* (Katus), *Albizia sp.* (Siris), *Madhuca longifolia* (Mahuwa), *Phyllanthus emblica* (Amala). In addition, *Shorea robusta* was found in lower part and *Acacia catechu* (Khair), *Dalbergia sissoo* and *Bombax ceiba* (Semal) in riverside. More importantly, *Pandanus odorifer* (Kewara) was found near to the Mid Marshyagdi hydropower station dam. Valuable medicinal and aromatic plant species like *Cynodon dactylon* (Dubo), *Buddleja tibetica* (Bhimsen pati), and *Centella asiatica* (Ghod Tapre) found close to riverside. *Arthromeris wallichiana* (Unyu), *Justicia adhatoda* (Asuro), *Solanum xanthocarpum* (Kantkari), *Bambusa vulgaris* (Bamboo) were found in this section. These sites need to manage according to protection status of the forest species as some valuable plant species like *Dendrobium ensiflorum Lindl*, *Cyathea brunoniana*, *Vanda cristata Wall. ex Lindl* and *Gnetum montanum* found in this section is protected under CITES and hence the high priority shall be given to protect these species in hot spot area.

6.3.2 Mitigation Measures against impact of TL on forest and vegetation in Udipur-Markichowk and Markichowk-Bharatpur Section

The mitigation measures against the impact of TL of Udipur-Markichowk and Markichowk-Bharatpur section will be grouped under six parts. These are clearance of the site, acquisition of land, plantation and protection, coordination with the forest authority, private forest owner and forest users, aware the workers about the illegal activities in the forest, hot spot management for protected species.

A. Clearance of the site: Obviously, some trees will be cut during construction phase of the TL project and the site needs to clear. Thus, the site clearance can be done in four steps. The first step of the site clearance is cutting 5519 trees (Trees+ poles). Some regeneration will also be removed

to construct the TL. Second step shall be focused on the logging activities like sectioning of the felled trees including poles and transporting them to safe places in log yard. So, feeling, logging and transporting activities shall be carried out in such a way that there shall be no or minimal damage to neighbouring plants (tree+ pole+ regeneration). Third step of the site clearance shall be focused on hand over of the log to the authority or users' group.

B. Land acquisition:

Total 90.6425 ha forest area will be affected because of the TL project. The government Nepal has policy for acquisition of same area of land to maintain the biodiversity. This principle shall be followed by the authority. The authority shall be given high priority to the percentage affected forest area and conservation status of the species. About 43.8325 (48.36%) community forest and around 43.5 ha (47.99%) government managed forests are affected due to TL in Lamjung, Gorkha, Tanahu and Chitwan districts, thus priority shall be given to manage this forest accordingly considering the conservation status of the species.

C. Plantation and protection: As total 5519 trees including poles will be harvested during the construction phase of the TL, total 137975 seedlings and sapling of same species shall be planted as a compensatory plantation. The plantations species shall be *Myrica esculenta* (Kafal), *Rhododendron arboretum* (Gurans), *Schima wallichii* (Chilaune), *Pinus oxburghii* (Khote Salla), *Alnus nepalensis* (Uti), *Dalbergia sissoo* (Sissoo), *Juglans regia* (Okhar), unknown (Pepe), *Madhuca Longifolia* (Mahuwa), *Fraxinus floribunda* (Lankuri), *Semecarpus anacardium* (Bhalayo), Tooni, *Albizia* sp. (Siris), *Castanopsis indica* (Katus), *Litsea monopelata* (Kutmiro), *Shorea robusta* (Sal), *Bombax ceiba* (Semal) in order to assure the ex-situ conservation. The project needs to protect the planted forest for five years and hand over the plantation area to the forest authority. Same mitigation measures shall be applied for affected trees in the private forest as well.

D. Coordination with forest authority:

The coordination is very important to protect the forest biodiversity. There are three types of forest management in these sections of the project. These are government managed forest, community forest and leasehold forest. Thus, it is very important to coordinate with the stakeholders like forest users, forest authority as well as private forest owner in order to get support to construct the TL. The coordination can be done through organizing the regular meeting, interaction and workshop with the stakeholders. The project needs to maintain the social harmony of the people in project area. The project authority shall provide the employment opportunity in construction work as well as provide financial help to the social development activities.

E. Aware the worker about the illegal activities in the forest: It is very important to aware the workers about the illegal activities in the forest. The illegal activities may be collection and use of firewood and small wood without permission of users for cooking and heating; poaching (hunting and killing) of wild life; activities that cause soil erosion like excavation and collection of non-timber forest product. Therefore, orientation is essential to aware the workers to avoid these illegal activities in the forest during construction phase of the TL. Thus, the project authority needs to provide the alternative source of energy for cooking and heating for workers.

F. Hot spot management for protected species: There are two major hot spots in Khudi Manang and Khudi Udipur section of the 220kV TL project.

Udipur and ended at Markichowk possesses some valuable types of vegetation which are valuable hotspots. These are *Acacia catechu* (Khair) and *Bombax ceiba* (Semal) in riverain area, *Schima wallichii* (Chilauene) and *Castonopsis spp* (Katush) Forest. Dhuwakot village having 463m and with South East aspect possesses unique composition of vegetation such as *Myrica esculanta* (Kafal), *Schima wallichii* (Chilauene), *Castonopsis sp.* (Katus), *Shorea robusta* (Sal), *Aegle marmelos* (Bel) and *Albizia sp.* (Siris). Moreover, *Anaphalis contorta* (Bukiphool), *Cyperus rotundus* (Methe), *Curcuma sp.* (Kalo Haledo), *Asparagus sp.* (Kurilo), *Dioscorea bulbifera* (Githa), *Oxalis corniculata* (Chari Amilo), *Phyllanthus niruri* (Bhuin Amala), *Trapa bispinosa* (Semal Kande) are valuable medicinal and aromatic plant species in the forest. Out of these *Euphorbia royleana*, *Euphorbia prostrata*, *Rauvolfia serpentine* and *Dioscorea deltoidea* are protected under CITES Appendixes. *Rauvolfia serpentine* and *Dioscorea deltoidea* are protected under Endangered and Threatened respectively under IUCN Red list. Considering the protection status of these species, the hotspot area needs to manage for biodiversity conservation.

Markichowk Bharatpur Section: possesses subtropical forest species like *Shorea robusta* (Sal) in Terai Sal Forest, Hill Sal Forest in Chure and Riverain *Bombax ceiba* (Simal) in Terai and Chure area. In addition, medicinal and aromatic plant species like *Abrus precatorius* (Ratigedi), *Abelmoschus moschatus* (Ban Kapas), *Achyranthes aspera* (Datiwan), *Allium sativum* (Ban Lasun), *Acorus calamus* (Bojho), *Aegle marmelos* (Bael), *Alstonia scholaris* (Chhatiwan), *Alternanthera sessilis* (Bhiringi Jhar) are valuable plant species in the forest of this section. Importantly, floral species found in this section like *Alstonia scholaris* is protected under IUCN Red list as rare species; *Acacia catechu* is protected under the government of Nepal and CITES IInd appendix. *Rauvolfia serpentine* and *Cycas pectinate* both species are protected under CITES IInd appendix and Endangered species in IUCN red list. Thus, considering the protection status of these floral species, the hotspots identified in this section, need to protect and manage accordingly.

7 CONCLUSION AND RECOMMENDATIONS

Certain section of the MCTLP line being developed lies in the Annapurna Conservation Area region. In this report, systematic assessment of wildlife, birds and vegetation was made to assess the impacts of the MCTLP on these aspects of environment. An attempt has been made in this study to gather more baseline information, predict impacts and recommend mitigation measures for wildlife birds and vegetation of the project impact area.

This assessment identified that the MCTLP project will results in impacts on forest/vegetation, wildlife and birds during the project construction and some impacts continuing during the operation phase of the project as well. The study predicted that the MCTLP will have more impacts on birds during its operation phase. Mitigation measures recommended in this study are specific and are additional to the approved IEE and EIA recommendations of the MCTLP.

This study identified and recommend the best practice measures for minimizing and managing the project related impacts arising mainly from clear felling of trees, wildlife habitat loss, human-wildlife conflict and illegal hunting, collision and electrocution, and construction disturbances. Awareness campaign and training is recommended as one of the key measures for managing human-wildlife conflict, illegal hunting and wildlife habitat restoration. Vegetation plantation program is recommended as a mitigation for habitat losses. Color balls and deflector devices are recommended in specific area based on the project impacts on birds.

The project will implement the mitigation measures proposed by this study in addition to those proposed in approved IEE and EIA of the project. This implementation will help ensure the avoidance/minimization of the impacts on the biodiversity.

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APPENDIX A: RELATED TO WILDLIFE*Table 1: Camera trap setup date and retrieved date with the coordinates and camera trap nights (first season).*

S.N	Station	Setup date	Retrieval date	Nights total	Latitude	Longitude
1	01A-ESSD10	2022-03-10	2022-03-17	7	28.5301	84.3399
2	03A-ESSD07	2022-03-10	2022-03-12	2	28.53045	84.32973
3	04A-ESSD04	2022-03-10	2022-03-17	7	28.54172	84.32973
4	05A-ESSD05	2022-03-10	2022-03-17	7	28.53383	84.36063
5	06A-ESSD17	2022-03-11	2022-03-18	7	28.53703	84.34552
6	07A-ESSD18	2022-03-09	2022-03-18	9	28.53882	84.34287
7	08A-ESSD16	2022-03-11	2022-03-18	7	28.52553	84.34713
8	09A-ESSD13	2022-03-11	2022-03-18	7	28.522	84.34908
9	11B-ESSD07	2022-03-15	2022-03-22	7	28.53523	84.37143
10	12B-ESSD08	2022-03-14	2022-03-22	8	28.46975	84.38002
11	13B-ESSD02	2022-03-15	2022-03-22	7	28.42372	84.38998
12	16B-ESSD14	2022-03-14	2022-03-22	8	28.43412	84.3907
13	16B-ESSD15	2022-03-14	2022-03-22	8	28.44173	84.3782
14	17B-ESSD01	2022-03-14	2022-03-22	8	28.47505	84.36298
15	19B-ESSD06	2022-03-14	2022-03-22	8	28.47828	84.35735
16	20B-ESSD03	2022-03-15	2022-03-22	7	28.48112	84.35255
17	24B-ESSD12	2022-03-13	2022-03-21	8	28.48612	84.34962
18	28B-ESSD19	2022-03-13	2022-03-21	8	28.49055	84.35095
19	29B-ESSD20	2022-03-13	2022-03-21	8	28.50528	84.36222
20	32C-ESSD03	2022-03-22	2022-03-27	5	28.4892	84.36187
21	33C-ESSD17	2022-03-20	2022-03-27	7	28.47675	84.37022
22	34C-ESSD16	2022-03-21	2022-03-28	7	28.38308	84.39897
23	35C-ESSD13	2022-03-20	2022-03-27	7	28.37593	84.39767
24	36C-ESSD04	2022-03-20	2022-03-27	7	28.39288	84.41352
25	38C-ESSD09	2022-03-19	2022-03-27	8	28.39877	84.41687
26	39C-ESSD10	2022-03-20	2022-03-27	7	28.39013	84.40465
27	40C-ESSD18	2022-03-19	2022-03-27	8	28.36278	84.38952
28	42C-ESSD05	2022-03-20	2022-03-26	6	28.37232	84.3874
29	43D-ESSD12	2022-03-24	2022-03-31	7	28.39023	84.38367
30	45D-ESSD08	2022-03-25	2022-04-01	7	28.40967	84.40168
31	46D-ESSD07	2022-03-24	2022-03-31	7	28.32875	84.408
32	47D-ESSD02	2022-03-23	2022-04-01	9	28.305	84.35613
33	49D-ESSD14	2022-03-24	2022-03-26	2	28.34835	84.38448

S.N	Station	Setup date	Retrieval date	Nights total	Latitude	Longitude
34	50D-ESSD11	2022-03-24	2022-04-01	8	28.33903	84.38573
35	51D-ESSD15	2022-03-25	2022-04-01	7	28.3103	84.38163
36	52D-ESSD06	2022-03-25	2022-04-01	7	28.347	84.40322
37	53D-ESSD20	2022-03-26	2022-04-02	7	28.30398	84.38295
38	54D-ESSD01	2022-03-26	2022-04-02	7	28.29208	84.35128
39	56D-ESSD19	2022-03-26	2022-04-02	7	28.28703	84.38692
40	A-OP-ESSD09	2022-03-09	2022-03-18	9	28.36863	84.36863
41	B-OP-ESSD11	2022-03-12	2022-03-22	10	28.27313	84.3554

Table 2: Camera trap setup date and retrieved date with the coordinates and camera trap nights (second season).

S. N	Camera station	Grid	Elevation	Latitude	Longitude	Installed Date	Retrieval Date	Effort Days
1.	ESSD-14	01A	2439.557	28.54197	84.34528	2022-05-19	2022-06-04	16
2.	ESSD-06	09A	2469.023	28.52198	84.3491	2022-05-20	2022-06-05	16
3.	ESSD-19	A-OP	2308.745	28.53015	84.33994	2022-05-20	2022-06-05	16
4.	ESSD-05	06A	2304.708	28.53521	84.37145	2022-05-20	2022-06-05	16
5.	ESSD-08	13B	2201.398	28.48977	84.36445	2022-05-20	2022-06-05	16
6.	ESSD-04	21B	2248.117	28.46847	84.36316	2022-05-21	2022-06-06	16
7.	ESSD-16	19B	2716.737	28.47766	84.36235	2022-05-21	2022-06-06	16
8.	ESSD-18	16B	2753.724	28.48111	84.35257	2022-05-21	2022-06-06	16
9.	ESSD-13	16B	2746.352	28.48607	84.34961	2022-05-21	2022-06-06	16
10.	ESSD-09	B-OP	2006.429	28.46967	84.37953	2022-05-22	2022-06-07	16
11.	ESSD-15	24B	1764.289	28.44214	84.37774	2022-05-22	2022-06-07	16
12.	ESSD-12	32C	1596.814	28.40964	84.40169	2022-05-22	2022-06-07	16
13.	ESSD-10	35C	1135.942	28.39025	84.40455	2022-05-22	2022-06-07	16
14.	ESSD-07	34C	1945.704	28.38945	84.3855	2022-05-23	2022-06-08	16
15.	ESSD-03	40C	1915.309	28.37527	84.40257	2022-05-23	2022-06-08	16
16.	ESSD-17	39C	1672.693	28.37343	84.38396	2022-05-23	2022-06-08	16
17.	ESSD-01	45D	1125.335	28.34712	84.40323	2022-05-24	2022-06-09	16

S. N	Camera station	Grid	Elevation	Latitude	Longitude	Installed Date	Retrieval Date	Effort Days
18.	ESSD-11	47D	1245.352	28.32885	84.40804	2022-05-24	2022-06-09	16
19.	ESSD-20	50D	1609.809	28.3074	84.36037	2022-05-24	2022-06-09	16
20.	ESSD-02	54D	1495.12	28.2871	84.38682	2022-05-25	2022-06-09	15

Table 3: III: Species captured in all stations with their independent capture numbers.

S N	Station	Species	Independent capture	S N	Station	Species	Independent capture
1.	01A-ESSD10	Humans	2	26.	08A-ESSD16	Humans	3
2.	01A-ESSD10	Leopard	1	27.	09A-ESSD06	Humans	5
3.	01A-ESSD10	Masked Palm Civet	1	28.	09A-ESSD06	Masked Palm Civet	8
4.	01A-ESSD14	Humans	3	29.	09A-ESSD06	Yellow Throated Marten	2
5.	01A-ESSD14	Leopard Cat	2	30.	09A-ESSD13	Humans	3
6.	01A-ESSD14	Masked Palm Civet	2	31.	09A-ESSD13	Livestock	1
7.	01A-ESSD14	Rodents	1	32.	09A-ESSD13	Masked Palm Civet	1
8.	03A-ESSD07	Humans	2	33.	11B-ESSD07	Humans	3
9.	03A-ESSD07	Masked Palm Civet	1	34.	11B-ESSD07	Livestock	5
10.	04A-ESSD04	Humans	2	35.	12B-ESSD08	Humans	7
11.	04A-ESSD04	Livestocks	12	36.	12B-ESSD08	Leopard	1
12.	05A-ESSD05	Humans	9	37.	12B-ESSD08	Livestock	5
13.	05A-ESSD05	Leopard Cat	6	38.	13B-ESSD02	Humans	2
14.	05A-ESSD05	Livestocks	6	39.	13B-ESSD02	Livestock	3
15.	05A-ESSD05	Masked Palm Civet	4	40.	13B-ESSD08	Humans	5
16.	05A-ESSD05	Yellow Throated Marten	1	41.	13B-ESSD08	Leopard Cat	1
17.	06A-ESSD05	Goral	1	42.	13B-ESSD08	Masked Palm Civet	1
18.	06A-ESSD05	Humans	42	43.	13B-ESSD08	Rodents	2
19.	06A-ESSD05	Livestock	57	44.	16B-ESSD13	Humans	2
20.	06A-ESSD05	Yellow Throated Marten	2	45.	16B-ESSD13	Langur	1
21.	06A-ESSD17	Humans	16	46.	16B-ESSD13	Leopard Cat	4
22.	06A-ESSD17	Leopard Cat	1	47.	16B-ESSD13	Livestock	11
23.	06A-ESSD17	Livestock	5	48.	16B-ESSD13	Masked Palm Civet	3
24.	07A-ESSD18	Humans	2	49.	16B-ESSD13	Yellow Throated Marten	1
25.	07A-ESSD18	Langur	2	50.	16B-ESSD14	Humans	2

S N	Station	Species	Independent capture
51.	16B-ESSD14	Leopard	1
52.	16B-ESSD14	Livestock	1
53.	16B-ESSD14	Yellow Throated Marten	1
54.	16B-ESSD15	Humans	2
55.	16B-ESSD15	Leopard	1
56.	16B-ESSD15	Livestock	7
57.	16B-ESSD18	Humans	3
58.	16B-ESSD18	Leopard Cat	3
59.	16B-ESSD18	Masked Palm Civet	8
60.	16B-ESSD18	Yellow Throated Marten	1
61.	17B-ESSD01	Humans	2
62.	17B-ESSD01	Langur	1
63.	19B-ESSD06	Humans	2
64.	19B-ESSD06	Masked Palm Civet	1
65.	19B-ESSD06	Rodents	2
66.	19B-ESSD16	Humans	5
67.	19B-ESSD16	Leopard Cat	1
68.	19B-ESSD16	Masked Palm Civet	1
69.	19B-ESSD16	Rodents	2
70.	20B-ESSD03	Humans	3
71.	21B-ESSD04	Humans	38
72.	21B-ESSD04	Langur	1
73.	21B-ESSD04	Livestock	26
74.	21B-ESSD04	Masked Palm Civet	4
75.	21B-ESSD04	Yellow Bellied Weasel	1
76.	21B-ESSD04	Yellow Throated Marten	1
77.	24B-ESSD12	Barking Deer	2
78.	24B-ESSD12	Ferret Badger	2
79.	24B-ESSD12	Humans	2
80.	24B-ESSD15	Barking Deer	1

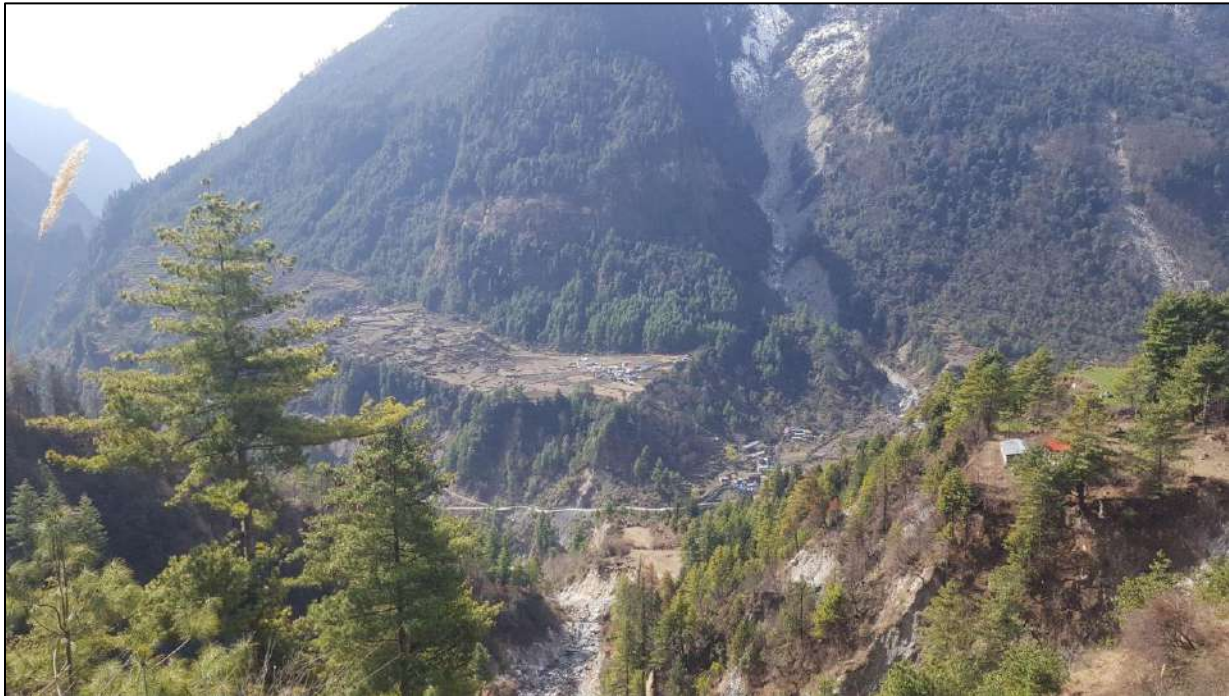
S N	Station	Species	Independent capture
81.	24B-ESSD15	Humans	2
82.	24B-ESSD15	Masked Palm Civet	1
83.	24B-ESSD15	Rodents	1
84.	28B-ESSD19	Humans	5
85.	28B-ESSD19	Leopard Cat	1
86.	29B-ESSD20	Humans	3
87.	32C-ESSD03	Humans	11
88.	32C-ESSD03	Jungle Cat	2
89.	32C-ESSD03	Livestock	8
90.	32C-ESSD03	Masked Palm Civet	1
91.	32C-ESSD12	Humans	34
92.	32C-ESSD12	Leopard Cat	3
93.	32C-ESSD12	Livestock	23
94.	32C-ESSD12	Masked Palm Civet	1
95.	32C-ESSD12	Rodents	1
96.	32C-ESSD12	Yellow Throated Marten	2
97.	33C-ESSD17	Humans	2
98.	33C-ESSD17	Livestock	1
99.	34C-ESSD07	Humans	18
100.	34C-ESSD07	Large Indian Civet	5
101.	34C-ESSD07	Leopard Cat	4
102.	34C-ESSD07	Masked Palm Civet	4
103.	34C-ESSD07	Rodents	2
104.	34C-ESSD16	Barking Deer	1
105.	34C-ESSD16	Humans	18
106.	34C-ESSD16	Large Indian Civet	1
107.	34C-ESSD16	Leopard Cat	5
108.	34C-ESSD16	Livestock	1
109.	34C-ESSD16	Rodents	3
110.	35C-ESSD10	Humans	2
111.	35C-ESSD10	Langur	2
112.	35C-ESSD10	Leopard Cat	1
113.	35C-ESSD10	Masked Palm Civet	1

S N	Station	Species	Independent capture	S N	Station	Species	Independent capture
114	35C-ESSD10	Rodents	4	147	43D-ESSD12	Livestock	4
115	35C-ESSD13	Ferret Badger	1	148	45D-ESSD01	Barking Deer	3
116	35C-ESSD13	Humans	4	149	45D-ESSD01	Humans	8
117	35C-ESSD13	Livestock	1	150	45D-ESSD01	Leopard Cat	9
118	35C-ESSD13	Masked Palm Civet	4	151	45D-ESSD01	Livestock	6
119	36C-ESSD04	Humans	5	152	45D-ESSD01	Malayan Porcupine	1
120	36C-ESSD04	Large Indian Civet	2	153	45D-ESSD01	Masked Palm Civet	3
121	36C-ESSD04	Livestock	1	154	45D-ESSD01	Rodents	3
122	38C-ESSD09	Humans	4	155	45D-ESSD01	Yellow Throated Marten	1
123	38C-ESSD09	Livestock	3	156	45D-ESSD08	Barking Deer	5
124	38C-ESSD09	Rodents	2	157	45D-ESSD08	Humans	5
125	39C-ESSD10	Humans	4	158	45D-ESSD08	Large Indian Civet	1
126	39C-ESSD10	Large Indian Civet	2	159	45D-ESSD08	Leopard	1
127	39C-ESSD10	Leopard Cat	1	160	45D-ESSD08	Livestock	3
128	39C-ESSD10	Livestock	2	161	45D-ESSD08	Malayan Porcupine	2
129	39C-ESSD17	Barking Deer	1	162	45D-ESSD08	Masked Palm Civet	4
130	39C-ESSD17	Humans	5	163	45D-ESSD08	Squirrel	1
131	39C-ESSD17	Large Indian Civet	3	164	46D-ESSD07	Humans	2
132	39C-ESSD17	Masked Palm Civet	3	165	46D-ESSD07	Leopard Cat	1
133	39C-ESSD17	Rodents	1	166	46D-ESSD07	Livestock	1
134	40C-ESSD03	Humans	4	167	46D-ESSD07	Rodents	1
135	40C-ESSD03	Rodents	3	168	47D-ESSD02	Assamese Macaque	3
136	40C-ESSD18	Humans	3	169	47D-ESSD02	Humans	38
137	40C-ESSD18	Rodents	2	170	47D-ESSD02	Livestock	21
138	40C-ESSD18	Yellow Throated Marten	1	171	47D-ESSD02	Masked Palm Civet	10
139	42C-ESSD05	Humans	10	172	47D-ESSD02	Rhesus Macaque	2
140	42C-ESSD05	Large Indian Civet	1	173	47D-ESSD11	Barking Deer	1
141	42C-ESSD05	Leopard Cat	3	174	47D-ESSD11	Humans	30
142	42C-ESSD05	Livestock	8	175	47D-ESSD11	Livestock	13
143	42C-ESSD05	Masked Palm Civet	1	176	47D-ESSD11	Masked Palm Civet	7
144	42C-ESSD05	Rodents	1	177	47D-ESSD11	Rodents	4
145	43D-ESSD12	Humans	12	178	47D-ESSD11	Yellow Throated Marten	1
146	43D-ESSD12	Large Indian Civet	1				

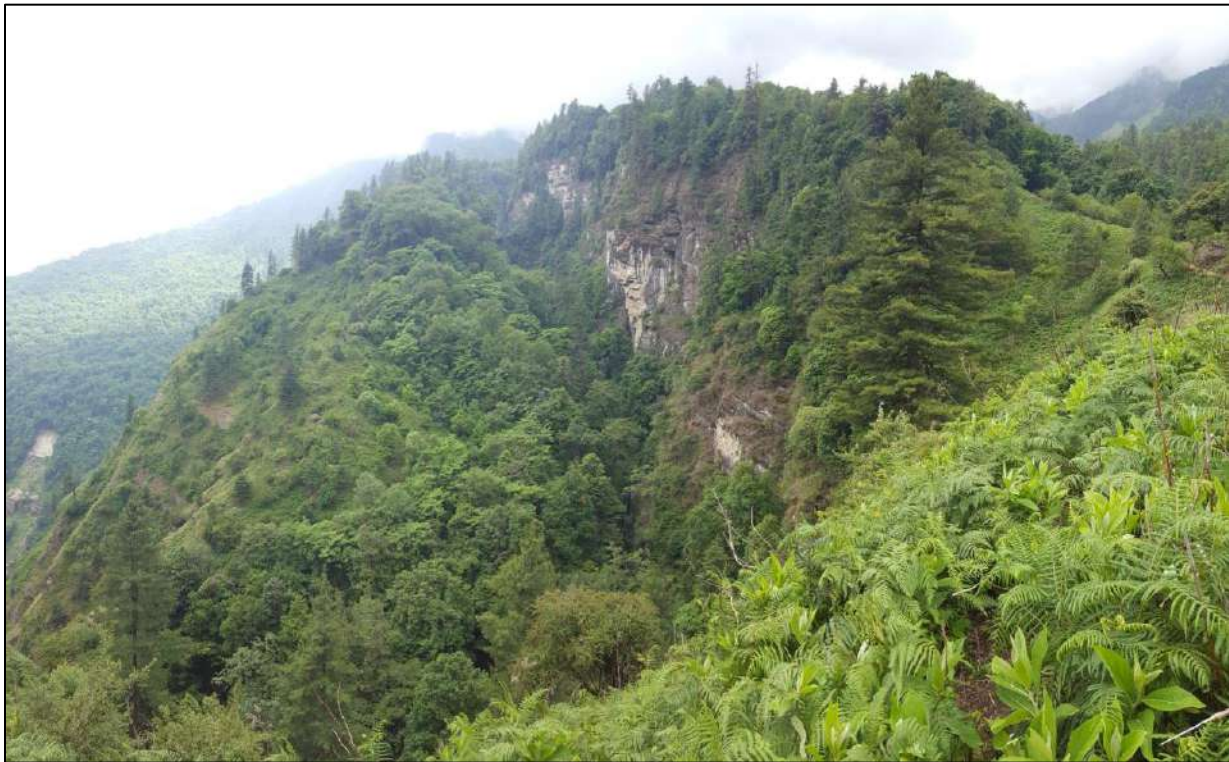
S N	Station	Species	Independent capture
179	49D-ESSD14	Humans	13
180	49D-ESSD14	Masked Palm Civet	1
181	50D-ESSD11	Humans	7
182	50D-ESSD11	Leopard Cat	2
183	50D-ESSD11	Yellow Throated Marten	1
184	50D-ESSD20	Barking Deer	3
185	50D-ESSD20	Humans	7
186	50D-ESSD20	Large Indian Civet	1
187	50D-ESSD20	Leopard Cat	9
188	50D-ESSD20	Livestock	2
189	50D-ESSD20	Masked Palm Civet	4
190	50D-ESSD20	Rodents	1
191	51D-ESSD15	Barking Deer	1
192	51D-ESSD15	Humans	5
193	51D-ESSD15	Masked Palm Civet	3
194	51D-ESSD15	Rodents	2
195	52D-ESSD06	Humans	12
196	52D-ESSD06	Livestock	1
197	52D-ESSD06	Masked Palm Civet	2
198	52D-ESSD06	Rodents	1
199	53D-ESSD20	Humans	3
200	53D-ESSD20	Masked Palm Civet	1
201	54D-ESSD01	Assamese Macaque	1
202	54D-ESSD01	Humans	9

S N	Station	Species	Independent capture
203	54D-ESSD01	Leopard Cat	1
204	54D-ESSD01	Livestock	1
205	54D-ESSD01	Rodents	3
206	54D-ESSD02	Humans	2
207	54D-ESSD02	Rodents	4
208	56D-ESSD19	Barking Deer	2
209	56D-ESSD19	Humans	5
210	A-OP-ESSD09	Humans	13
211	A-OP-ESSD09	Leopard Cat	1
212	A-OP-ESSD09	Livestock	2
213	A-OP-ESSD09	Masked Palm Civet	3
214	A-OP-ESSD09	Yellow Throated Marten	1
215	A-OP-ESSD19	Humans	10
216	A-OP-ESSD19	Leopard Cat	1
217	A-OP-ESSD19	Livestock	2
218	A-OP-ESSD19	Masked Palm Civet	1
219	A-OP-ESSD19	Yellow Throated Marten	2
220	B-OP-ESSD09	Humans	14
221	B-OP-ESSD09	Livestock	19
222	B-OP-ESSD09	Masked Palm Civet	1
223	B-OP-ESSD11	Humans	2
224	B-OP-ESSD11	Livestock	1

Some photographs from the Biodiversity Impact Assessment field work



Landscape around Tachai village in Manang district, Cluster A



Landscape around Khotro village in Manang district, Cluster B



Landscape around Syange region in Lamjung district, Cluster C



Landscape around Bahun danda in Lamjung district, Cluster D



A typical camera trap station setup - camera traps were placed in optimum locations within grids, and secured to trees with chains and padlocks after which they were camouflaged to blend in with the environment to minimize detection/disturbance.



Animal signs - scats and tracks, were recorded in the camera trap station grids to verify presence of mammals and determine optimum locations to place the camera traps.



Focus Group Discussion at Tal village in Manang



Focus Group Discussion at Tachai village in Manang

APPENDIX B: RELATED TO AVI-FAUNA

Table B-1: Bird survey vantage points and survey days

<i>S N</i>	<i>Transmission line section</i>	<i>Total vantage points and sub-station location points</i>	<i>Number of vantage points for bird survey</i>	<i>Total survey days</i>
1.	Dharapani Substation – Khudi Substation	20	20	3
2.	Khudi Substation – Udipur Substation	11	11	2
3.	Udipur Substation – Markichowk Substation	25	14 (bird survey was carried out from each alternate vantage points)	2
4.	Markichowk Substation – Bharatpur Substation	20	20	3
	Total	76	65	10

Table B-2: Bird survey vantage points and their coordinates (locations)

<i>Vantage Points</i>	<i>Latitude(N)</i>	<i>Longitude(E)</i>
Dharapani Substation	28.5327	84.3444
0	28.5250	84.3561
1	28.5128	84.3611
2	28.5001	84.3633
3	28.4888	84.3698
4	28.4763	84.3749
5	28.4633	84.3740
6	28.4504	84.3784
7	28.4399	84.3877
8	28.4296	84.3974
9	28.4182	84.4055
10	28.4059	84.4114
11	28.3947	84.4087
12	28.3830	84.4027
13	28.3696	84.4030
14	28.3563	84.4018
15	28.3438	84.3963
16	28.3303	84.3969
17	28.3171	84.3998
18	28.3058	84.3928
Khudi Substation	28.2980	84.3809
19	28.2921	84.3670
20	28.2806	84.3639

Vantage Points	Latitude(N)	Longitude(E)
21	28.2677	84.3674
22	28.2554	84.3732
23	28.2438	84.3808
24	28.2315	84.3870
25	28.2207	84.3955
26	28.2092	84.4029
27	28.1983	84.4108
28	28.1905	84.4222
Udipur Substation	28.1850	84.4269
29	28.1771	84.4393
31	28.1527	84.4476
33	28.1293	84.4375
35	28.1061	84.4431
37	28.0857	84.4631
39	28.0634	84.4794
41	28.0394	84.4719
43	28.0139	84.4678
45	27.9950	84.4468
47	27.9717	84.4492
49	27.9549	84.4664
51	27.9316	84.4805
52	27.9277	84.4944
Markichowk Substation	27.9220	84.5048
53	27.9124	84.5128
54	27.9035	84.5232
55	27.8917	84.5303
56	27.8801	84.5337
57	27.8694	84.5247
58	27.8589	84.5154
59	27.8470	84.5108
60	27.8339	84.5074
61	27.8214	84.5033
62	27.8110	84.4935
63	27.8019	84.4825
64	27.7918	84.4752
65	27.7784	84.4772
66	27.7650	84.4793
67	27.7516	84.4792
68	27.7441	84.4678
69	27.7330	84.4593
70	27.7206	84.4532
Bharatpur Substation	27.7073	84.4464

Table B-3: List of bird species recorded along the Marsyangdi Corridor TL (Dharapani Substation to Bharatpur Substation)

(Notes: NTS=Nationally Threatened Species, GTS=Globally Threatened Species, RR=Restricted Range Species, BR=Biome Restricted Species, CR=Critically Endangered, EN=Endangered, VU=Vulnerable, NT=Near Threatened, B05=Eurasian High Montane (Alpine and Tibetan), B07=Sino-Himalayan Temperate Forest, B08=Sino-Himalayan Subtropical Forest, B09=Indochinese Tropical Moist Forests, B11=Indo-Malayan Tropical Dry Zone, R=Residential, PM=Passage Migrant, WV=Winter Visitor, SV=Summer Visitor)

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
GALLIFORMES												
Phasianidae												
1	Hill Partridge	<i>Arborophilatorqueola</i>	पिउरा			B07			R			2
2	Black Francolin	<i>Francolinusfrancolinus</i>	कालो तित्रा						R		8	29
3	Indian Peafowl	<i>Pavocristatus</i>	मुजुर			B11	III	NT	R	2	2	2
4	Red Junglefowl	<i>Gallus gallus</i>	लुईचे						R	2	8	3
5	Satyr Tragopan	<i>Tragopan satyra</i>	मुनाल			B07	III	VU	R			1
6	Kalij Pheasant	<i>Lophuraleucomelanos</i>	कालिज				III		R		10	5
ANSERIFORMES												
Anatidae												
7	Goosander	<i>Mergus merganser</i>	मणितुण्डक						WV		1	
8	Ruddy Shelduck	<i>Tadornaferruginea</i>	चखेवाचखेवी					NT	WV		8	
9	Common Pochard	<i>Aythya ferina</i>	कैलोटाउके हाँस	VU				NT	PM/WV		1	
10	Tufted Duck	<i>Aythya fuligula</i>	कालीजुरे हाँस						PM/WV	2		1
11	Gadwall	<i>Mareca strepera</i>	खडखडे हाँस						PM/WV	8	4	
12	Eurasian Wigeon	<i>Marecapenelope</i>	सिन्दुरे हाँस						PM/WV	1		
COLUMBIFORMES												
Columbidae												
13	Rock Dove	<i>Columba livia</i>	मलेवा						R	37	102	125
14	Hill Pigeon	<i>Columba rupestris</i>	लेकालीमलेवा						R			2
15	Ashy Woodpigeon	<i>Columba pulchricollis</i>	फुस्रो बनपरेवा						R			1
16	Oriental Turtle-dove	<i>Streptopeliaorientalis</i>	तामे ढुकुर						R	6	14	38
17	Western Spotted Dove	<i>Spilopeliasuratensis</i>	कुले ढुकुर						R	34	21	45
18	Barred Cuckoo-dove	<i>Macropygiaunchall</i>	धर्के ढुकुर					VU	R			1
19	Yellow-footed Green-pigeon	<i>Treronphoenicopterus</i>	हलेसो			B11			R	8		5
CAPRIMULGIFORMES												

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
Apodidae												
20	White-rumped Spinetail	<i>Zoonavena sylvatica</i>	सानो बनगौथली					NT	R			10
21	Himalayan Swiftlet	<i>Aerodramus brevirostris</i>	चींचिकागौथली						R		8	8
22	Alpine Swift	<i>Tachymarptis melba</i>	बतासीगौथली						R			18
23	House Swift	<i>Apus nipalensis</i>	फिरफिरे घरगौथली						R	127	213	231
24	Common Swift	<i>Apus apus</i>	खैरो गौथली						SV			8
CUCULIFORMES												
Cuculidae												
25	Greater Coucal	<i>Centropus sinensis</i>	ढोडे गोकुल						R	8	21	24
26	Green-billed Malkoha	<i>Phaenicophaeus tristis</i>	हरित मालकौवा						R	2		5
27	Chestnut-winged Cuckoo	<i>Clamatorcoromandus</i>	ठूलो जुरे कोइली					NT	SV			1
28	Western Koel	<i>Eudynamis scolopaceus</i>	कोइली						R/SV		1	39
29	Banded Bay Cuckoo	<i>Cacomantis sonneratii</i>	धर्के खैरो कोइली						R			2
30	Grey-bellied Cuckoo	<i>Cacomantis passerinus</i>	फुस्रो सानो कोइली						SV			6
31	Fork-tailed Drongo-cuckoo	<i>Surniculus dicruroides</i>	चिबे कोइली						SV			1
32	Large Hawk-cuckoo	<i>Hierococcyx sparverioides</i>	पहाडी बीउकृहियो						SV			8
33	Common Hawk-cuckoo	<i>Hierococcyx varius</i>	बीउकृहियो						R			6
34	Indian Cuckoo	<i>Cuculus micropterus</i>	काफलपाक्यो						SV			26
35	Common Cuckoo	<i>Cuculus canorus</i>	कुकुकु कोइली						SV			10
36	Lesser Cuckoo	<i>Cuculus poliocephalus</i>	सानो कोइली						SV			1
37	Oriental Cuckoo	<i>Cuculus saturatus</i>	पूर्वीय कोइली						SV			2
GRUIFORMES												
Rallidae												
38	White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	सिमकखुरा						R			2
OTIDIFORMES												
Ciconiidae												
39	Asian Woollyneck	<i>Ciconia episcopus</i>	लोभीपापी गरुड	NT				NT	R			2
Threskiornithidae												
40	Red-naped Ibis	<i>Pseudibis papillosa</i>	करा साँवरी			B11			R			5
PELECANIFORMES												

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
Ardeidae												
41	Indian Pond-heron	<i>Ardeolagrayii</i>	आसकोटे बकुल्ला						R	4	14	23
42	Cattle Egret	<i>Bubulcus ibis</i>	वस्तु बकुल्ला						R	29	107	190
43	Little Egret	<i>Egretta garzetta</i>	सानो सेतोबकुल्ला						R	5	4	4
SULIFORMES												
Phalacrocoracidae												
44	Great Cormorant	<i>Phalacrocorax carbo</i>	जलेवा					NT	WV	2	111	
CHARADRIIFORMES												
Charadriidae												
45	River Lapwing	<i>Vanellus duvaucelii</i>	खोले हटिट्याउ					NT	R			2
46	Red-wattled Lapwing	<i>Vanellus indicus</i>	हटिट्याउँ						R			2
Scolopacidae												
47	Common Sandpiper	<i>Actitis hypoleucos</i>	चञ्चले सुडसुडिया						PM/WV	1		
48	Green Sandpiper	<i>Tringa ochropus</i>	रुख सुडसुडिया						PM/WV	1		
STRIGIFORMES												
Strigidae												
49	Collared Owlet	<i>Glaucidium brodiei</i>	सानो डुन्दुल				II		R		3	
50	Asian Barred Owlet	<i>Glaucidium cuculoides</i>	ठूलो डुन्दुल				II		R	1	8	6
51	Jungle Owlet	<i>Glaucidium radiatum</i>	डुन्दुल				II		R		1	1
52	Spotted Owlet	<i>Athene brama</i>	कोचलगौडे लाटोकोसेरो				II		R			2
53	Collared Scops-owl	<i>Otus lettia</i>	चित्रीउलूक				II		R			1
ACCIPITRIFORMES												
Accipitridae												
54	Oriental Honey-buzzard	<i>Pernis ptilorhynchus</i>	मधुहा				II		R/PM	2		2
55	Crested Serpent-eagle	<i>Spilornis cheela</i>	काकाकुल				II		R		10	10
56	Bearded Vulture	<i>Gypaetus barbatus</i>	हाडफोर				II	VU	R	2	2	3
57	Egyptian Vulture	<i>Neophron percnopterus</i>	सेतो गिद्ध	EN			II	VU	R	1	3	9
58	Red-headed Vulture	<i>Sarcogyps calvus</i>	सुन गिद्ध	CR		B11	II	EN	R	3	6	5
59	Himalayan Griffon	<i>Gyps himalayensis</i>	हिमाली गिद्ध			B05	II	VU	R	4	73	23
60	White-rumped Vulture	<i>Gyps bengalensis</i>	डगर गिद्ध	CR		B11	II	CR	R		2	1
61	Cinereous Vulture	<i>Aegypius monachus</i>	राजगिद्ध				II	EN	PM/WV		1	
62	Mountain Hawk-eagle	<i>Nisaetus nipalensis</i>	पहाडी शदलचील				II		R/WV	1	1	2
63	Black Eagle	<i>Ictinaetus malaiensis</i>	द्रोणक चील				II		R	3	1	

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
64	Greater Spotted Eagle	<i>Clangaclanga</i>	जीवाहार महाचील	VU			II	VU	WV	1		
65	Steppe Eagle	<i>Aquila nipalensis</i>	गोमायु महाचील	EN			II	VU	PM/WV	10	14	
66	Bonelli's Eagle	<i>Aquila fasciata</i>	मोरङ्गी चील				II		R	8	3	4
67	Booted Eagle	<i>Hieraaetus pennatus</i>	काँधचन्द्र चील				II		R/PM/WV	1	1	
68	Shikra	<i>Accipiter badius</i>	शिक्रा				II		R	1		4
69	Besra	<i>Accipiter virgatus</i>	बेसरा				II		R	1		
70	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	वनवाज				II		R/PM	1		2
71	Northern Goshawk	<i>Accipiter gentilis</i>	बलाकांक्षवनवाज				II		R			1
72	Black Kite	<i>Milvus migrans</i>	कालो चील				II		R/PM	42	46	47
73	Himalayan Buzzard	<i>Buteo refectus</i>	श्येनवाज				II		PM/WV	7	6	
74	Long-legged Buzzard	<i>Buteo rufinus</i>	लामखुट्टे श्येनवाज				II		PM/WV	2	1	
75	Upland Buzzard	<i>Buteo hemilasius</i>	पहाडी श्येनवाज				II	DD	R/WV	2	1	
BUCEROTIFORMES												
Upupidae												
76	Common Hoopoe	<i>Upupa epops</i>	फाप्पे चरा						R	2		
CORACIIFORMES												
Meropidae												
77	Asian Green Bee-eater	<i>Merops orientalis</i>	मुरलीचरा						R	3	16	5
78	Chestnut-headed Bee-eater	<i>Merops leschenaulti</i>	कटुसटाउके मुरलीचरा						SV		7	22
Coraciidae												
79	Indian Roller	<i>Coracias benghalensis</i>	ठेउवा						R	2	2	5
80	Oriental Dollarbird	<i>Eurystomus orientalis</i>	लालचुच्चे ठेउवा						SV			1
Alcedinidae												
81	Common Kingfisher	<i>Alcedo atthis</i>	सानो माटीकोरे						R		1	2
82	Crested Kingfisher	<i>Megaceryle lugubris</i>	ठूलो छिरबिरे माटीकोरे						R		2	
83	White-breasted Kingfisher	<i>Halcyon smyrnensis</i>	सेतो कण्ठे माटीकोरे						R	11	7	23
PICIFORMES												
Megalaimidae												
84	Coppersmith Barbet	<i>Psilopogon haemacephalus</i>	मिलचरा						R	1	3	4
85	Great Barbet	<i>Psilopogon virens</i>	न्याउली						R	12	60	61

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
86	Lineated Barbet	<i>Psilopogon lineatus</i>	छिके कथुके			B11			R	1	5	10
87	Golden-throated Barbet	<i>Psilopogon franklinii</i>	कुक्लुङ्ग			B08			R		1	6
88	Blue-throated Barbet	<i>Psilopogon asiaticus</i>	कथुके			B08			R	8	33	67
Indicatoridae												
89	Yellow-rumped Honeyguide	<i>Indicator xanthonotus</i>	चाकासूचक			B07		EN	R			1
90	Speckled Piculet	<i>Picumnus innominatus</i>	थोप्ले ससिया						R	2	1	1
91	Greater Flameback	<i>Chrysocolaptes guttacriscristatus</i>	गर्दनथोप्ले लाहाँचे						R	2		
92	Rufous Woodpecker	<i>Micropternus brachyurus</i>	सानो तामे लाहाँचे						R			2
93	Greater Yellownape	<i>Chrysophlegma flavinucha</i>	ठूलो सुनजुरे काठफोर						R	3	1	2
94	Lesser Yellownape	<i>Picus chlorolophus</i>	सुनजुरे काठफोर						R			1
95	Black-naped Woodpecker	<i>Picus guerini</i>	कालोगर्दने काठफोर						R		4	2
96	Grey-capped Woodpecker	<i>Picoides canicapillus</i>	फुस्रोटाउके काष्ठकूट						R	7		
97	Fulvous-breasted Woodpecker	<i>Dendrocopos macei</i>	काष्ठकूट						R	5	1	2
CARIAMIFORMES												
Falconidae												
98	Collared Falconet	<i>Microhierax caerulescens</i>	पौरी बाज				II	NT	R	2		
99	Lesser Kestrel	<i>Falco naumanni</i>	सानो बौडाइ				II	NT	PM/WV	1		
100	Common Kestrel	<i>Falco tinnunculus</i>	बौडाइ				II		R/PM/WV	10	11	14
101	Peregrine Falcon	<i>Falco peregrinus</i>	शाहीबाज				I		R/PM/WV	2	1	2
PSITTACIFORMES												
Psittacidae												
102	Slaty-headed Parakeet	<i>Psittacula himalayana</i>	करा सुगा			B08	II		R		45	
103	Plum-headed Parakeet	<i>Psittacula cyanocephala</i>	टुइंसी सुगा			B11	II		R	12	10	12
104	Red-breasted Parakeet	<i>Psittacula alexandri</i>	कागभेला सुगा				II	VU	R			11
105	Alexandrine Parakeet	<i>Psittacula eupatria</i>	करा सुगा				II	NT	R	3	1	7
106	Rose-ringed Parakeet	<i>Psittacula krameri</i>	कण्ठे सुगा						R	24	15	13
PASSERIFORMES												
Eurylaimidae												
107	Long-tailed Broadbill	<i>Psarisomus dalhousiae</i>	चित्रकूट						R			3

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
Oriolidae												
108	Maroon Oriole	<i>Oriolustrailii</i>	घनरक्त सुनचरी			B08			R		1	2
109	Black-hooded Oriole	<i>Oriolusxanthornus</i>	कालोटाउके सुनचरी						R	4	16	16
110	Indian Golden Oriole	<i>Orioluskundoo</i>	गाजले सुनचरी						SV	1		10
Campephagidae												
111	Long-tailed Minivet	<i>Pericrocotusethologus</i>	लामपुछे रानीचरी						R	2	15	14
112	Scarlet Minivet	<i>Pericrocotusflammeus</i>	रानीचरी						R	17	40	14
113	Indian Cuckooshrike		लटुशक विरहीचरी						R	10	8	9
114	Black-winged Cuckooshrike	<i>Lalage melaschistos</i>	कालो विरहीचरी			B08			R			1
Artamidae												
115	Ashy Woodswallow	<i>Artamusfuscus</i>	मिथुन			B11			R	13		7
Vangidae												
116	Bar-winged Flycatcher-shrike	<i>Hemipuspicatus</i>	आसकोटे चरी						R	3		
Aegithinidae												
117	Common Iora	<i>Aegithina tiphia</i>	सुसेलीचरी						R	2	3	4
Rhipiduridae												
118	White-throated Fantail	<i>Rhipiduraalbicollis</i>	नक्कले मारुनीचरी						R	1		2
Dicruridae												
119	Black Drongo	<i>Dicrurusmacrocerus</i>	कालो चिबे						R	31	23	59
120	Ashy Drongo	<i>Dicrurusleucophaeus</i>	ध्वाँसे चिबे						R			4
121	White-bellied Drongo	<i>Dicruruscaerulescens</i>	सेतोपेटे चिबे			B11			R	1		2
122	Bronzed Drongo	<i>Dicrurus aeneus</i>	सानो चिबे						R	39	7	14
123	Hair-crested Drongo	<i>Dicrurushottentottus</i>	केशराजचिबे						R	19	30	31
124	Greater Racquet-tailed Drongo	<i>Dicrurusparadiseus</i>	भीमराजचिबे						R	3	4	
Laniidae												
125	Long-tailed Shrike	<i>Laniusschach</i>	भद्राई						R	13	12	13
126	Grey-backed Shrike	<i>Laniustephronotus</i>	हिमालीभद्राई			B05			R	5	2	1
Corvidae												
127	Rufous Treepie	<i>Dendrocittavagabunda</i>	कोकले						R	14	7	10
128	Grey Treepie	<i>Dendrocittaformosae</i>	पहाडी कोकले			B08			R	58	37	31

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
129	Red-billed Blue Magpie	<i>Urocissaerythroryncha</i>	स्यालपोथरी लामपुच्छे						R	6	13	3
130	Common Green Magpie	<i>Cissa chinensis</i>	हरियो लामपुच्छे						R		2	
131	Southern Nutcracker	<i>Nucifragahemispila</i>	वनसरां						R		2	
132	House Crow	<i>Corvus splendens</i>	घर काग						R	17	16	101
133	Large-billed Crow	<i>Corvus macrorhynchos</i>	कालो काग						R	32	164	182
Stenostiridae												
134	Yellow-bellied Fairy-fantail	<i>Chelidorhynchypoxanthus</i>	पहेलो मारुनीचरी						R		2	
135	Grey-headed Canary-flycatcher	<i>Culicicapaceylonensis</i>	चञ्चले अर्जुनक						R	27	10	13
Paridae												
136	Rufous-vented Tit	<i>Periparusrubidiventris</i>	सेतोगदने चिचिलकोटे			B07			R	1	2	
137	Green-backed Tit	<i>Parus monticolus</i>	हरियो चिचिलकोटे			B07			R		11	15
138	Great Tit	<i>Parus major</i>	चिचिलकोटे						R	48	22	40
139	Black-lored Tit	<i>Machlolophusxanthogenys</i>	पाण्डु चिचिलकोटे						R	59	18	56
Cisticolidae												
140	Striated Prinia	<i>Priniaacrinigera</i>	सुया घाँसेफिस्टो			B08			R	1	24	36
141	Grey-breasted Prinia	<i>Priniahodgsonii</i>	फुस्रोछाती घाँसेफिस्टो						R	2	2	4
142	Yellow-bellied Prinia	<i>Priniaflaviventris</i>	पीतोदर घाँसेफिस्टो					NT	R		6	
143	Ashy Prinia	<i>Priniasocialis</i>	टुण्क घाँसेफिस्टो			B11			R			6
144	Common Tailorbird	<i>Orthotomussutorius</i>	पातसिउने फिस्टो						R	39	69	50
Hirundinidae												
145	Asian House Martin	<i>Delichondasypus</i>	एशियालीभीरगौथली						R			12
146	Nepal House Martin	<i>Delichonnipalense</i>	नेपालभीरगौथली			B07			R		10	25
147	Northern House Martin	<i>Delichonurbicum</i>	भीरगौथली						PM			5
148	Barn Swallow	<i>Hirundorustica</i>	घर गौथली						R	30	13	21
149	Red-rumped Swallow	<i>Cecropisdaurica</i>	गेरुकटी गौथली						R	11	23	36
150	Eurasian Crag Martin	<i>Ptyonoprognerrupestis</i>	नहिकटी गौथली						R	28		
151	Asian Plain Martin	<i>Riparia chinensis</i>	भित्तेगौथली					NT	R		237	108
Pycnonotidae												
152	Ashy Bulbul	<i>Hemixosflavala</i>	फुस्रोपेटे जुरेली						R	2	9	2
153	Mountain Bulbul	<i>Ixosmcclellandii</i>	कैलोपेटे जुरेली			B08			R	13		7

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
154	Black Bulbul	<i>Hypsipetes leucocephalus</i>	बाख्रे जुरेली			B08			R	14	92	121
155	Black-crested Bulbul	<i>Pycnonotus flaviventris</i>	कालोकल्कीपहेंलोजुरेली						R	2		
156	Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	श्वेतवक्ष जुरेली						R	6	6	5
157	Himalayan Bulbul	<i>Pycnonotus leucogenys</i>	जुल्फे जुरेली			B08			R	49	91	99
158	Red-vented Bulbul	<i>Pycnonotus cafer</i>	जुरेली						R	77	109	149
Phylloscopidae												
159	Hume's Leaf-warbler	<i>Phylloscopus humei</i>	चञ्चले फिस्टो						R	10	25	
160	Buff-barred Warbler	<i>Phylloscopus pulcher</i>	सन्तलेरेखी फिस्टो			B07			R		4	
161	Ashy-throated Warbler	<i>Phylloscopus maculipennis</i>	फुस्रो कण्ठे फिस्टो			B07						4
162	Tickell's Leaf-warbler	<i>Phylloscopus affinis</i>	पीतोदर फिस्टो			B05						1
163	Grey-cheeked Warbler	<i>Phylloscopus poliogenys</i>	सेतोचशमे फिस्टो			B07		NT			2	
164	Whistler's Warbler	<i>Phylloscopus whistleri</i>	सुसेली फिस्टो								1	
165	Chestnut-crowned Warbler	<i>Phylloscopus castaniceps</i>	रातोटाउके फिस्टो								5	
166	Greenish Warbler	<i>Phylloscopus trochiloides</i>	जीवल फिस्टो							18	8	
167	Blyth's Leaf-warbler	<i>Phylloscopus reguloides</i>	तालुघर्के फिस्टो							6		
168	Grey-hooded Warbler	<i>Phylloscopus xanthoschistos</i>	तुमलकारी फिस्टो			B08				34	82	45
169	Yellow-bellied Warbler	<i>Abroscopus superciliaris</i>	पहेंलोपेटे फिस्टो					VU			2	
170	Hume's Bush-warbler	<i>Horornis brunnescens</i>	पीतेदर भाडीफिस्टो			B07		VU	R	1	4	
Aegithalidae												
171	Red-headed Tit	<i>Aegithalosiredalei</i>	कालीकण्ठे राजचिचिक्कोटे		RR	B08						2
Zosteropidae												
172	Stripe-throated Yuhina	<i>Yuhina gularis</i>	थुपलकल्की जुरेचरा			B07						13
173	Whiskered Yuhina	<i>Yuhina flavicollis</i>	जुंगे जुरेचरा								17	6
174	Oriental White-eye	<i>Zosterops palpebrosus</i>	कांकीर							37	12	27
Timaliidae												
175	Rusty-cheeked Scimitar-babbler	<i>Erythrogonys erythrogonys</i>	पाल्कोटे			B08				6	2	4
176	Pin-striped Tit-babbler	<i>Mixornis gularis</i>	पीतोदर फिस्टेभ्याक्							1		
177	Black-chinned Babbler	<i>Cyanodermapyrrhops</i>	कालोचिउँडे वनभ्याक्			B08				9	8	9
Pellorneidae												

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
178	Puff-throated Babbler	<i>Pellorneumruficeps</i>	थोप्ले भ्याकुर							11	3	2
Leiotrichidae												
179	Spiny Babbler	<i>Acanthoptilanipalensis</i>	काँडे भ्याकुर		RR				R	2	6	
180	Jungle Babbler	<i>Turdoides striata</i>	बगाले भ्याकुर			B11			R	33	6	25
181	Striated Laughingthrush	<i>Grammatoptila striata</i>	कल्कीतोरीगाँडा			B07			R			3
182	White-crested Laughingthrush	<i>Garrulaxleucolophus</i>	हिउँजुरे तोरीगाँडा						R	15	38	29
183	White-throated Laughingthrush	<i>Garrulaxalbogularis</i>	सोइरने तोरीगाँडा			B07			R			2
184	Streaked Laughingthrush	<i>Trochalopteronlineatum</i>	छिके तोरीगाँडा			B07			R		2	
185	Variiegated Laughingthrush	<i>Trochalopteron variegatum</i>	टिकीयुरी तोरीगाँडा						R		2	
186	Chestnut-crowned Laughingthrush	<i>Trochalopteronerythrocephalum</i>	कटुसटाउके तोरीगाँडा						R		7	2
187	Rufous Sibia	<i>Heterophasiacapistrata</i>	सिबिया			B07			R		5	
Certhiidae												
188	Rusty-flanked Treecreeper	<i>Certhianipalensis</i>	कैलोकोखे छेपारेचरी			B07					1	
Sittidae												
189	Chestnut-bellied Nuthatch	<i>Sittacinnamoventris</i>	कटुसे मट्टा							20	10	10
190	Velvet-fronted Nuthatch	<i>Sitta frontalis</i>	मखमलीमट्टा							1		5
191	Wallcreeper	<i>Tichodromamuraria</i>	मुरारी पुतलीचरा			B05					3	
Troglodytidae												
192	Northern Wren	<i>Troglodytes troglodytes</i>	चित्री								1	
Cinclidae												
193	Brown Dipper	<i>Cincluspallasii</i>	खैरो वञ्जूल								2	1
Sturnidae												
194	Asian Pied Starling	<i>Gracupica contra</i>	डाङ्गे सारौ							1	1	7
195	Chestnut-tailed Starling	<i>Sturniamalabarica</i>	फुस्रोटाउके सारौ			B11				14	3	26
196	Common Myna	<i>Acridotheres tristis</i>	डाङ्गे रुपी							51	86	171
197	Jungle Myna	<i>Acridotheresfuscus</i>	वन रुपी							6	13	25
198	Common Hill Myna	<i>Gracula religiosa</i>	मदनसारिका मैना				II					6

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
	Turdidae											
199	Orange-headed Thrush	<i>Geokichlacitrina</i>	सुन्तले चाँचर									2
200	White-collared Blackbird	<i>Turdus albocinctus</i>	कण्ठे चाँचर			B07					1	
201	Black-throated Thrush	<i>Turdus atrogularis</i>	कालोकण्ठे चाँचर								6	
	Muscicapidae											
202	Oriental Magpie-robin	<i>Copsychussauralis</i>	धोबिनी चरा							24	27	36
203	Dark-sided Flycatcher	<i>Muscicapasibirica</i>	ध्वाँसे अर्जुनक							20	5	
204	Small Niltava	<i>Niltavamacgrigoriae</i>	सानो नीलतभा			B08						1
205	Large Niltava	<i>Niltava grandis</i>	ठूलो नीलतभा					NT			1	1
206	Verditer Flycatcher	<i>Eumyiasthalassinus</i>	नीलतुथो अर्जुनक							2	4	4
207	Pale Blue-flycatcher	<i>Cyornis unicolor</i>	नीलगगनअर्जुनक								1	
208	Indian Blue Robin	<i>Larvivora brunnea</i>	नीलो रबिन			B07						3
209	Himalayan Bush-robin	<i>Tarsigerrufilatus</i>	सुन्तलाकोखे रबिन								2	
210	Golden Bush-robin	<i>Tarsigerchrysaeus</i>	सुनौलो रबिन			B07					2	
211	Little Forktail	<i>Enicurus scouleri</i>	गंगाखोलेधोबिनी						R	5	2	3
212	Slaty-backed Forktail	<i>Enicurus schistaceus</i>	फुस्रोढाडे खोलेधोबिनी			B08			R		2	
213	Black-backed Forktail	<i>Enicurus immaculatus</i>	कालोढाडे खोलेधोबिनी			B09			R	1		1
214	Blue Whistling-thrush	<i>Myophonus caeruleus</i>	कल्चौडे						R	12	30	39
215	Slaty-backed Flycatcher	<i>Ficedula erithacus</i>	नीलढाडे अर्जुनक			B07		NT			2	
216	Rufous-gorgeted Flycatcher	<i>Ficedula strophilata</i>	सेतोटिके अर्जुनक			B07					2	
217	Rusty-tailed Flycatcher	<i>Ficedula ruficauda</i>	कैलोपुच्छे अर्जुनक			B07					2	
218	Red-throated Flycatcher	<i>Ficedula albicilla</i>	लालकण्ठे अर्जुनक							7	3	
219	Blue-fronted Redstart	<i>Phoenicurus frontalis</i>	नीलटाउके खञ्जरी									2
220	Blue-capped Redstart	<i>Phoenicurus coeruleocephala</i>	धोबिनीखञ्जरी			B07					1	
221	White-capped Water-redstart	<i>Phoenicurus leucocephalus</i>	सेतोटाउके जलखञ्जरी						R	7	8	5
222	Plumbeous Water-redstart	<i>Phoenicurus fuliginosus</i>	नीलाम्बर जलखञ्जरी						R	11	13	11
223	White-winged Redstart	<i>Phoenicurus erythrogastrus</i>	सेतोपंखे खञ्जरी			B05						3
224	Hodgson's Redstart	<i>Phoenicurus hodgsoni</i>	तनकम्पखञ्जरी			B05						2

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
225	Blue-capped Rock-thrush	<i>Monticolacinclorhyncha</i>	सानो हजार चाँचर			B08				2		3
226	Blue Rock-thrush	<i>Monticola solitarius</i>	उमा चाँचर									1
227	Grey Bushchat	<i>Saxicola ferreus</i>	हिमाली भ्याप्सी								6	4
228	Pied Bushchat	<i>Saxicola caprata</i>	काले भ्याप्सी							17	24	20
229	Common Stonechat	<i>Saxicola torquatus</i>	भेकभेक भ्याप्सी							19	8	4
Chloropseidae												
230	Golden-fronted Leafbird	<i>Chloropsisaurifrons</i>	कृष्णकण्ठे हरितचरी								1	
231	Orange-bellied Leafbird	<i>Chloropsishardwickii</i>	स्वर्णोदर हरितचरी			B08				3	4	3
Dicaeidae												
232	Thick-billed Flowerpecker	<i>Dicaeum agile</i>	मोटोटुँडे पुष्पकोकिल						R		1	
233	Fire-breasted Flowerpecker	<i>Dicaeumignipectus</i>	अग्निवक्षपुष्पकोकिल						R	10	3	2
Nectariniidae												
234	Purple Sunbird	<i>Cinnyris asiaticus</i>	कालोबुङ्गेचरा						R	1	5	5
235	Fire-tailed Sunbird	<i>Aethopygaignicauda</i>	लामपुच्छे बुङ्गेचरा			B07			R	6	1	
236	Black-throated Sunbird	<i>Aethopygasaturata</i>	कालीकण्ठ बुङ्गेचरा			B08			R	1	1	2
237	Gould's Sunbird	<i>Aethopygagouldiae</i>	कान्ति बुङ्गेचरा						R	4	1	
238	Crimson Sunbird	<i>Aethopygasiparaja</i>	सिपराजाबुङ्गेचरा						R	10	9	10
Prunellidae												
239	Rufous-breasted Accentor	<i>Prunella strophciata</i>	मुसे लेकचरी			B07						2
Ploceidae												
240	Baya Weaver	<i>Ploceusphilippinus</i>	बयातोपचरा					NT	R			28
Estrildidae												
241	White-rumped Munia	<i>Lonchura striata</i>	सेतोढाडे मुनियाँ						R	20	2	16
Passeridae												
242	House Sparrow	<i>Passer domesticus</i>	घर भँगेरा						R	50	91	123
243	Eurasian Tree Sparrow	<i>Passer montanus</i>	रुख भँगेरा						R	24	32	34
Motacillidae												
244	Olive-backed Pipit	<i>Anthushodgsoni</i>	रुख चुइयाँ							44	11	6
245	Rosy Pipit	<i>Anthusroseatus</i>	गुलाफीकण्ठे चुइयाँ			B05						6
246	Upland Pipit	<i>Anthussylvanus</i>	पहाडी चुइयाँ								2	

S N	English name	Scientific name	Nepali	GTS	RR	BR	CITES	NTS	Migration	Autumn Survey	Winter Survey	Summer Survey
247	Paddyfield Pipit	<i>Anthusrufulus</i>	आलीचुइयाँ							6	2	23
248	Grey Wagtail	<i>Motacilla cinerea</i>	फुस्रो टिकटिके							14	2	3
249	White-browed Wagtail	<i>Motacillamaderaspatensis</i>	खोले टिकटिके							1	6	
250	White Wagtail	<i>Motacilla alba</i>	फुस्रो टिकटिके							10	21	
Fringillidae												
251	Common Rosefinch	<i>Carpodacus erythrinus</i>	अमोगातित्तु									2
252	Beautiful Rosefinch	<i>Carpodacus pulcherrimus</i>	भिवीतित्तु			B05						12
253	Dark-rumped Rosefinch	<i>Carpodacus edwardsii</i>	कमधकें तित्तु			B07				2	16	
254	Plain Mountain-finch	<i>Leucosticte nemoricola</i>	तित्तुभंगेरा			B05					276	
255	Yellow-breasted Greenfinch	<i>Chloris spinoides</i>	गाजले पीतचरी			B07					7	
Emberizidae												
256	Crested Bunting	<i>Emberizalathami</i>	जुरे बगेडी								5	6

B-1: Field photos









Biodiversity within the surveyed forest

Herbs, Shrubs and Grass diversity of the forest plot (Plot size = 5 x 5 m²)

Corresponding plot no.	Local name	Botanical name	Number	Coverage	Remarks

Table C-4: Location of sample plots

Khudi Manang Section			
Sample plot No	X coordinate	Y coordinate	Altitude m
MK1	84.3461050	28.532053	2065
MK2	84.3481250	28.531926	2037
MK3	84.3587590	28.505989	1817
MK4	84.3582470	28.504883	1829
MK6	84.3705380	28.463093	1725
MK7	84.4078850	28.401882	1147
Mk8	84.4061210	28.392437	1166
MK10	84.4004600	28.381838	1093
MK11	84.4002890	28.381873	1097
MK12	84.3962180	28.321172	1125
MK13	84.3972760	28.315529	1123
Khudi Udipur Section			
Sample plot No	X coordinate	Y coordinate	Altitude m
KU1	84.3643100	28.292224	907
KU2	84.3648040	28.293031	907
KU3	84.3627610	28.290935	888
KU4	84.3742450	28.295772	985
KU5	84.3630060	28.282024	801
KU6	84.3643660	28.273623	812
KU7	84.3673060	28.264077	828
KU8	84.3794140	28.242174	752
KU9	84.3826400	28.236200	720
KU10	84.3846620	28.231638	719
KU11	84.3902880	28.227759	764
KU12	84.4001700	28.209282	770
Udipur Markichowk Section			
Sample plot No	X coordinate	Y coordinate	Altitude m
UM1	84.4466420	28.158224	633
UM2	84.4445620	28.147194	600
UM3	84.4401350	28.135781	537
UM4	84.4509220	28.097376	506
UM5	84.4686520	28.078302	544
UM6	84.4697480	28.075630	507

UM7	84.4771680	28.064265	473
UM8	84.4812320	28.064107	558
UM9	84.4947370	28.050584	604
UM10	84.4393179	27.984930	473
UM11	84.4765806	27.936330	396
Markichowk Bharatpur Section			
Sample plot No	X coordinate	Y coordinate	Altitude m
MB1	84.5093170	27.918343	434
MB2	84.5216990	27.901616	628
MB3	84.5203400	27.865595	1219
MB4	84.4994380	27.817977	335
MB6	84.4804040	27.802534	1002
MB7	84.4769950	27.760989	220
MB8	84.4762750	27.750306	284
MB9	84.4660360	27.744431	271

Table C-5: Details of Key informants

List of informants in Khudi Manang Section				
SN	Person consulted	Address	Mobile	Remark
1	Bijaya Gupta	Marsyangdi Corridor Project Head Manang-Udipur Section	9841569876	
2	Dhan Bahadur Gurung	Marshyangdi GAPA -4, Tangring	9846738372	
3	Bal Bahadur Gurung	Marshyangdi GAPA -4, Tangring	9846273817	
4	Jit Bahadur Gurung	Marshyangdi GAPA -4, Tangring	9846409772	
5	Kanchaman Gurung	Marshyangdi GAPA -4, Mipra	9846632958	
6	Khum Bahdur Gurung	Marshyangdi GAPA -4, Mipra		
7	Dipak Gurung	Marshyangdi GAPA -4, Mipra		
List of informants in Khudi Udipur Section				
1	Bir Bal Tamang	Tarkhu Gau	9846824855	
2	Budhi Bahadur Tamang	Tarkhu Gau	9846753215	
3	Bhabar Jung Gurung	Besi Sahar 10, Pasachuar	9840412149	
4	Dhan Bahadur Dawadi	Besi Sahar 10, Pasachuar	9851026735	
5	Uttam Gurung	Besi Sahar 10, Pasachuar	9815111019	
6	Achyut Babu Tiwari	Besi Sahar 11, Tharchaur	9827117741	
7	San Kaji Mijar	Besi Sahar 11, Tharchaur	9806500862	
8	Hark Nidhi Tiwari	Besi Sahar 11, Tharchaur	9862219084	
9	Gopal Kumar Shrestha	Besi Sahar 11, Tharchaur	9823177012	
10	Sunil Tiwai	Besi Sahar 11, Tharchaur	9842776930	
11	Pawan Tiwari	Besi Sahar 11, Tharchaur	9819181822	
Udipur Markichowk Section				
1	Narayan Regmi	Marsyangdi Corridor Project Asst. Manager Udipur-Bharatpur Section	9851147454	
2	Narayan Babu Tiwari	Besi Sahar 11,	9866021042	
3	Achyut Regmi	Dordi GAPA 2, Archalbot	9846128158	
4	Satya Devi Dhakal	Dordi GAPA 2, Archalbot	9846458232	
5	Ram Prasad Poudel	Dordi GAPA 2, Archalbot	9864172821	
6	Sobita Kunwar	Dordi GAPA 2, Archalbot	9866041115	
7	Biswa Kant Sadaula	Rainas NAPA 8, Harrabot	9841315072	

8	Tika Prasad Shrestha	Rainas NAPA 8, Harrabot		
9	Prem Bahadur Kandel	Rainas NAPA 8, Godetari	9745685590	
10	Daran Ranabhat	Rainas NAPA 8, Harrabot	9846416641	
11	Binod Thapa	Rainas NAPA 8, Harrabot	9808924114	
12	Kuber Ranabhat	Rainas NAPA 8, Harrabot	9846644436	
13	Ram Bahadur Gurung	Rainas NAPA 8, Bagar	9814134865	
14	Dev Bahadur Gurung	Rainas NAPA 8, Harrabot		
15	Prem Nepali	Palungtar NAPA 6,	9819186790	
16	Nir Bahadur Nepal	Palungtar 6,	9812294487	
17	Devka Regmi	Palungtar 6	9806580646	
18	Thakur Adhikari	Palungtar 6		
19	Ujeli Maya Kumal	Palungtar 7, Pareghhat	9814168495	
20	Sandesh Nepali	Palungtar 7, Pareghhat		
21	Bishnu Maya Kumal	Palungtar 7, Pareghhat	9817164722	
Markichowk-Bharatpur Section				
1	Nahesh Poudel	Gorkha	9846146805	DFO
2	Purneshwar Subedi	Lamjung	9856046630	DFO
3	Ashok Kumar Shreatha	Gorkha	9856040136	DFO
4	Lok Raj Nepal	Chitwan	9855057215	DFO
5	Gobardhan Thapa	Abukhaireni-3, Tanahu, jyabisara	9814119624	
6	Kesh Bahadur Ale	Abukhaaireni-4 Chimkesai, Tanahu		
1	Shyam Thapa	Abukhaaireni-4 Chimkesai, Tanahu	9846968220	
2	Tilak Bahadur Thapa	Abukhaaireni-4 Chimkesai, Tanahu	9840643319	
3	Aaitaram Bhujel	Abukhaaireni-4 Chimkesai, Tanahu	9849955240	
4	Gore Gurung	Bhatratpur Ghamne chauki		
5	Santa Bahadur Gurung	Bhatratpur Ghamne chauki	9807172085	

Appendix C-2: Photographs

A. Photographs of vegetation taken in Khudi Manang section

		
<p>Photo 1 : <i>Rumex</i> sp.</p>	<p>Photo 2: <i>Biden pilosa</i></p>	<p>Photo 3: <i>Persicaria chinensis</i></p>
		
<p>Photo plate 4: <i>Rubus elipticus</i></p>	<p>Photo plate 5: <i>Coelogyne</i> sp.</p>	<p>Photo 6: <i>Artemissia vulgaris</i></p>
		
<p>Photo plate 7: <i>Berberis</i> sp.</p>	<p>Photo plate 8: <i>Pyrrosia</i> sp</p>	<p>Photo plate 9: <i>Trachycarpus</i> sp.</p>
		
<p>Photo plate 10: <i>Plantago major</i></p>	<p>Photo plate 11: <i>Selaginella</i> sp.</p>	<p>Photo plate 12: <i>Maesa chisia</i></p>



Photo plate 13: Hotspot Area



Photo plate 14: *Gentiana* sp.



Photo plate 16: *Marchantia* sp.



Photo plate 17: *Oplismenus* sp.



Photo plate 18: *Cythea* sp.



Photo plate 19: Plot Design for Herb

B. Photographs of vegetation taken in Khudi Udipur section



Photo 20: *Kyllinga nemoralis*



Photo plate 21: *Smilax* sp.



Photo plate 22: *Pyrrhosia* sp.



Photo plate 23: *Solanum* sp.



Photo plate 24: *Stephania* sp.



Photo 25: *Euphorbia hirta*



Photo plate 26: *Pandanus* sp.



Photo plate 27: *Pteris vitata*



Photo 28: *Clerodendrum* sp.



Photo plate 291: *Cyperus* sp.



Photo plate 30: *Hupergia* sp.



Photo 31: *Commelina* sp.



Photo plate 32: *Ageratina adenophora*



Photo plate 33: *Persicaria* sp.



Photo plate 34: *Acmella* sp.



Photo plate 35: *Imperata cylindrica*



Photo plate 36: Hotspot Area near AP4



Photo plate 37: With informants

C. Photographs of vegetation taken in Udipur-Markichowk section



Photo 38: *Tridax procumbens*



Photo 39: *Cromolaena odorata*



Photo plate 40: *Casia tora*



Photo plate 41: *Ariesema* sp.



Photo plate 42: *Urnea lobata*



Photo 43: *Cyperus rotundus*



Photo plate 44: *Adiantum* sp.



Photo 45: *Achyranthus aspera*



Photo plate 46: *Tectaria* sp.



Photo plate 47: *Fragaria* sp.



Photo 48: *Kyllinga brevifolius*



Photo plate 49: *Lygodium* sp.



Photo plate 49: *Mumosa pudica*



Photo plate 51: *Cajanus* sp.



Photo plate 52: *Barleria* sp.



Photo plate 53: *Rauvolfia serpentine*



Photo plate 54: Hotspot area



Photo plate 55: Ecological plot

D. Photographs of vegetation taken in Markichowk-Bharatpur section



		
<p>Photo 56: <i>Melostoma</i> sp.</p>	<p>Photo 57: <i>Lycopodium Japonicum</i></p>	<p>Photo 58: <i>Cyperus</i> sp.</p>
		
<p>Photo 59: <i>Phyllanthus</i> sp.</p>	<p>Photo plate 60: <i>Hypoxis</i> sp.</p>	<p>Photo 61: <i>Colebrookia oppositifolia</i></p>
		
<p>62: <i>Michania macrantha</i></p>	<p>Photo 63: <i>Spermacoce alata</i></p>	<p>Photo 64: <i>Desmodium</i> sp.</p>
		
<p>Photo 65: <i>Barleria cristata</i></p>	<p>Photo 66: <i>Triumfetta</i> sp.</p>	<p>Photo plate 67: <i>Solanum</i> sp.</p>



Photo plate 68: *Stephania japonica*



Photo plate 69: *Gonostegia* sp.



Photo plate 70: *Blumea* sp.



Photo plate 71: *Calotropis gigantea*



Photo plate 72: Hot spot Area



Photo plate 73: Ecological plot for Herb

E. Miscellaneous photographs



Photo plate 74: Measurement of BA

Photo plate 75: *Pinus* forest (Upper part)

Photo plate 76: Measurement in upper part



Photo 77: Bushy portion in the middle part



Photo 78: Small busy region (middle region)

Photo plate 79: *Nephrolepis* sp, (Pani amala)



Photo 80: Tree fern recorded in the corridor

Photo 81: *Pandanus* sp. in the lower portionPhoto 82: Discussion with local people
(Impact analysis)Photo 83: *Aegle marmelos* (Bel) NTFPs
recorded during studyPhoto plate 84: Measurement of DBH of
Schima wallichii (Chilaune)

Photo plate 85: Sal Forest in the lower belt



Photo 86: Study team recorded floral diversity



Photo 87: Riverine sal forest (Tropical belt)



Photo plate 88: Sal forest patches



Photo 89: Invasive species (*Lantana camera*)



Photo plate 90: Spreading of *Lantana camera*



Photo 91: *Melastoma* sp. (sal-chilaune forest)



Photo 92: Seedling of *Mallotus philippensis*



Photo93: Sal-forest in Bharatpur section

APPENDIX D: PUBLIC DISCLOSURE

Public Notice

हाम्रो गौरव, राष्ट्रको पत्रिका

गौरवापत्र

सर्वे भवन्तु सुखिनः सर्वे सन्तु निरामयाः । सर्वे भद्राणि पश्यन्तु मा कश्चिद् दुःखभाग्जनः ।

आलोकन महेन्द्रको जाग्राम, बीपीको अनिदो | मोरक्को र क्रोएसियाबीचको रोमाञ्चक

वर्ष १२२ | अङ्क २१५ | २०७९ साल पुस २ गते शनिवार | पौष कृष्ण नवमे | नेपाल संवत् १९४३ थिंलागा ९ | 2022 December 17 Saturday | पृष्ठ : १२+१४+१ | मूल्य : दस रुपैयाँ

सूचना

प्रकाशित मिति : २०७९/०९/०२

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment–BIA) र सो प्रसारण लाइनलाई आधार मानेर यस क्षेत्रमा सञ्चालनमा रहेका/निर्माणाधीन तथा प्रस्तावित विकास आयोजनाहरूको समष्टिगत प्रभाव मूल्याङ्कन (Cumulative Impact Assessment–CIA) को कार्यकारी सारांश र मस्यौदा प्रतिवेदनहरू वातावरण तथा सामाजिक अध्ययन विभागद्वारा तयार गरी नेपाल विद्युत प्राधिकरणको वेबसाइट <https://nea.org.np/publications> मा राखिएको हुँदा यो सूचना प्रकाशन भएको मितिले १५ (पन्ध्र) दिनभित्र निम्न ठेगानामा उक्त मस्यौदा प्रतिवेदनहरू उपर राय सुझाव उपलब्ध गराइदिनुहुन सम्पूर्ण सरोकारवाला व्यक्ति र संस्थाहरूलाई अनुरोध छ ।

राय सुझाव पठाउने ठेगाना:

 <p>नेपाल विद्युत प्राधिकरण इन्जिनियरिङ सेवा निर्देशनालय वातावरण तथा सामाजिक अध्ययन विभाग लाजिम्पाट, काठमाडौं इमेल : env.social@nea.org.np फोन नं. : ०१-४४३३५८००</p>	<p>नेपाल विद्युत प्राधिकरण आयोजना व्यवस्थापन निर्देशनालय मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजना मातातीर्थ काठमाडौं इमेल : mc220kv@nea.org.np फोन नं. : ०१-५१६४१०३</p>
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नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरुको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ

मिति: २०७९/०९/२१ गते बिहिबार समय: बिहान ११:०० बजे

नाम: विद्या डमिकारी

ठेगाना: बेसीशहर मपा-७ मोबाईल
राय सुझाव

निर्माण कार्य गर्ने क्रममा वनजंगल फडानी गर्दा लोप हुने जाने जीवजन्तुको संरक्षण के कसरी गर्न सकिन्छ र के आक्रामक हुने जन्तुहरु मानव वस्तीमा परेर हुने नोक्सानी पुग्छन् या को जिम्मेवारी कसले लिने ?

विद्या
दस्तखत

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरुको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ

मिति: २०७९/०९/२१ गते बिहिबार समय: बिहान ११:०० बजे

नाम: प्रेमबहादुर खस

ठेगाना: मर्स्याङ्दी गा.पा. ३ खुरी मोबाईल ९८५६७३५५८८
राय सुझाव

- लागू हुने जग्गा बलामाई डाँचेत धारि पूर्व लिपि
- तारुनी परेको जग्गा खुसी वा नोकिगत रूपले खेडुवा विविध कारोबार गर्न
लागिने व्यवस्थापन गर्नु

- अक्षय, काप्रा, कलमा आदि जलविद्युतका कारण परेको पूर्व लिपि
(लोप हुने अवस्थाको पूर्व लिपि प्रतापिका आदि संरक्षणका लागि व्यवस्थापन
गर्नु पर्ने)

- कसैको अक्षय जग्गा खुली भएमा बनाउन दिने अक्षय दिने विद्यालयका
लागि खुफि व्यवस्थापन गर्नु पर्ने

प्रेमबहादुर
दस्तखत

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ्ग

मिति: २०७९/०९/२९ गते बिहिवार समय: बिहान ११:०० बजे

नाम: राय सुझाव

ठेगाना: राय सुझाव मोबाईल: ९७७९७७७७७७

राज्यको प्राथम्य

१. सबै जिम्मेवार राज्यको हो

(क) प्राथमिकता राज्यको हो

(ख) जनताको हितको आधार राज्यको हो

२। राज्यको काम

(क) राज्यले नेपालको जन हितको, उच्चतर ^{पुस्तक} चर जिवजन्तु जति उच्च जङ्गलको विस्थापन तथा ^{तथा} तयार गरेका हुन, पछि नयाँ गतु पछि

(ख) विकास राज्यभर राज्यको, स्वामित्व मार्ग स्वामित्व कार्यालय, विद्यालय, मसानघाट, अन्य विविध

(ग) वातावरण प्रभाव-मान्य ^{सबै} समितिको जिवजन्तु चरा ^{जुसुङ्गी} किराफलाङ्ग ^{मार्ग}

(घ) वातावरण प्रभाव मान्य ^{व्यक्ति} पत्र ^{पत्र}

दस्तखत
राय सुझाव

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ्ग

मिति: २०७९/०९/२९ गते बिहिवार समय: बिहान ११:०० बजे

नाम: राय सुझाव

ठेगाना: राय सुझाव मोबाईल: ९७७९७७७७७७

१. राज्यको प्राथमिकता राज्यको हो

(क) प्राथमिकता राज्यको हो

(ख) जनताको हितको आधार राज्यको हो

२। राज्यको काम

(क) राज्यले नेपालको जन हितको, उच्चतर ^{पुस्तक} चर जिवजन्तु जति उच्च जङ्गलको विस्थापन तथा ^{तथा} तयार गरेका हुन, पछि नयाँ गतु पछि

(ख) विकास राज्यभर राज्यको, स्वामित्व मार्ग स्वामित्व कार्यालय, विद्यालय, मसानघाट, अन्य विविध

(ग) वातावरण प्रभाव-मान्य ^{सबै} समितिको जिवजन्तु चरा ^{जुसुङ्गी} किराफलाङ्ग ^{मार्ग}

(घ) वातावरण प्रभाव मान्य ^{व्यक्ति} पत्र ^{पत्र}

दस्तखत

प्रमाणपत्र

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ्ग

मिति: २०७९/०९/२१ गते बिहिबार समय: बिहान ११:०० बजे

नाम: अथाराम श्रेष्ठ

ठेगाना: सुदूरपश्चिम प्रदेश-६ मोबाईल ९९९६०५९२५

राय सुझाव

१) गुणस्तरिय केवल प्रयोग गरी एडभोकेटरी कार्य प्रस्तुत विद्युत प्रवाह गर्ने लाइनहरू हुँदा छिन् गुणस्तरिय केवल प्रयोग नगरी धेरै विद्युत प्रवाह लाइन प्रयोग गर्नु नकार्नु हो।

अस्का अक्षर

जग्गा शक्तिशाली भएको सुचना हो।

हरियो निर्माणका लागि नकार्य हो।

~~सुदूर~~ उचाइले प्रभावित नभएको र लोको जातको हो।

कामको तथा जिव जन्तु असुरक्षित हो।

पन जंगल तथा वातावरण प्रभावित हो।

दस्ताखत

३

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: गेटवे हिमालय रिसोर्ट, बेसीशहर न.पा.-७, बेसीशहर, लमजुङ्ग

मिति: २०७९/०९/२१ गते बिहिबार समय: बिहान ११:०० बजे

नाम:

ठेगाना: मोबाईल

राय सुझाव

१) राज्यको नियमनादिक अन्त राष्ट्रिय शक्तिशाली कार्यको उद्देश्य दिने हो।

२) प्रवाह शक्तिको पाउने उद्देश्यको लागि विविध विधाका रोजगार हाप्पी टापी प्रसार पाउनुपर्दो।

३) विद्युत वाट राज्यको कानून सुविधा र फाइदा।

४) विद्युत को जाति नैले वा तरकारी तर को रक्षक पन्छ।

५) विद्युतको ए कुलको नकारको प्रभावको साथै के एसके, एमके, र एपकेको साथै अन्तर्गतको नेपालको कार्य आवधिक प्रजन हुन्छ।

६) अन्तर्गतको नेपालको कार्य आवधिक प्रजन हुन्छ।

दस्ताखत

२०७९/०९/२१ गते

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: इन्द्रेणी चुलो होटल, दासढुङ्गा, भरतपुर महानगरपालिका-२९, चितवन

मिति: २०७९/०९/२४ गते आइतबार समय: बिहान ११:०० बजे

नाम: ~~सुभाष पहाडुर धापा~~
 ठेगाना: ~~भरतपुर २२ भन्ने~~ इन्द्रेणी.सि.मोबाईल ~~९७४६९~~
 राय सुझाव ~~९७४६९~~

- १. इन्द्रेणी अ. व. वनमा छुट्टै छुट्टै हाइलेनको खाँदो आएको हाउस जङ्गल उपलगत हाँडीपुत्र होला
- २. हाइलेन लाइन मुनि पत्त अक्षय जस्तै कडाणी केरा जस्तै वा गध्याउको
- ३. खाली हाँउ मा पिकव खोल्ने

दस्तखत

नेपाल विद्युत प्राधिकरणद्वारा निर्माणाधीन मर्स्याङ्दी कोरिडोर २२० के.भी. प्रसारण लाइन आयोजनाको जैविक विविधता प्रभाव मूल्याङ्कन (Biodiversity Impact Assessment-BIA) को प्रतिवेदन तयारीको सिलसिलामा सरोकारवाला व्यक्ति/संस्थाहरूको राय सुझाव संकलनका लागि आयोजित कार्यशाला गोष्ठी

स्थान: इन्द्रेणी चुलो होटल, दासढुङ्गा, भरतपुर महानगरपालिका-२९, चितवन

मिति: २०७९/०९/२४ गते आइतबार समय: बिहान ११:०० बजे

नाम: ~~चित्त पहाडुर~~
 ठेगाना: ~~इन्द्रोलाबाटो २९~~ मोबाईल ~~९७४६९~~
 राय सुझाव ~~९७४६९~~

- जाडो बागको देखेउ मात्र गरेको लुटा करी
- करी फुरती वा करी उपार ५ द करी
- १ एक एक फुरती लाईन लाई गरन
- गरेर लुगाको मर २०१ २०२०को
- २ मेलि धल मेलि टाँडे बने करमा
- खान करान लुटा मरिपोको ज २०१२
- हुने भएकोले वेउ इरीपी ता १२
- जाली मर उपार २०१२ २०१३ २०१४
- २०१५ /

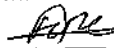

 दस्तखत

Table: Issue raised in stakeholder consultation and public disclosure program and issue addressed in the CIA/BIA report

SN	Respondent/Public	Issues raised	Issue addressed	Remarks
Jan.3, 2023, Dharapani, Nasong RM-4, Manang				
1.	Surendra Gurung, secretary of Nepali Congress District Chapter, Manang	Asked about the route alignment of TL in Manang district	The route alignment on the google earth was presented by the project representatives in the same program. The maps are presented in figure 4-2 of CIA report.	
2.	Bel Kumari Gurung, Chair of Mothers' Group	Raised concerned about air pollution and electric hazard close to vicinity of substation area	The ESSD staffs explained that the measures to control air pollution are presented in the EIA report and will be implemented in the substation construction phase. Further, the project team ensured that international safety measures/standards will be taken in SS to avoid electric hazard.	The issue raised was project focused, rather than CIA/BIA focused
3.	Dhara Jung Gurung, Ward Chair of Nasong RM-4	Noted that the study team well captured and elaborated biodiversity of the project area, mainly in the Manang District	The study team acknowledged the feedback received	
4.	Dhan Bahadur Gurung, Ghelanchowk	<ul style="list-style-type: none"> Project should properly manage the waste generated during the construction phase. The project should coordinate with the local people and other stakeholders. The project should give attention to conservation of temples, religious sites, and environment. 	These issues are addressed in EIA/IEE of the report and the mitigation measures will be implemented accordingly.	The issue raised was project focused, rather than CIA/BIA focused
5.	Khusi Raut Kurmi and Prakash Adhikari, ACAP Manang	<ul style="list-style-type: none"> The project should reduce the impact of noise and air pollution on wildlife and birds. 	Section 6.1 and section 6.2 of BIA	Much of these issues are addressed in EIA/IEE
Jan 4, 2023, Palungtar, Gorkha				
6.	Ramesh Khadka, Project Affected People (PAP)	Complaint the approach undertaken for study, the discussion at Birutar didn't place. The information provided was not adequate, delayed and didn't reach to all PAP's.	The consultation process with the affected people and other stakeholder has taken place since IEE. The consultation for CIA was also carried out in the Gorkha district (Table 2-2 of CIA). Further the public notice was published on Dec.17, 2022 regarding the availability of draft reports in NEA website. To disseminate the information, a copy of such public notice was affixed in the notice board of Palungtar Municipality Office and the	

SN	Respondent/Public	Issues raised	Issue addressed	Remarks
			Offices of Ward No. 3, 4,5,6,7 and 8 on Dec 19, 2022 (Appendix D of CIA).	
7.	Bhadra Giri, PAP	Raised RoW and full compensation. We don't oppose the project but demand full compensation under RoW. Or progressive compensation 30% in each year for 30 years.	The CIA calls for RoW management policy for addressing the issues related to RoW acquisition and multiple TL affected people.	Project based issues rather than that of CIA/BIA
8.	Durga Adhikari, PAP	We oppose the project if used security force used, ready to negotiate the problem of compensation step by step and case by case.	Project representatives stated that the project is always ready for negotiation and shall there be any grievances/issues, the grievance redress committees (GRCs) are formed, as mentioned in EIA/IEE, to address those issues.	
9.	Amrit Aryal, PAP	<ul style="list-style-type: none"> Advised to apply the realignment in problem solving approach. Prepare master plan, invite for consultation adopt approach case by case in compensation and realignment 	<ul style="list-style-type: none"> Alternative analysis has been carried out in initial phase of project inception and is well covered in EIA/IEE reports. Master plan of TL has been recommended in Table 7-2 of CIA report 	
10.	Bandana Pandey Deputy Mayor:	<ul style="list-style-type: none"> Highlighted the importance of the outcome of BIA/CIA study and advised to get alert to manage and cope forthcoming environment and social issues by the multiple projects coming in village. Ensured providing justice to all people and apply participatory approach while deciding compensation under RoW. Advised project to continue communicate and provide adequate information to the PAP and the community. 	The ESSD team and the project appreciated the remarks made by the Deputy Mayor and the Mayor of the Palungtar Municipality and for helping out the team to flow the correct message to the project affected people and the relevant stakeholders	
11.	Bibas Chintan, Mayor:	The CIA/BIA is new study and appreciated projects efforts and EIB's encouragement to assess the impact beyond national legislation.		
Jan 5, 2023, Besishahar Municipality, Lamjung				
12.	Ram Pd. Poudyal Vice Chair FPIC and Right Forum:	Land valuation, RoW compensation, treat differently to the project affected families by the multiple TL lines, and appropriate implement of CSR activities.	Table 7-1 of CIA report	
13.	Ramesh Gupta, ACAP Coordinator:	Appreciated the study approach and methodology adopted through camera trapping. But the fishes and reptiles were not covered. The wildlife, birds and plants have been well captured and elaborated. Several	Less impact was anticipated in fish due to TL so was not considered in BIA. Tube traps for reptiles and amphibians were not used as the mortality of these species was a major	

SN	Respondent/Public	Issues raised	Issue addressed	Remarks
		landslide cases are noticed in the alignment but not covered. Expected to mitigate potential negative impacts	threat and thus the primary data could not be collected for BIA. Anthropogenic and other physical process/stressors were not considered as elaborated in section 2.8 of CIA. So, landslide assessment was not considered	
14.	Hom Bdr. Magar, Chair Nepal Magar Committee, district chapter	Advised to avoid impact of multiple TL alignment 33/132/220 kV in their village. IP people are more affected than non-IP in the village so special attention to be paid.	Table 7-1 and table 7-2 of CIA report.	
15.	Chandra Bdr. Mishra, Secretary of FPIC and Right Forum:	Provided big thanks to EIB for advising NEA in implementing the concern raised by EIB-CM. The 15 days' time given to the public to put their opinion and suggestion is not enough. Current practice for RoW compensation is not appropriate. Advised to avoid the impact of occurred by multiple lines. The Forum is ready to sit in dialogue with NEA. For this the forum has submitted letter to NEA dated on 27 December 2022.	The 15 days' time was given for public to receive suggestions/feedback on the draft reports of CIA/BIA which were disclosed through NEA webpages. The ESSD team clarified that the 15-day time will be valid from the date of the notice received by the concerned government body or other stakeholder. The proposal for dialogue was appreciated.	
16.	Hari Jung Gurung, Chair NEFIN district chapter:	The project to apply equal treatment to all and assess differential impacts and mitigate them accordingly. The study is new for us. This type of study would be good if placed before the project activities commenced. Its late but we appreciate EIB and NEA's efforts on it.	The CIA is not recognized by the legal regime of Nepal and is not mandated before the project execution as mentioned in Chapter 3 of CIA report. Nevertheless, the CIA was initiated for MCTLP which is probably the first of its kind in Nepal, done for transmission line.	
17.	Guman Singh Aryal, Mayor, Besisahar Municipality	Appreciated the CIA and BIA study. The RoW compensation is to be address in policy level. Advised to implement the project construction activities mitigating potential negative impact mentioned in EIA. NEA to apply the policy of decommissioning low voltage power transmission line in Marsyangdi corridor.	The need of formulating and implementing RoW management policy are presented in Table 7-2 and Conclusion chapter of CIA report.	
18.	Khem Jung Gurung, Chair FPIC and Right Forum:	<ul style="list-style-type: none"> Expressed happiness for CIA/BIA study which they have been raising since 2018. Provided thanks to EIB for pushing NEA to undertake this study. Expressed the role played by the forum to establish right of IP community. The campaign provided them a learning ground from national and 	<ul style="list-style-type: none"> The mitigation measures are proposed at project level and beyond project level (Policy level) presented in table 7-1 and table 7-2 respectively. The project level mitigation measures are to be implemented by the project. 	

SN	Respondent/Public	Issues raised	Issue addressed	Remarks
		<p>international legal provisions and EIB E&S standards.</p> <ul style="list-style-type: none"> The project activities to be implemented appropriately the mitigation plan proposed in EIA/BIA and CIA. The community interaction and consultation should take place at the beginning of the project commencement which didn't happen here. However, there are still ways to go forward together. The affected community are ready to join in negotiation call with the project and a formal application has been registered putting seven points pre-condition for dialogue. 	<ul style="list-style-type: none"> The community interaction has taken place during the EIA and IEE much before the commencement of the project. The project/ESSD team appreciated the proposal of negotiation between the project and the affected community. 	
19.	Ghanashyam Ghale, Chair of Marsyangdi RM ward 8:	The area is potential for herbal and medicine value plants which is the asset of villagers. The migratory birds visit villages once in a year. The CIA provided opportunity of clubbing issues together and a big picture of potential negative impact. Advised to increase RoW compensation.	The CIA calls for RoW management policy which also need to address the issue of multiple projects affected households.	Increasing RoW compensation is project-based issue.
20.	Kul Bdr. Tamang, PAP:	Tree cutting at Champawati Community Forestry and clash happened in the month of September 2022.	Project stated that the issue will be solved through dialogue with the community forestry group.	Project based issue
21.	Sochana Pandey PAP:	The report came late but is good symptom for future. The project to implement social awareness program before commencing any construction related works to increase safety and security. Gender participation to be increased and at least 30% in each event.	Social awareness programs are being implemented by the project as per the approved IEE/EIA documents	Project based issue
22.	Representative from Bjuje Pani CF:	A school is located close to RoW and could potential electrical and electromagnetic hazards to the students. Advised to assist the project to the school relocation process.	Every physical structure, whether private or public, within the RoW of the TL will be relocated as per the prevailing laws with the said compensation (Table 7-1 of CIA)	Addressed in EIA/IEE
23.	Amar Bdr. Gurung chair Marshyangi RM:	Advised to reduce impact decommissioning 33 kV/132 kV TLs. Raised concern RoW payment practice. Prompt implement EMP to mitigate environment and social impacts. RM is ready to play role mediation closing the issues and facilitate to implement the project.	<p>Table 7-2 and conclusion chapter of CIA report.</p> <p>The team appreciated the remarks made by the Chair of the Rainas RM</p>	

SN	Respondent/Public	Issues raised	Issue addressed	Remarks
24.	Khadga Bdr. Gurung Chair Rainas Municipality:	Provide thanks for undertaking this study. He is not in position to comments on the results of the study undertaken by experts but as a leader expect prompt to implement the program underlined to mitigation negative impact. Expected to establish regular communication and close relation of the project to the affected community and other concerned stakeholders.	The team appreciated the remarks made by the Chair of the Rainas RM	
January 6, 2023 Anbu Khaireni Tanahun				
25.	Januka Dhakal, PAP	She raised concern about safety during the construction and operation phase. Potential electrical hazards and its negative impacts in the community. The environment management and cash compensation are major concern from community side.	the project will ensure that international safety measures/standards will be taken in development and operation of SS and TL to avoid electric hazard	Project based issues
26.	Rabin Karki PAP/ CF member	Advised to reduce multiple number of TL alignment in village.	Table 7-2, CIA report	
27.	Resham Gurung, PAP/CF member	Requested a map of project footprint in their vicinity and CF boundary. Advised to run awareness programs in village level.	Project map was shown during the disclosure and is presented in Figure 4-2 of CIA Awareness program are being conducted in the project area by the Environment and Social Management Units (ESMUs) established as per EIA/IEE	
28.	Ram Bdr. B.K., PAP/CF:	Apply adequate mitigation activities to reduce impact, increase RoW compensation and replantation for the loss of trees.	Table 7-1 of CIA and Section 6.1.1 of BIA	
29.	Suk Maya Chepang, CF:	Advised to implement social support programs to project affected people. Compensation under RoW is not appropriate to address the direct impact.	Table 7-1 of CIA	
Jan 8, 2023, Bharatpur Metropolitan City, Chitwan				
30.	Setu Gurung, Ward Member, Bharatpur Metropolitan City-29	Raised the issue of the land acquisition of non-title holders	RoW Management Policy recommended by the CIA is to address the land acquisition of non-title holders.	Project based issue
31.	Aaita Bahadur Gurung, Indreni Community Forest	Raised the concern about the increasing impact of development projects on the community forests and national forest. Advised to make single TL despite of making multiple lines	Table 7-2 of CIA	

