Environmental Impact Assessment Report

of

SFDP Management Plan (2075/76-2084/85)

Submitted to:

Ministry of Forests and Environment

Singha Durbar, Kathmandu, Nepal

Submitted by:

Forest Products Development Board

BabarMahal, Kathmandu, Nepal

Consultation by:

Green Governance Nepal

Shantinagar, Kathmandu, Nepal

2019 May

नेपाल सरकार
वन तथा वातावरण मन्त्रालय
EX: पो.ब.नं. :३५८७
[illegible], काठमाण्डौ
वातावरण तथा जैविक विविधता महाशाखा

वा.प्र.अ.शा.-४०४-२०७५/०७६

पत्र संख्या:-
चलानी नं.:१७६२
प्राप्त पत्र संख्या र मितिः- पर्सो नं.५६६ मिति २०७६।३।२३

योजना २.५५ ७६।३।२२

मिति : २०७६/०३/२२

विषयः वातावरणीय प्रभाव मूल्याङ्कन (EIA) प्रतिवेदन स्वीकृत भएको सम्बन्धमा ।

श्री वन पैदावार विकास समिति
बबरमहल, काठमाडौं ।

प्रस्तुत विषयमा ताहाँ समिति प्रस्तावक रहेको प्रदेश नं. २ अन्तर्गत महोत्तरी र सर्लाही जिल्लाको बर्दिवास नगरपालिका, गौशाला नगरपालिका, इश्वरपुर नगरपालिका, बागमती गाउँपालिका, हरिवन नगरपालिका र लालबन्दी नगरपालिकामा स्थित सागरनाथ वन विकास परियोजनाको १० बर्षे दिगो वन व्यवस्थापन योजना कार्यान्वयन गर्ने प्रस्तावको वातावरणीय प्रभाव मूल्याङ्कन (EIA) प्रतिवेदन स्वीकृतिको लागि यस मन्त्रालयमा प्राप्त हुन आएकोमा कारवाही हुँदा वातांवरण संरक्षण नियमावली, २०५४ को नियम ११. को उपनियम (४) बमोजिम श्री श्री वन पैदावार विकास समिति प्रस्तावक रहेको प्रदेश नं. २ अन्तर्गत महोत्तरी र सर्लाही जिल्लाको बर्दिवास नगरपालिका, गौशाला नगरपालिका, इश्वरपुर नगरपालिका, बागमती गाउँपालिका, हरिवन नगरपालिका र लालबन्दी नगरपालिकामा स्थित सागरनाथ वन विकास परियोजनाको १० बर्षे दिगो वन व्यवस्थापन योजना कार्यान्वयन गर्ने प्रस्तावको वातावरणीय प्रभाव मूल्याङ्कन अध्ययन (EIA-May, 2019) प्रतिवेदन देहायमा उल्लेखित शर्तहरुको अधिनमा रहने गरी नेपाल सरकार वन तथा वातावरण मन्त्रालय (मा. मन्त्रीस्तर) को मिति २०७६/०३/१६ को निर्णयानुसार स्वीकृत भएको व्यहोरा अनुरोध गर्दछु ।

शर्तहरुः

१. प्रस्ताव कार्यान्वयन तथा सञ्चालनको क्रममा कुनै नया/थप वातावरणीय प्रभावहरु पहिचान हुन गएमा त्यसलाई प्रस्तावकले निराकरण/न्यूनिकरण गर्नुपर्नेछ ।
२. प्रस्ताव कार्यान्वयन तथा सञ्चालनमा आएको जानकारी यस मन्त्रालय, सरोकारवाला निकायहरु तथा वातावरण विभागलाई यथाशिघ्र दिनुपर्नेछ ।
३. प्रस्ताव कार्यान्वयनको सिलसिलामा प्रस्तावकले नियमित अनुगमनको व्यवस्था गर्नुपर्नेछ र अनुगमनको वार्षिक प्रतिवेदन तयार गरी यस मन्त्रालय लगायत सरोकारवाला निकायलाई नियमित बुझाउनुपर्नेछ ।
४. सार्वजनिक सुनूवाईका क्रममा उठेका सवालहरुको सम्बन्धमा आयोजना कार्यान्वयनको क्रममा विवाद उत्पन्न भएमा प्रस्तावकले सरोकारवाला सँग समन्वय गरी समस्या को समाधान गर्नुपर्नेछ ।

सचिव : ४२११५६७, फ्याक्स: ४२११८६८

नेपाल सरकार

वन तथा वातावरण मन्त्रालय

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वातावरण तथा जैविक विविधता महाशाखा

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पत्र संख्या:-

चलानी नं. ५४६२

प्राप्त पत्र संख्या र मिति:-

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५. विद्यमान वातावरणसंग सम्बन्धित ऐन, नियम, नियमावली तथा मन्त्रालयबाट जारी भएका विभिन्न मापदण्डहरु एवं प्रस्ताव कार्यान्वयन हुने क्षेत्रसंग सम्बन्धित निकायबाट जारी भएको ऐन, नियम तथा मापदण्डहरुको समेत पूर्ण पालना हुने गरी प्रस्तावकले प्रस्तावको कार्यान्वयन गर्नु पर्नेछ ।

६. आयोजना कार्यान्वयनको क्रममा उत्सर्जन हुने Solid तथा Liquid Waste हरु लाई उचित तरिकाबाट प्रसोधन गरी मात्र Dispose गर्नु पर्ने ।

२०६६/०३/२२

(सुभाष कुमार शर्मा)
सहायक वन अधिकृत

बोधार्थ:

श्री वातावरण विभाग
बबरमहल, काठमाडौं ।

सचिव : ४२११५६७, फ्याक्स: ४२११८६८

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Executive Summary in Nepali

नेपालको दक्षिणी भागमा अवस्थित सर्लाही र महोत्तरी जिल्लामा रहेको सागरनाथ वन क्षेत्रको १० वर्षे दीगो व्यवस्थापन कार्ययोजना कार्यान्वयनले भौतिक, जैविक, सामाजिक र आर्थिक क्षेत्रमा पार्ने सकारात्मक र नकारात्मक प्रभावका बारेमा केन्द्रित रही यो वातारवरणीय प्रभाव मूल्याङ्कन प्रतिवेदन तयारी गरिएको छ । यसले निर्णयकर्तालाई योजना कार्यान्वयन सम्बन्धी निर्णय गर्न सहयोग पुग्दछ ।

वन तथा वातावरण मन्त्रालय, वन पैदावार विकास समितिको सागरनाथ वन विकास परियोजनाले यस सागरनाथ वनलाई व्यवस्थापन गरिरहेको छ । तराईमा तीव्र गतिमा भइरहेको वन विनाश र जमीन क्षयीकरण रोक्नु तथा काठ र दाउराको आपूर्ति बढाउनु, रोजगारी सिर्जना गर्नु यस परियोजनाको स्थापनाकालको मूल उद्देश्य रहेको थियो । अबको यसको उद्देश्य भनेको गुणस्तरीय काठ र वनजन्य कच्चा उत्पादन गर्दै रोजगारी सिर्जना गरी राष्ट्रको अर्थतन्त्र र पर्यावरणमा टेवा पुऱ्याउनु हो । सागरनाथ वन विकास परियोजनाको नेपालकै लागि नमूना वन क्षेत्र हो जुन वृक्षारोपण गरी हुर्काइएको हो । महोत्तरी र सर्लाही जिल्लाको ५ नगरपालिका र १ गाउँपालिकामा फैलिएको यस परियोजनालाई सागरनाथ, हातीलेत र मुर्तिया डिभिजनले व्यवस्थापन गर्दछ । परियोजनाको कूल क्षेत्रफल १३, ५०० हेक्टर हो, जसमध्ये १०, ७४० हेक्टर क्षेत्रफल कम हैसियत भएका प्राकृतिक वन जंगल सरपट कटान गरी छिटो बढ्ने र कम समयमा धेरै उत्पादन दिने प्रजाति मसला, सिसौ, टीक आदि वृक्षरोपण गरिएको थियो र हाल वृक्षारोपण राम्रो नभएको ठाउँमा सालको पुनरोत्पादन राम्रो भइरहेको छ । वृक्षारोपण गरिएको क्षेत्रमा बाटोघाटो, अग्नि संरक्षण रेखा, वाच टावर, संरक्षण अफिस आदि भौतिक संरचना बनाइएको छ । यस वनलाई कम्पार्टमेन्टहरूमा विभाजन गरिएको जस अन्तर्गत ४ ब्लक हुन्छ । यस सागरनथ वन क्षेत्रमा भएको विरुवा र त्यसको क्षेत्रफल (हेक्टरमा) तालिकामा प्रस्तुत गरिएको छ ।

तालिका कः सागरनाथ आयोजनाका विभिन्न क्षेत्रमा भएका रुख प्रजातिको विवरण

प्रजाति	सागरनाथ	भक्तिपुर	फुल्जोर	पर्वानीपुर	हातीलेत	कुस्मारी	लक्ष्मणीया	मुर्तिया
मसला	१७८	११४८	७८	८७	६०४	५११	४०४	३२४
मसला र अन्य	१०९७	३८०	५७	१७	८६४	८५४	८८०	५१

प्रजाति	सागरनाथ	भक्तिपुर	फुल्जोर	पर्वानीपुर	हातीलेत	कुस्मारी	लक्ष्मणीया	मुर्तिया
खयर						११	२३	
साल							९४	१७
साल र अन्य	३४६					२१	१२०	
सिसौ	९			२६	१८			
टिक	१०४	२५	२४		२८		१४	३१
टिक र अन्य		२४	२५					
जम्मा	१७३३	१५७७	१८४	१३०	१५१४	१३९७	१५३५	४२३

यस सागरनाथ वन व्यवस्थापनका लागि १० बर्षमा गरिने क्रियाकलापमा पत्ल्याउने, झाडी सफाई, नर्सरी व्यवस्थापन, अग्निरेखा निर्माण जस्ता विभिन्न कार्यहरू तय गरिएको छ जसको संक्षिप्त विवरण तालिकामा प्रस्तुत गरिएको छ । १० वर्षको अवधिमा करीब २ हजार ६ सय हेक्टरमा सरपट कटान गरिनेछ र करीब ३ हजार ३ सय हेक्टरमा वृक्षरोपण गरिनेछ । यस वृक्षरोपण क्षेत्रमा भने कटान गरिएको क्षेत्र र अतिक्रमित क्षेत्र समेत पर्दछन् । प्रस्तावित कार्यक्रममलाई १० वर्षका लागि कहाँ, कति, कहिले गर्ने भनी विस्तृत कार्ययोजना तयार गरिएको छ । साथै, क्षमता अभिवृद्धि, सूचना र तथ्याङ्क व्यवस्थापन, उद्यम विकास लगायतका कार्यक्रम प्रस्तावित छन् ।

विविध विषयका विज्ञ सम्मिलित टोलीले विभिन्न प्राथमिक र द्वितीय स्रोतका तथ्याङ्कलाई विश्लेषण गरी कार्ययोजनामा प्रस्तावित क्रियाकलापको प्रभावलाई विभिन्न वर्गमा वर्गीकरण गरिएको थियो ।

तालिका खः प्रभाव र वर्गीकरण

प्रभाव	प्रकार वा वर्ग
प्रभावको गुण	फाइदाजनक/हानिकारक
किसिम	प्रत्यक्ष/अप्रत्यक्ष
परिमाण	उच्च/मध्यम/न्यून
विस्तार	स्थानीय/क्षेत्रीय/राष्ट्रिय, वा सीमापार

प्रभाव	प्रकार वा वर्ग
समय वा अवधि	अल्पकालीन/मध्यमकालीन/दीर्घकालीन
प्रभावकारिता	प्रभावी/निष्प्रभावी/गैरप्रभावी

प्रस्तावित १० वर्षे कार्ययोजनाका क्रियाकलापलाई माथि उल्लेख भएका तालिकाबाट सम्भाव्य प्रभावहरूलाई विश्लेषण गरियो र त्यसका न्यूनीकरणका उपाय समेत समेत दिइएको छ । कार्यान्वयन मूलतः सकारात्मक प्रभाव पार्ने देखिए पनि केही नकारात्मक प्रभाव पर्ने देखिएकाले प्रभाव र न्यूनीकरणका उपाय तपसिल बमोजिम रहेका छन् ।

तालिका गः प्रभाव एवम् न्यूनीकरण उपाय

प्रभाव	न्यूनीकरणका उपाय
माटोको गुणस्तरमा ह्रास	• यसका लागि अध्ययन गरी पानीको उपलब्धता एवं माटोको गुणस्तरमा पारेका प्रभाव अध्ययन गरिने • बस्तीको वरपर टिक रोपिनेछ ।
जमीनको पानीमा ह्रास	• संरक्षण पोखरी र रिचार्ज पोखरीको व्यवस्था
वातावरणीय प्रदूषण र ठोस फोहोर	• वस्तीसँग जोडिएको बाटो छेउ पानी छर्कने जसले धुलो कम गर्दछ • ठाउँठाउँमा फोहोर थुपार्ने बिनको व्यवस्था र समयक्रममा त्यसलाई व्यवस्थापन गर्ने
मानव वन्यजन्तु द्वन्द्व	• जनचेतना अभियान • स्टल फिडिङको अभ्यास बढाउने
वनस्पतिजन्य रोगमा वृद्धि	• यसका लागि अध्ययन गरी अध्ययनमा सिफारीस भएका क्रियाकलाप गर्ने
पेशागत सुरक्षा	• जनचेतना र समय अनुसारका तालिम र क्षमता अभिवृद्धि

प्रस्तावित क्रियाकलापबाट हुने नकारात्मक प्रभाव न्यून र सजिलै व्यवस्थापन गर्न सकिने किसिमका छन् । यस किसिमका क्रियाकलापका लागि रु. ९९,००,०००।०० छुट्टचाइएको छ । यसको सुपरिवेक्षणको जिम्मेवार वन तथा वातावरण मन्त्रालय र वन पैदावार विकास

समिति हुनेछ । कार्ययोजना र त्यसको वातावरणीय प्रभाव मूल्याङ्न प्रतिवेदनका आधारमा कार्यान्वयन गर्न उपयुक्त र लाभ पुऱ्याउने देखिएको छ जसबाट स्थानीय राष्ट्रिय आयमा सहयोग पुग्नेछ ।

Executive Summary

The proposed management plan entitled, "Sustainable Management Plan" for Sagarnath Forestry Development Project has been prepared for 10 years i.e. 2075/76-2084/85. This report of Environment Impact Assessment (EIA) is focused in implementation of the management plan and its probable impacts and mitigation measures against the negative impacts. Major objectives of the proposed management plan was to produce electricity transmission poles from eucalyptus and timbers from eucalyptus and teak. Sagarnath Forestry Development Project (SFDP) was initiated in 1977 by Government, basically to augment fuelwood and timber supply as Terai was facing serious problems of deforestations and degradation.

SFDP covers 5 municipalities and 1 rural municipality of Mohottari and Sarlahi districts and is managed from 3 different divisions viz Sagarnath, Hatilet and Murtiya. The total area is 13,500 hectare, however after deducting greenbelt, forest roads and other infrastructures, the actual effective and plantation site is lesser. Primarily, 10740 Ha low grade land was clear felled and planted with fast growing and high yielding species. Each compartment is equal to 100 hectare comprising 4 blocks. The areas (unit in ha.) of various species in different regions are given in following table:

Table A: Areas Occupied by Various Species

SN	Species/Regions	Sagarnath	Bhaktipur	Phuljor	Parwanipur	Hatilet	Kusmari	Lakshminiya	Murtia
1	Eucalyptus	178	1148	78	87	604	511	404	324
2	Eucalyptus and others	1097	380	57	17	864	854	880	51
3	A. catechu						11	23	
4	S. robusta							94	17
5	S. robusta and other	346					21	120	
6	D. sissoo	9			26	18			
7	T. grandis	104	25	24		28		14	31
8	T. grandis & other		24	25					
	Total	1733	1577	184	130	1514	1397	1535	423

About 2610 ha. is proposed for plantation in 10 year and about 3305 ha. is proposed for plantation which includes encroached areas and clear felled area. Besides regular forest management activities, several capacities building capacity building activities, upgrading of existing machinery and infrastructures. Activities are proportionately divided into 10 years such that negative impacts become lower and manageable. Besides, plantation, control burn, activities like fire break maintenance, air pollution control, solid waste management.

A multidisciplinary team carried out the impact assessment of proposed activities. Mostly positive impacts were observed where a few negative impacts to environment were there. Alternative analysis was also done, the option of not implementing this management plan which is not the appropriate one. Impacts were first categorized into several classes as shown in the table below:

Table B: Categories of Impacts

Category Type	Categories
Impact Quality	Adverse / Beneficial
Nature	Direct / Indirect
Magnitude	High / Moderate / Low
Extent	local/ Regional/ National/ Transboundary
Timing / Duration	Short Term / Medium Term/ Long Term
Significance	Significant, insignificant, non-significant

Hence, Mitigation measures against the negative impacts have been proposed along with monitoring mechanisms. Some of major mitigation measure against the identified negative impacts are in the following table:

Table C: Impact and Mitigation Measures

Impact	Mitigation Measures for adverse Impacts
Soil Quality decline	* Separate research will be conducted to find out whether there are any negative impacts of masala tree to water quantity reduction. *Similarly other tree species like teak will be planted near to the settlement area.

Decline of groundwater level	* Water conservation ponds will be made for sufficient supply of water in the area
Environmental Pollution and Solid waste	*Daily water sprinkle will be done in the all roads connected to the settlements to reduce the air pollution and dust in an area. * Similarly dustbin in every area will be placed by the project to collect the solid waste in proper manner and to dispose these solid wastes.
Human Wildlife Conflict	* Awareness campaign will be done for livestock shed improvement in the settlement area * Stall feeding area will be enhanced
Spreading of plant disease	* Different research will be conducted and implemented as per research findings
Occupational safety	*Awareness campaign

For these mitigation measure NRs 99, 00, 000.00 (In words: ninety nine lakhs only) has been allocated and the supervision will be the responsibility of FPDB and MOFE. All mitigation measures as well as monitoring system are prescribed for all kinds of impacts. The SFDP and FPDB will be major responsible. Project management should coordinate with all government and non-government agents. The finding of EIA shows that whatever negative impacts are identified are all minimal and manageable. Therefore, implementation is encouraged and is found to beneficial to local people, national economy and proponent too.

Acronym and Abbreviations

ADB	Asian Development Bank
AFU	Agriculture and Forestry University
CITES	Convention on the International Trade in Endangered Wild Fauna and Flora
DCC	District Coordination Committee
DOFS	Department of Forests and Soil Conservation
DFO	Division Forest Office
EMP	Environmental Management Plan
EPR	Environmental Protection Rule
EPA	Environmental Protection Act
EIA	Environmental Impact Assessment
FGD	Focal Group Discussion
FI	Forest Inventory
FPDB	Forest Products' Development
FO	Field Observation
GoN	Government of Nepal
GGN	Green Governance Nepal
GLR	Ground Level Water Resource
IAIA	International Association for Impact Assessment
ILO	International La Organization
IoF	Institute of Forestry
IEE	Initial Environment Examination
IUCN	International Union for Conservation of Nature
KAFCOL	Kathmandu For College
KII	Key Informant In Interview
LPG	Liquefied Petrol Gas
LRP	Local Resource Person
MFE	Ministry of Forests and Environment
NGO	Non-Governmental Organization
NTF	Non Timber Forest product
OHR	Overhead Water Resource

PA	Protected Areas
RAP	Ratuwamai Afforestation Project
RM	Rural Municipality
SFDP	Sagarnath Forestry Development Project
RTR	Terms of Reference
TSI	Timber Stand Imp Improvement
TS	Transect Survey
VDC	Village Development Committee

CHAPTER: 1 INTRODUCTION

The conservation and protection of the environment is the major for any type of project implementation or continuation. Any region is liable to inferred with its economic, social and environmental changes because of new project implementation or continuation of same project for long term.

The purpose of the assessment is to ensure that decision makers consider the environmental impacts when deciding whether or not to proceed with a project. The International Association for Impact Assessment (IAIA) defines an environmental impact assessment as "the process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made". EIAs are unique in that they do not require adherence to a predetermined environmental outcome, but rather they require decision makers to account for environmental values in their decisions and to justify those decisions in light of detailed environmental studies and public comments on the potential environmental impacts.

Sagarnath Forestry Development Project (SFDP) was approved by Government of Nepal (GoN) in support of Asian Development Bank (ADB) in 20 December 1977 AD but became effective only in 1978. The primary objective of project was to establish a tree plantation of fast growing species by replacing depleted and degraded natural forest of Sal (Shorea robusta), which was 10740 out of 13500 ha. after deducting various infrastructures, green belts, fire lines etc. The plantation was intended to augment the supply of fuel wood and timber. The scope of the project as originally envisaged comprised comprises establishment and maintenance, residual forest harvesting, saw log and small wood processing, establishment of necessary infrastructure and community facilities.

SFDP will be conducting its activities as per the plan they have made for each year. But the project has been in lack of formal management plan since 2003. New Management plan is to be developed for effective implementation of desired project activities. The implementation of activities each year needs an Environmental Impact Assessment (EIA) study to find out different environmental consequences that could

occur during the project implementation. The major activities of the project which needs EIA are clear felling of the blocks and plantation of exotic species in an area.

New management plan has been prepared for upcoming ten years (2075/76-2084/85). Several activities have been listed in new management plan which will be implemented in field level. Clear felling of different blocks, Plantation in those clear felled blocks needs an EIA for the sustainability of the project. This EIA has been prepared for the implementation of new management plan of SFDP. During the implementation of new management plan EIA has focused on uplifting the positive impacts on the project and people surrounding the project area. Similarly EIA has focused on mitigating the negative impacts which could be the major cause for unsustainably of the project in future.

1.1 Relevancy of the Proposal

Despite the fact that SFDP is one of the leading projects in plantation forest management in the country, it faces several challenges. The success of SFDP does not only provide financial benefits to the project itself but also promotes plantation forestry and encourage private forest owners. Lesson learned from the project could contribute to national economy, in the context of increasing area of barren land. The SFDP has several challenges and opportunities. For the project, encroachment, forest fire, regular forest management, and adequate infrastructures are major challenges, whereas developing as a center for excellence and reducing the import of processed soft wood products by replacing appropriate species are opportunities.

In addition, existing institutional framework and management is a serious concern, which could jeopardize Project sustainability, as it has contributed to suboptimal yields and financial and economic benefits. At central level, upgrading FPDB to a fully autonomous organization with total accountability is critical to ensure its profitability and sustainability. At a project level, development of management plans and manuals, strengthening management information system, commercial accounting systems, marketing, equipment maintenance, procurement and inventory control deserve priority attention. In addition, capacity building of the project staff is crucial to make project competitive in the dynamics market. This management plan is expected to address some of these pertinent issues.

Similarly the project site is one of the research centers for the students of Institute of Forestry (IoF) Pokhara and Hetauda; and Kathmandu Forestry College (KaFCOL) and AFU. In the project site students can learn different silvicultutral operations like harvesting, thinning, cleaning, fire line construction and so on.

In addition, the project contributes to minimize the gap of forest product demand in national market as well as fulfilling the electricity poles in rural areas. Similarly the project generates employment at local level.

1.2 Name/Address of the Proponent

Forest Product Development Board (FPDB) is the proponent of this project. The role of FPDB is to manage the forest of Sagarnath Forestry Development Project (SFDP) located in Sarlahi, Mahottari as well as managing Ratuwamai forest project in Jhapa. The Forest Product Development Board (FPDB) is the executive agency to prepare and implement the management plan and execute it to make the program financially viable in SFDP.

Forest Products Development Board
BabarMahal, Kathmandu, Nepal
Ph. no: - 01- 4253302 (Planning)
01- 4221230 (Administration)
01- 4231634 (Executive Chairman)
Email: fpdb2033@gmail.com

Name and Address of the Consultant

Green Governance Nepal (GGN) is an organization responsible to carry out the EIA of the Sustainable Management Plan of SFDP. Established in 2004, GGN is a non-Governmental Organization (NGO) working to create an environmental friendly society, where every person can exercise the rights over the natural resources through good governance approach and take the responsibility of biodiversity conservation.

Green Governance Nepal (GGN)
Shantinagar, Kathmandu
Tel.: 977- 01-4620920
Email: info@ggnepal.org.np

1.3 Rationality for Conducting the EIA

The rationality for conducting EIA is to determine whether the implementation of the proposed plan may result adverse environmental impacts. The proposed project SFDP is a plantation forest project which has different silvicultural activities like clear felling after the rotational age, thinning per the guideline and requirement in different species, cleaning, weeding, plantation on clear felled land are major silvicultural operations being conducted in an area. These silvicultural operations could have different beneficial and adverse impacts in the surrounding area. SFDP is working toward removal of forest floor biomass as a part of forest fire management. The management had made a decision to make a public call inviting private sector to be engaged for the removal of forest floor biomass. To this end, Forest Products Development Board (FPDB) has entered a long term agreement with a company which will remove forest floor biomass annually adhering to the terms and conditions set sides by FPDB. The company, after paying the royalty to SFDP may use this removed biomass into appropriate end products including biomass pellets, briquette, biochar, bio fertilizer, cattle food pellet, among others. This study will also identify the impacts on forest by removing these forest floor biomass.

According to schedule-II pertaining rule 3 of EPR, 1997 with subsequent revision in 2073 B.S., forestry projects for preparation of forest management plan, projects related to single plantation of tested exotic species exceeding 100 ha in Terai and 50 ha in hills in single plot, project related to clear felling of forest exceeding 5 ha area require an EIA. All these criteria are applied for the proposed project SFDP. The project will clear fell more than 100 ha in different blocks in each year. Similarly plantation of exotic species like Eucalyptus and teak will be done in more than 120 ha each year. The project is also planning to reopen its saw mill which is also another criterion for conducting EIA.

1.4 Objective of EIA

The general objective of the study is to prepare an EIA report in order to decide whether to implement the proposed Sagarnath Forestry Development Project (SFDP) management plan by assessing the proposal's impacts, both beneficial and harmful

impacts. The EIA will be carried out systematically specifically for following objectives.

- To assess and identify the physical, biological and socio-economic impacts of project intervention;
- To examine significance of environmental implications;
- To identify, predict and evaluate both beneficial and adverse impacts of the proposed project;
- To ensure people's participation and inform the affected parties on time;
- To propose environmental protection measures (benefit augmentation and adverse impacts mitigation measures) along with environmental monitoring requirements;
- To recommend the decision-makers about the environmental implications of the proposal;
- To identify the residual uncertainties not possible to be resolved by the EIA study, if any;
- To assess the alternative study and recommend the environmentally best alternative;

1.5 Study Methodology

The EIA study of the sustainable management plan was carried out according to the EPR 2054 and the National EIA Guidelines 2050. The following stepwise procedure were taken to prepare EIA Report.

- Making a plan for public involvement
- Specifying the program for collecting data and information.
- Providing necessary notification and information to the people likely to be affected by the project.
- Identifying major issues of public concern.
- Evaluating the seriousness of issues based on available information.
- Undertaking EIA as per prioritized issues.
- Developing a strategy for addressing priority issues.

In order to meet the objectives of EIA, some preliminary information was obtained from field visits and field surveys whereas, secondary data were obtained through annual reports, relevant literatures, maps and so on during the scoping and ToR preparation based on the scoping an ToR documents field visit was undertaken by the relevant experts during the EIA. The gathered data were analyzed, interpreted and prioritized to provide information on effects and impacts associated with project implementation. Activities performed and adopted to prepare scoping documents are discussed here under.

1.5.1 Data Analysis

Based on previous experiences and the review of relevant literature associated with EIA studies of various projects, demographic tables was developed. To fill these tables, a desk study was conducted. All the relevant information associated with socio-economic and cultural environment were be reviewed. While carrying out the EIA study, literature review of data of Central Bureau of Statistics, district profile of concerned districts and municipalities and village municipalities, EPA, EPR, Reference manuals and other Environmental Management Guidelines of IEE/EIA, published literatures, documents, textbooks and other relevant workbooks was done. Desk study of review of existing management plan report of the project as well as related environmental reports was carried out. Map of the project sites was studied in detail. The geographic boundary of the influence area was delineated tentatively so that these can serve as the base map to present the information collected during the field survey which was further analyzed using Geographical Information System (GIS). These materials was studied to gain information on the physical, biological, climate, socio-economic characters, geography, soil and other environmental components of the SFDP. The baseline information data collected during desk study was scrutinized and updated. In later stages, this baseline was used as basis for impact monitoring.

1.5.2 Field Study

The EIA team conducted a detailed survey in and around the project sites and collect the necessary information regarding possible environmental impacts. Prescribed formats and models for check lists/ matrices, equipment, and process was used to

collect specific data on physical, biological, socio-economic and cultural environmental condition of the project affected areas.

1.3.2.1 Physical Environment

The data on the physical environment was collected within the influence area of proposal, as delineated in scoping report and Terms of Reference. Land Use Map, Topographic maps was used to assess the different land use in adjoin villages. The team investigate walk along the proposed project area and verify the data collected through different secondary review. The data on climatological record and settlement pattern was collected through the relevant agencies like metrological department and previous VDCs. Similarly the data on soil type/texture land use was collected through direct field visit in the area. Collected data were primary and site specific.

- Field observation of specific site by Environmental/forestry experts
- Checklist survey was conducted
- GIS maps (Preparation of Land use maps, hydrological and spatial analysis)

1.3.2.2 Biological Environment

Environment survey on biological aspects relating to forest types and watershed management and flora and fauna were be carried out to accomplish the task. Wildlife and flora including different endangered species with in the area were be studied in terms of possible impacts to them.

Survey of natural forest resources has already been conducted through the inventory of different plots for the preparation of draft management plan. Same data were used to find out the impacts on the forest vegetation and NTFP by the proposed project. Similarly, the impacts on the soil through the plantation of exotic species were taken during the field study. A field visit was done during the preparation of scoping report and management plan. Further field visits were conducted during the EIA accomplishment for data collection. Data on vegetation, wildlife were collected through following techniques:

- Field observation by forest specialist, wildlife specialist
- Field monitoring and validation of forest inventory

- Sampling intensity: Sample plots were laid in the total area according to the age class of different forest species like Masala (Eucalyptus species), Teak (Tectona grandis), Sal (Shorea robusta) and so on
- Plot Size and Number: 25*20 plots designed for the tree species where as 10*10 plot was designed for the pole species. Similarly 5*5 and 2*5 plots designed for NTFP and regeneration for inventory.

- Line transect surveys for collection of information about the mammals, birds and reptiles
- Site specific survey (Survey of important and potential habitat of animals)
- Stakeholder meetings
- Data sheets, questionnaire and checklists to collect site specific data.

1.5.3 Forest Inventory

Detail information of all blocks (age, species, and mode of regeneration) were collected. Then, the blocks were stratified based on species, their age and mode of regeneration. A total of 142 blocks out of 423 blocks were selected randomly for the inventory. Out of them 93 Blocks were planted and 49 were naturally regenerated. From each block on an average two plots were selected randomly, hence 248 sample plots (158 planted and 90 naturally regenerated) were inventoried.

Systematic random sampling was applied to select sample plots. To select sample plots, first plot was selected 100 m inside the forest from the border then next plot was selected 50 m further from the first plot. Rectangular plot of 500 m^2 (25 m x 20 m) was laid to measure trees (≥30 cm dbh), a square sub-plot of 100 m^2 (10 m x 10 m) nested in 500 m^2 tree plot for the measurement of pole (≥10-29.99 cm dbh), then a square plot of 25 m^2 (5 m x 5 m) was laid inside the pole plot to measure saplings (height ≥1 m and dbh <10cm), and then seedlings were counted in a rectangular plot of 10m^2 (5 m x 2 m).

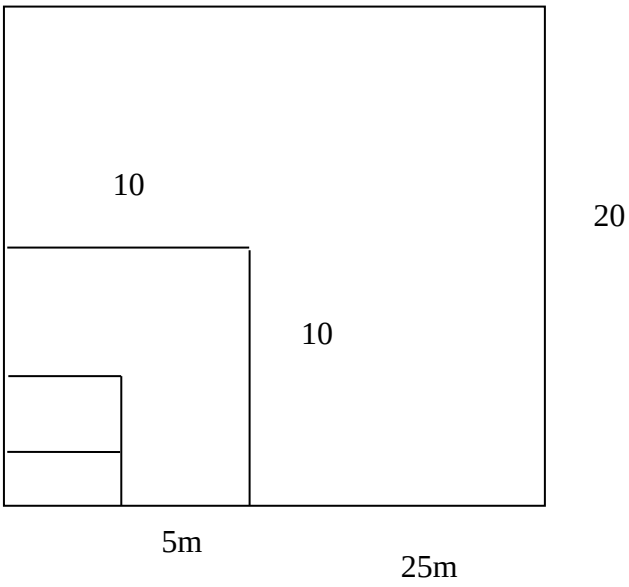


Figure 1: Sample Plot Design

Interaction and Group Discussion with Forest User Groups

Similarly, meetings, interviews and discussions were held with the members of Community, local peoples and officials of concerned Division Forest Office to collect information on the availability of flora & fauna, dependency of local people on forest resources, availability of Non-Timber Forest Products etc.

During the group meetings and discussions, participants were introduced about the project features, potential impact on the environment, various mitigation and enhancement measures likely to be adopted. The issues and suggestions raised during meetings were discussed and recorded.

1.5.4 Socioeconomic and cultural Environment

Environmental survey on social aspects of people residing within the region of proposed project area was conducted using the secondary as well as primary information. Different types of structure and non-structure questionnaire were developed and household survey were conducted. Similarly Key Informant interview (KII), Focus Group Discussion (FGD), consultation with different personnel were be conducted to collect the socio economic data on project site.

Information regarding land use pattern, water supply, health facility, irrigation, education, energy source were collected through secondary literature review and direct field visit. Following procedure were used to collect data regarding socioeconomic and cultural environment:

- Field observations by sociologist and economist supported by database specialist and surveyors
- Census survey of project site to collect demography, ethnicity, education, land holding, livestock, income, expenditure etc.
- Household survey were conducted.
- Key informant survey and Focal group Discussion

1.5.5 Data Analysis

The collected data were processed and analyzed by the experts using various quantitative tools, spread sheet and different formats. Data generated from the household survey were analyzed in Microsoft excel and SPSS. A data collection and analysis matrix is given in table 1.

Table 1: Data Analysis Matrix

Information	Data Collection	Data Analysis
Household level information	Household survey	MS excel, SPSS
Perception and knowledge of local people on project	KII, FGD, Consultation, Questionnaire	Qualitative analysis
Information about social infrastructure, cultural sites		
Sampling design	Stratified Systematic sampling	Inventory Guideline 2061.
Number of Sample plots	Designed as per the age class of the tree	
Size and shape of sample plot	Rectangular plot (25*20m for tree 10*10m for pole, 5*5m for sapling and 5*2m for regeneration)	

Information	Data Collection	Data Analysis
Number of seedling, sapling, pole and tree, Frequency, Density, Relative ground cover	Forest inventory	Using unitary method per plot, per ha, total number of seedling, sapling, pole and tree were calculated.
		No. of plots where species occur*100/Total no. of plots
		No. of that species in all plots *10,000 Esq./Total no. of plots*area of plots
		Length of the cover of that species*100/Total length of cover of all species
Wildlife, Habitat, and Invasive Species	FI, TS, FGD, KII	Qualitative analysis as seen by the researcher and analysis from secondary results

1.5 Impact Prediction and Assessment

An impact matrix was developed and used to identify impact of implementation of the management plan and other activities on physical, biological and socioeconomic and cultural environment resources. Based on the information and assessment of the studies, project induced positive and adverse environmental impacts were identified. The impacts were further classified in terms of duration (Short, Medium and Long term), magnitude (Low, medium and high) and extent (Site specific, local and

regional) as per National EIA guideline 1993. The impacts were classified as significant and insignificant. The details are given in the following chapters.

1.4.1 Evaluation Procedure

After collecting baseline field data from the project area on physical, biological, socio- economic and cultural environment, these were analyzed and interpreted as per EPR 1997. Mitigation measures and monitoring plans will be described for each impacts identified.

1.4.2 Impact Identification and Prediction

A logical, simple and systematic approach were adopted for impact identification, evaluation and prediction. To evaluate the issues on physical, biological, socio-economic and cultural environment of the project area, compensation modalities, enhancement measures and the baseline information were generated through discussions, meetings and observation. Information collected was compiled, analyzed and then interpreted for the purpose of impact predictions. The significance of both identified and predicted impacts were evaluated. Based on the evaluation each significant impact was further categorized as high, medium and low in terms of magnitude, short term, medium term and long term in terms of duration and local, site specific and regional in terms of extent. The magnitude, extent and duration were categorized as per National EIA Guideline 1993.

- **Significance of Impacts**

Significant: If the impact is considerable and changes the baseline condition it is considered significant impact.

Insignificant: If the change is so minor that baseline condition is not affected considerably it is called insignificant.

- **Magnitude of Impacts**

Low Impact (L): If the value of the resources could be used with no or minimum inconvenience to the public.

Medium/Moderate Impact (M): If the value of the resources could be used with inconvenience to the public.

High Impact (Hl): If the value of the resources reduced far below publicly acceptable level.

- **Extent of Impacts**

Site Specific (S): If the impact is limited to the project area then it is a site specific one.

Local (L): If the impact of the work extends to the watershed then it is termed as local

Regional (R): If the impact of the work extends beyond the project area then it is termed as regional

National (N): If the resources are affected at national scale, it is known as a national impact.

- **Duration of Impacts**

Short Term (ST): If the impacts last for 1 year after project initiation it is classified as short term.

Medium Term (MT): An impact that continues for more than 3 years but less than 5 years is considered as medium-term.

Long Term (LT): An impact that lasts beyond 5 years to 10 years is considered to be long term.

1.6 Conduction of Public Hearing

As per Rule 7 (Sub Rule 2) of EPR 1997, while preparing the EIA report, the proponent affixed a notice in the concerned municipality and rural Municipality, office of concerned district, school, hospital and health post requesting the VDC, Municipality and DDC or concerned individual or institution to offer their written opinion and suggestions within 30 days with regard to the possible impact of the implementation of the proposed project on the environment where the project is to be implemented and a deed (Muchulka) was prepared. The 30 days' notice was published in the national level daily national newspaper requesting to submit their comments on the draft EIA report made available in the adjoining municipality and rural municipalities. After publication of such notice, the opinions and suggestions so received in relation to the same was included in the report. Recommendations letter regarding implementation of the proposed project were obtained from the different municipalities and rural municipality.

Public hearings were be conducted in the project area to inform the local communities about the proposed project to collect their opinions and suggestions. The public hearing focused on findings of EIA, creating awareness about the management plan, implementation arrangements, building up financial and institutional arrangements on implementation of management plan, identification of key issues and considering of those issues in the EIA report and in management plan. Public views, options and relevant issues raised in the program were recorded.

1.7 Recommendation Letters

As per EPR 1997, a 30 days' public notice in Gorkhapatra national daily was published on BS 2073/10/11 notice consists of a statement regarding brief project information and request to provide comments and suggestions within 15 days to the project office. A copy of the public notice is attached **in Annex II.**

A team was mobilized in the field with copy of public notice along with cover letters to the concerned rural municipalities, municipalities, district level line agencies and other local stakeholders. Copy of the notice was displayed in the project sites and proof of deed (Muchulkas) was collected. Recommendation (consent) letters was collected from the rural municipality and municipalities. In addition, recommendations and suggestions were collected from the affected concerned stakeholders (government bodies). Summary of the draft report was distributed to the concerned rural municipality and municipalities for public viewing and comments. The Muchulkas and recommendations letters are attached in **Annex III of** this report.

CHAPTER 2: PROJECT DESCRIPTION

Around 4 decades ago, Sagarnath Forestry Development Project (SFDP) was designed and implemented to address the serious problem confronting the forestry sector in Terai region. In the Terai, deforestation and forest degradation were rampant, as a result of the increasing demand for fuel wood and other forest products. This situation has demand the need for intensive management as well as improve the degraded and non-productive forests. A joint mission of the Food and Agriculture Organization (FAO) and Asian Development Bank (ADB) identified a forest plantation project in the central Terai; the government of Nepal concurred with the idea of undertaking a feasibility study in anticipation of subsequent project financing.

The project was approved on 20 December 1977 and implemented in 1978. The Forest Products Development Board (FPDB) was the Executing Agency. The project implementation was completed in 1986 after a major reformulation in 1982, when the plantation area was scaled down to 4,150 ha Project Performance Audit Report, ADB 1987).

The primary focus of the project was to establish 10,000 ha of tree plantation of fast growing; short rotation species to replace 11,000 ha depleted and degraded natural forest of Sal (Shorea robusta) with a view to supplementing the domestic supply of fuel wood. The plantation was intended to augment the supply of fuel wood to Janakpur cigarette factory, Kathmandu and Pokhara city (Project Performance Audit Report, ADB 1987).

During the project establishment two major species were planted: Eucalyptus (*Eucalyptus camaldulensis*), an exotic variety and Sisau (*Dalbergia sissoo*), an indigenous species. Teak (*Tectona grandis*) was also planted in a small scale at the initial stage of project.

During the running of the project it was known that the plantation project has much more value than only producing fuel wood. The project could produce the small logs and poles which were more valuable in the market than the fuel wood. The exotic species Eucalyptus has manifold industrial uses.

There is no formal management plan of SFDP since 2059/60. The SFDP has been working by preparing tier annual plan to conduct different activities each year. The project focuses mainly on supplying different forest product which a clear management plans to work in future. Draft Sagarnath Forestry Development Project Management Plan (SFDPMP)-II has been prepared and different activities to be conducted in next 10 years have been proposed. The main objective is to successfully establish plantation forest which could supply quality timber in short time and with low investment. The clear felled sal forest has been regenerating vigorously in some of the blocks of project which the new management plan has targeted to produce timber of sal. Except these the new management plan has made an objective to fulfill the demand of fuel wood in different regions, value adding on the timber by seasoning and conversing them in to different sizes logs and selling it in the different markets.

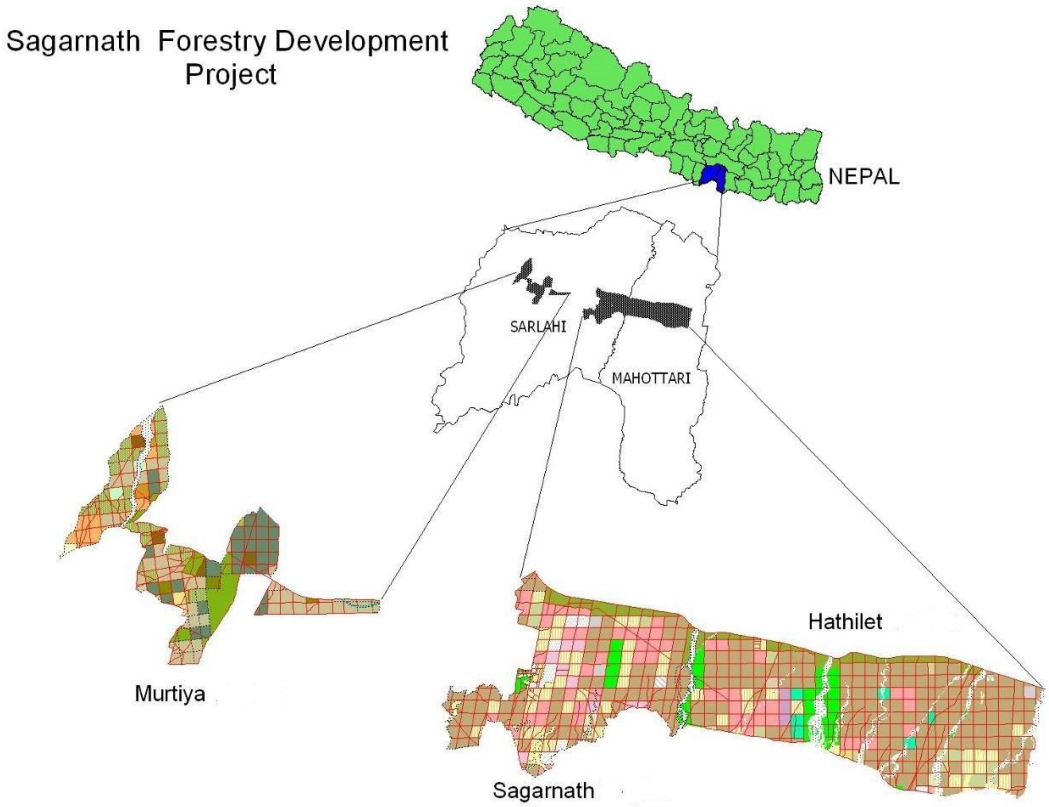
Table 2: Adjoining Municipalities and Rural Municipalities

SN	Municipality and Rural Municipality	Previous Municipality and VDCs	District
1	Bardibas Municipality	Bardibas Municipality, Hatilet VDC	Mahottari
2	Gausala Municipality	Gausala Municipality, Laxminiya, Belgachi	
3	Ishworpur Municipality	Ishworpur, Guarisankhar,	Sarlahi
4	Bagmati Rural Municipality	Dhungrekhola, Shankarpur, Rajghat, Karmaiya VDCs	
5	Hariwan Municipality	Hariwan Municipality	
6	Lalbandi Municipality	Ranijung VDC, Parwanipur VDC	

2.1 Project Location

The project site is located in Southern plain of Nepal i.e. Terai. The following figure 2 shows that locations of the districts and project site and divisions within the project. The main office lies in Ishwarpur of Sarlahi district.

Figure 2: Location Map of SFDP



For management efficiency, the project area has been divided into three management Divisions Sagarnath, Hatilet and Murtiya (Figure 1) which are further divided into regions, whose details are given in the following paragraphs.

2.2 Project Accessibility

The project area is accessible from two highways, namely: East West Highway and BP Highway:

a. From : Kathmandu ; B.P Highway to Sarlahi 233 Km

B.P Highway takes about estimated 6 hours to reach Sarlahi, Terai region.

b. From : Kathmandu; East-West Highway to Sarlahi 193 km

East-West Highway takes about estimated 5 hours- 47 minutes to reach Sarlahi, Terai region.

c. Air flight to Janakpur or Simara Airport

2.3 Salient Feature of the Project

The SFDP is a model project of Nepal presenting a plantation forest practice in a degrading land. The project has following salient features as tabulated in Table 3.

Table 3: Salient Features of the Project

<table>
<tr><th>Feature</th><th colspan="2">Description</th></tr>
<tr><td>Project</td><td colspan="2">Sagarnath Forestry Development Project (SFDP)</td></tr>
<tr><td>Province</td><td colspan="2">Two</td></tr>
<tr><td>District</td><td colspan="2">Sarlahi District
Mahottari District</td></tr>
<tr><td>Municipalities and Rural municipalities</td><td colspan="2">1. Bardibas Municipality
2. Gausala Municipality
3. Ishworpur Municipality
4. Bagmati Rural Municipality
5. Hariwan Municipality
6. Lalbandi Municipality</td></tr>
<tr><td>Category of Forest</td><td colspan="2">National Forest</td></tr>
<tr><td>Land Area</td><td colspan="2">13, 500 ha</td></tr>
<tr><td rowspan="4">Administrative Division</td><td>Division</td><td>Regions</td></tr>
<tr><td>Sagarnath</td><td>Sagarnath, Bhaktipur, Parwanipur, Phuljor</td></tr>
<tr><td>Hatilet</td><td>Kusmari, Hatilet, Lakshiminiya</td></tr>
<tr><td>Murtiya</td><td>Murtiya, Ghurkauli</td></tr>
<tr><td>Area of Each Compartment (4 blocks comprises 1 compartment)</td><td colspan="2">100 ha.</td></tr>
<tr><td>Total Compartment</td><td colspan="2">106</td></tr>
<tr><td>Total Number of Blocks</td><td colspan="2">429</td></tr>
<tr><td>Area of each Block</td><td colspan="2">25 ha.</td></tr>
<tr><td>Nursery</td><td colspan="2">18 ha at Sagarnath, 5 ha at Murtiya</td></tr>
</table>

Feature	Description
Species to be planted	• Eucalyptus • Teak • Kadam • Khair • Sajiwan
Key Benefits	• Forest products and Revenues • Employment • Enterprise development • Research and studies

2.4 Management Activities

Forest management activities primarily includes silvicultural operations based on a silvilcutral system. A silvicultural system is “the process by which the crops constituting a forest are tended, removed and replaced by new crops, resulting in the production of stands of distinctive form .The terms ‘stand’ and ‘crop’ are both used to denote silvicultural or management units that are homogeneous in one or several aspects.

A silvicultural treatment is a set of silvicultural operations that can be implemented during the entire or partial rotation of a stand. Within the context of silvicultural stand treatment, each stand is assigned a specific silvicultural objective and separately assessed for the characteristics of its site (e.g. locality, slope and soil type) and stocking (e.g. composition, age, diameter distribution and regeneration). Based on this information, a silvicultural treatment regime is formulated.

Silvicultural operations are procedures that aim to achieve stand-specific objectives by using silvicultural techniques. Such techniques include, for example, canopy alterations to induce natural regeneration, the harvesting of mature trees, planting, and thinning to improve timber quality and stand growth. Silvicultural operations involve decisions on machinery and other equipment, techniques, work organization and human resources, as well as considerations of operational cost and investment.

Silvicultural interventions have been planned in accordance with the management objectives of the forest. The intensity of interventions has been varied depending on, accessibility, markets, site quality, management objectives and ownership. The main

objective of SFDP is to produce pole size Eucalyptus for the purpose of electrical poling but with the time the objectives have been changed. For the new management plan the objective has been changed towards the production of timber and mainly focused on teak species. Before moving towards the silvicultural activities the importance of the activities and their needs re most important.

- **Clear Felling:** In simple terms, clear-felling is the removal of all trees from an area chosen for harvesting (logging). An area designated for logging is called a coupe. After the "bole" (the trunk section of a tree that is suitable for sawmilling or wood chipping) is removed from the site, all other logging residue such as branches, foliage and bark (called "slash") is left on the ground to dry.
- **Thinning:** Thinning is an operation that artificially reduces the number of trees growing in a stand with the aim of hastening the development of the remainder. The goal of thinning is to control the amount and distribution of available growing space. By altering stand density, foresters can influence the growth, quality, and health of residual trees. It also provides an opportunity to capture mortality and cull the commercially less desirable, usually smaller and malformed, trees. Unlike regeneration treatments, thinning's are not intended to establish a new tree crop or create permanent canopy openings.
- **Coppicing:** A regeneration method which depends on the sprouting of cut trees. Coppicing is generally used to produce fuelwood, pulpwood, and other products dependent on small trees.
- **Cleaning and weeding:** Cleaning and weeding are two similar terms referring to the practice of selecting particularly desirable trees in a young stand and removing or killing trees that threaten their survival or development. Used correctly, the term cleaning refers to the removal or killing of overtopping competitors that are significantly taller than the desired trees and unwanted woody biomass from the forest floor. Cleaning is usually done in the sapling stage but also in later stage as necessary. While the term weeding refers to the removal of mainly herbaceous plants and shrubs that are of the same height, but still competing for the resources that could be used by the selected trees. It is usually done in the seedling stage.

Silvicultural operations have been prescribed as per the objective set for ten years. Timber stand improvement is to be applied for S. robusta. In addition, management activities of Murtiya division are not included in table 10, as this division comprises mostly encroached area. The following summary covers areas from Sagarnath and Hatilet.

2.4.1 Annual Silvicultural Activities

It is necessary to know the area of each activity with their blocks and plots/sub-plots for planning on an annual basis. The details of annual activities is provided in **Annex V however** table 4 and 5 presents detailed areas of harvesting and plantation during 10 years period.

Table 4*: Annual Plantation in SFD (Areas in Ha.)*

Division	Sagarnath division				Hatilet division			Murtiya division*	
Year	Sagarnath	Phuljor	Parwanipur	Bhaktipur	Kusmari	Hatilet	Lakshminiya	Ghurkauli	Murtiya
1				11.8		11.1		32	193
2	37.4	6.9	10.6	7.6	138.3	145.0	41.3	32	193
3			11.2	4.2	95.7	79.9	72.5	32	193
4	24.3	1.0	2.2		23.0	61.8	73.1	32	193
5	15.3	4.2	2.1		4.5	11.1	23.3	32	193
6					27.9			32	193
7	30.3					24.0		32	193
8								32	193
9	24.3						30.0	32	193
10								32	193
Total	**132**	**12**	**26**	**24**	**289**	**333**	**240**	**320**	**1930**
*** Proposed plantation for enchroachment**									

Table 5: Annual Harvesting Areas for 10 Year in SFDP (Areas in Ha.)

Division	Sagarnath division				Hatilet division			Murtiya division
Region / Year	Sagarnath	Phuljor	Parwanipur	Bhaktipur	Kusmari	hatilet	Lakshminiya	Ghurkauli
1	93.5	6.9	10.6	29.1	180.3	154.6	30.1	1.6
2	66.5	1.2	11.2	83.9	134.4	79.9	99.5	
3	24.3	1.0	2.2		42.1	71.7	157.0	
4	40.3	26.5	2.1		21.5	11.1	93.2	
5	37.2	4.3			66.7	4.0	22.0	
6	254.5			7.0	11.0	24.0		
7	70.1			11.0		5.0		
8	148.3	24.3		1.7	24.1		41.8	
9	32.6			67.1	22.4	23.5		
10				94.2	25.2	29.4	81.8	
Total	**767.3**	**64.2**	**26.1**	**294.0**	**527.7**	**403.2**	**525.5**	**1.6**

Table 6: List of species felled in 10 Years

	Area (ha) and year										Total area (ha)
Latin name	1	2	3	4	5	6	7	8	9	10	
Eucalyptus sp.	400.7	309.1	252.1	162.6	121.9	289.5	81.6	219.0	145.6	213.4	**2195**
Tectona grandis	49.6	56.3		25.0				8.0			**139**
Dalbergia sissoo	10.6	32.2	12.2	2.1		5.0					**62**
Acacia catechu	14.0	68.5	7.5	5.0	4.0	2.0		9.3		17.2	**127**
Shorea robusta	28.3										**28**
Other species*	3.5	10.5	26.5		8.3		4.5	4.0			**57**
Total	**507**	**477**	**298**	**195**	**134**	**297**	**86**	**240**	**146**	**231**	**2610**

2.4.2 Other Activities

Besides various management activities like thinning, pruning etc., many other activities have been proposed for management plan, they are described in the following passage. The details plan of the activities is put on **Annex VI.**

Forest Protection

Different activities are to be conducted and implemented for the better protection of the forest. The major threat from the local societies and natural environment are to be identified. The major threats for the project from the local societies are illicit felling and encroachment. The forest guard are to be trained and well equipped for minimizing the illegal felling from the project area as well proper management strategies and rules are be made for minimizing the encroachment from the project site. Fire and encroachment are other major issues for the protection of the forest.

Community participation in different project activities should be done for the protection and sustainability of the project. Local people should be involved in different employment generation activities and implementation activities for making them feel ownership of the project.

Fire management

Regular patrolling during the dry season for the reduction in the fire management will be conducted in the area. Similarly 18 different sets of fire fighting equipment in 7 different regions will be equipped for effective controlling of the fire. Fire breaks will be managed annually and maintained for reduction in the fire hazards inside the forest. Control burning are being practice and will be continued.

Innovative Fire Management

A financial mechanism will be employed in order to deploy an innovative tool for forest fire management. In this process, private sector will be introduced for the removal of forest floor biomass which acts as the hazardous fuel causing annual forest fires on the plantation sites. Private sector may use the hazardous biomass converting it into alternative energy products including pellet, biochar, bio fertilizer or brickette as appropriate. The party responsible for collection of such biomass will pay annual royalty to SFDP and as the removal of hazardous fuel reduce the probability of forest

fire, the cost of fire management to the part of SFDP management also reduces substantially.

Encroachment control

Training to forest guard and proper information technologies is most needed for the control of encroachment. Advanced technologies of communication mainly mobile set is to be provided to the forest guard to update about the encroachment status in the forest. Similarly different trainings to clear the encroachment and tackle with those people is needed for the staff of SFDP to control massive forest land encroachment. Legal approach and coordination with local bodies will be helpful in controlling and stopping encroachment.

Illegal Felling Control

SFDP has a monitoring approach and forest guard in different places till now for minimizing the illegal felling control. Some innovative techniques for illicit feeling of the timber and forest products are to be developed for sustainable protection of forest and forest products.

Illegal felling is one of the major problems of the SFDP. Illegal logging causes enormous damage to forests, forest people, and the economies of producer. Illegal logging is the cause of widespread environmental damage and presents a grave threat to biodiversity of an area. Effective control of illegal logging requires action across many policy areas: the promotion of good governance, action to tackle corruption, land reform, industrial and fiscal policy reform, development assistance, and so on. The project will follow the following procedures for effective protection of Forest

Equipment

Machinery equipment for forest management are most important for the proper management of the forest resources. The machinery and equipment in the Project are not properly managed. There are different old equipment's which needs to be replaced and new machinery technologies are to be introduced for efficient and effective quality of forest works in future.

Nursery Management

The project has 2 nurseries, one is 18 ha big at Sagarnath region and another is 5 ha big at Murtiya region. Till now the major purpose of nursery is to grow the seedling of different species for plantation in the project site. The nursery should be developed in a modern way and new other species is to be introduced for the sustainability of SFDP.

Species for Nursery

The major tree species for the nursery in SFDP will be Teak and Eucalyptus. Similarly other fast growing tree species like Kadam, Sajiwan, will also be given priority. Some of the species that will be grown in SFDP nursery are listed below:

- Eucalyptus
- Teak
- Kadam
- Sajiwan
- Khair
- Bamboo
- Sissoo
- Satisal

Infrastructure for Nursery

The essential infrastructure elements of a nursery of SFDP are a water source, nursery beds, water conveyance channels or hydrants and working tools. However, it is a permanent nursery so it should also have other infrastructure elements, such as one or more ground-level water reservoir (GLR) or overhead water reservoir (OHR), a seed store, and irrigation sprinklers.

Biodiversity Conservation

While all of the project activities is about conservation and utilization of biodiversity, the biodiversity conservation is basically about 2 focuses i.e. green belt management and wetland management, described in following paragraphs.

Green Belt Management

The existing green belts will be managed. Sal trees will be promoted in the green belts and TSI will be conducted for the species for effective management. The green belt

will help to protect the core area of the forest and reduce the illegal cutting and encroachment in the forest.

Wetland Management

There is a 5 km seasonal wetland in the boarder of Sagarnath and hatilet division. The area consists the blocks 16, 17, 18, 19 and 20 of Sagarnath region and Bhaktipur region. This area will be managed as wetland. There are natural dykes in both sides of the area which will act as the boarder and boundary for the wetland. This area will be promoted as the tourist destination site by introducing different required facilities in the area. The detail plan for the area will be provided in the annual plan of SFDP.

Road Network and Fire Breaks

Plantation sites are south to the east west highway. One needs to travel 1-5 km through gravel road to reach the plantation sites in Sarlahi and Mahottari districts. The project area is well covered by many kilo meters of road networks; each compartment and plots are surrounded by fire line and boundary road, which are earthen and liable to produce dust during dry. Culverts and cause ways are constructed on the access road at river crossings. The access roads and compartment boundary need regular maintenance.

By the end of the 1985/86 season, a total of 41 km of all-weather roads and 201 km of fair-weather roads were built. These roads provided access to the planting areas, demarcated the 100-ha blocks (into which the plantations are divided for easy identification), and served as firebreak.

Database Management System (DBMS)

SFDP has a long history of plantation of exotic species and other native species. It has been running since 4 decades. Some plantation has even surpasses three coppice rotation while most have surpasses 2 coppice rotation. Similarly the concept of SFDP in its initial stage was to form the evenly blocks and plots in all the area. The project has been conducting different plantation, thinning, clear felling, wedding and cleaning at different times. Conversion of the species from the initial stage to recent years has been done in many blocks.

But due to the lack of proper management of these data the information are not easily available to the concerned stakeholders. Database management should be introduced in SFDP. A DBMS makes it possible for SFDP to create, read, update and delete. A separate software should be developed for SFDP to update all the data from history to recent. Software will contain all the data like block history, species wise block description, age wise block description, rotation age, thinning cycle, clear felling age and description and all other silvicultural and management activities.

Training and Human Resource Development

A staff development program is an essential component of management Policy. The key personnel working at various levels of organization in the Project will need reorientation and changed attitude to successfully implement the Plan; to achieve this a preliminary training program is proposed here for implementation.

- Management training for management plan Implementation for Forest Officers and Rangers
- Reorientation training for labor supervisor and other field
- Training/Seminar for local community
- Community level motivation workshops/meetings

Enterprises Development

Enterprises development is one of the focus activities to be carried out from various forest products. Pellet production, essential oils, and other wood based products can be important products from the forest as enterprises. While carrying out these products extraction, no environment will be affected. Ecotourism will also be promoted in the areas of wetland and cultural areas.

Utilization of Sands/Gravel

There are several rivers inside the project which will be utilized without disturbing the river banks and surrounding ecology i.e. sands and gravel will be extracted without negatively impacting the surrounding environment and river system itself. The following site as mentioned in Table7 are potential areas of sand and gravel.

Table 7: Sand and Gravel Sites

S.N.	Name of place	GPS location		References	length of river from starting location point	channel size (m)	Per Channel volume cuq m.	Channel to chanel distance	no of channel	Total volume cu.m.
		x_co-ordinate	Y_co-ordinate							
1	Banke khola	374798	2986215	0.6km south from railway	1500 m	100*75*10	75000	20 m.	12	900000
2	Mahara khola	379757	2984806	0.5km south from railway	300 m	100*75*10	75000	10 m.	3	225000
3	Belgachii	381881	2983842	1 km south from railway	650 m	50*30*5	7500	11 m.	10	75000
4	gadanta khola	383825	2983822	1.1 km south from railway	1450 m	75*50*5	18750	12 m.	17	318750
5	Jangha khola	385176	2983976	0.9km south from railway	2250 m	75*50*10	37500	13 m.	26	975000
6	Bhabsi khola	388198	2983848	1km south from railway	2300 m	75*50*5	18750	14 m.	26	487500
7	Budi bagmati	348598	2999736	-	7000 m	20*10*10	2000	15 m.	175	350000
					Total					**3331250**

Research and Development

Research is one of the major components for the sustainability and upgrading of any long term project. Different types of research which helps in upgradation of the forest species and products of SFDP is most needed. Different collaborative research is needed in coordination with Institute of Forest (IoF) and Department of Research and Survey (DFRS). Collaboration with these institute will be done in the future to develop SFDP as a research hub.

2.4.4.3 Management Supporting Details

Infrastructures and Facilities

There are altogether 127 buildings, which consist of SFDP main building, workshop, management units, range units, guard quarter and guest house. More than 50% of the buildings and houses (75) including guest house and quarter are in very poor condition due to lack of timely maintenance and damage. Jalandhar Janakpur Bardibas railway line is being constructed as a development project in eastern Nepal. This rail way line goes through the SFDP in Mahottari and Sarlahi. It covers an area of 150 ha in the project. This includes 56 blocks of SFDP in which 42 blocks lies in Hatilet division and 14 blocks lies in Sagarnath Division. Other 6 green belts are also in railway track.

Vehicles and Equipment

There are altogether 17 vehicles in SFDP. The condition of the vehicles is poor. Though SFDP has its own workshop for vehicle maintenance, but nearly all well skilled manpower have been retired and remaining others are about to retirement. A large number of vehicles used for forestry operations such as Dozer, Loader, Truck and Jeep are in auctioned. The project has its own Saw mill to produce sawn timber. Now, it is in poor condition. There is a need to enhance the quality of saw mill in the area.

Forest Road

In between every compartment, there are forest roads. One compartment is made of 4 different blocks. The major purpose of forest road is for easy transportation of the forest product after conducting the silvicultural activities in the blocks.

Nursery

There are 2 nurseries at Sagarnath and Murtiya regions which produce seedlings and stumps, mainly of Eucalyptus and Sissoo, required for the SFDP. About 15%-35% of its seedlings are sold to the market. In past, the nursery used to supply about 1.4 million seedlings, mostly of eucalyptus, to individuals and organizations. This indicates the demand of fast growing species that can produce quick returns. Proper management of nursery could be one of the important sources of income for SFDP.

2.4.4.4 Human Resource Requirement

The SFDP has 150 staff, headed by the project manager. The capacity of staff ranges from field level forestry worker to forest manager. Among the total 150 posts only 121 people staff is fulfilled while remaining 29 staff are vacant. Among the fulfilled one also maximum number of employees are taken in daily basis or in addition, administrative and finance staffs provide administrative support to facilitate day-do-day activities.

2.5 Project Impact Area

2.5.1 Direct Impact Zone

This is the area which the core plantation forest area and their immediate vicinity occupy, which obviously include the 10,000 ha of land which was clear felled for the purpose of plantation of exotic species in the area. Immediate vicinity is the areas where the project materials are loaded as well as all the infrastructures build for the ease of the project implementation.

2.5.3 Indirect impact Zone

The areas around the project sites which may be affected indirectly due to the project implementation activities such as mobility of people, noise of vehicles and equipment and their vibrations during operations, dust from saw mills the project falls under this category. The surrounding environment of the proposed project SFDP will be indirectly affected by the project activities. The increased facilities by the project would impose indirect impacts as well. The extent of the indirect impact would be beyond the immediate influence area of the SFDP.

Table 8: Project Area Delineation

S.N	Impact Area	Range	Significance	Remarks
1	Direct impact Area	The area of core forest project where all the interventions will be conducted	Loss of forest during clear felling, habitat fragmentation, Local ecosystem effect, loss of soil fertility, decline of ground water level and so on	Disturbance on physical and biological environment is most probable
2	Indirect Impact Area	Surrounding villages of the project area up to 1 Km in all direction	Decline of ground water level, Mobility of people, Vehicles, noise, vibrations, dust, waste disposal from project site	Likely to be benefitted on socio economical environment
3	Zone of influence	All the Municipalities and rural municipality (Bardibas, Gausala, Ishworpur, Hariwan, Lalbandi municipality and Bagmati rural Municipality) of project site	Increase in connectivity	Reference for public consultation and legal procedure

CHAPTER 3: REVIEW OF POLICY & LEGAL ASPECTS

This chapter summarizes existing policies, plans, laws, guidelines and institutions in order to inform the decision-makers and stakeholders about their implications on the project functioning. These references have been used in preparing the EIA report.

3.1 Plan/Policies

3.1.1 Nepal Environment Policy and Action Plan - 1993 AD and 1998 AD

Nepal Environmental Policy and Action Plan (NEPAP) were endorsed to further institutionalize environmental protection in the development processes. The NEPAP recognize that a growing number of people are exposed to pollute from industrial enterprises. The NEPAP identifies the following factors as contributing to this process:

- Industrial plan inappropriately cited close to pollution centers.
- Insufficient emphasis on fuel efficiency
- Little, if any pollution abatement equipment used for reducing emission,
- A total lack of industry pollution standards

3.1.2 Forest Policy 2019 AD

The Forest Sector Policies of Nepal such as the National Forestry Plan, 1976, Master Plan for the Forestry Sector, 1988, Periodic Five Year Plan and Forestry Policy have emphasized people's participation in the forest management. Nepal's main forest management is based on people's participation and various management models are underway. The Forestry Sector Policy, 2057 stresses on conservation of biodiversity, ecosystem and protection of land degradation by soil erosion, landslide, floods desertification and other ecological disturbances.

3.2 Strategy

3.2.1 Forestry Sector Strategy 2016-2025 AD

The forestry sector strategy (FSS) is a key milestone in the forestry sector, paving future development of Nepal's forestry sector which is based on the framework of Forest Policy 2015, however new policy has been promulgated, the 2015 policy gives a clear way forward.

FSS aims to deliver five major outcomes ranging from sustainable production and supply of forest products, improving of biodiversity and watersheds and ecosystems services; increased contribution to national economy.

3.2.2 Nepal Biodiversity Strategy 2014-20 AD

National Biodiversity Strategy and Action Plan (NBSAP) was state's commitment in biodiversity conservation as a member country of Convention on Biological Diversity (CBD). The NBSAP provides a comprehensive monitoring framework of country's biodiversity identifies threats, presents theme-specific strategies and priority actions. There are 75 national targets under various themes. For example, preparation and implementation of 10 species conservation plans for fauna was the most relevant target pertaining to this strategy.

3.3 Acts

3.3.1 Forest Act- 1991 AD

The Forest Act, 1991 recognizes the importance of forests in maintaining a healthy environment. The Act requires decision-makers to take account of all forest values, including environment services and bio-diversity, not just the production to timber and other commodities. The basis of the Act's approach to forest and forest products is "resources orient rather than use orient".

This Act empowers the government to delineate any part of a national forest, which has "special environmental, scientific or cultural importance", as a protected forest. It also prohibits reclaiming lands, setting fires, grazing, removing or damaging forest products, felling trees or plants, wildlife hunting and extracting boulders, sand and soil from the national forest without the prior approval.

The Act empowers government to permit use of any part of government-managed forest, leasehold forest or community forest, if there is no alternative for the implementation of a plan or project of national priority without significantly affecting the environment.

3.3.2 Water Resources Act 1992 AD

The objectives of the Water Resources Act, 1992 is to make legal arrangements for determining beneficial use of water resources, preventing environmental and other hazardous effects thereof and also for keeping water resources free from pollution. The Act strives to minimize the environmental damage to water bodies, especially lakes and river through environmental impact assessment and the proponent who wish to use water resources for various purposes should prepare EIA report before a license can be granted. The Act stipulates that soil erosion, flooding, landslides or any significant impact on the environment should be avoided in all uses of water resources. The provision made in Water Resources Act, 2049 is mandatory in case of the implementation of the proposed project. As per the provision, the environmental impact mitigation and enhancement measures have been proposed in view of environment conservation.

3.3.3 Environment Protection Act 1997 AD

The EPA, 1997 says that no development activity shall take without conducting Initial Environmental Examination (EIA) or Environmental Impact Assessment (EIA) study as per schedule mentioned in the EPR, 1997. The project proponent must publish a public notice in the national daily newspaper about the project, seeking suggestions regarding impacts due to project; the SFDP conducted EIA study and make EIA report as per EPR, 1997. Public access to information and transparency of activities has also been looked at in EPR, 1997. However, EIA of hydropower project can be approved by Ministry of Energy. Finally, Ministry of Energy has the prerogative to verify the final report and approve the EIA report.

3.3.4 Land Acquisition Act, 1977 AD

It is the main legislation to guide the acquisition of land in the country. This Act covers all aspects of land acquisition, compensation and other assets. It authorizes the government to acquire land for public purpose by providing compensation to the private land owners.

3.3.5 CITES Implementation Act 2017 AD

CITES Implementation Act 2017 was promulgated to control and regulate the illegal trade of wild flora and fauna. The act has prohibited the illegal possession of wild flora and fauna or

any of their parts but has allowed collection of specimens for scientific and educational research. The punishments such as imprisonment and/or monetary fine have been provisioned for the guilty of possessing or trading wild flora and fauna as recognized by CITES.

3.3.6 Labor Act 1993

Many workers are required to conduct various management activities. The labour act 1993 has classified under 15 child as anabolic. This act is in effect since 1993 June. A separate labour court and labor department are set up by government to secure the rights of labour.

3.4 Rules/Regulation

3.4.2 Forest Regulation-1994 AD

The Forest Regulation, 1994 provides guidelines for the preparation of a "Forest Management Plan" of Government managed forest. Emphasis has been given to monitoring and evaluating the implementation of the Plan of the Government managed forests. Rule 65 of the Forest Regulation stipulates that in case the execution of any project having national priority in any forest area causes any loss or harm to any local individual or community, the proponent of the project itself shall bear the amount of compensation to be paid. Similarly, the entire expenses required for the cutting and transporting the forest products in a forest area to be used by the approved project should be borne by the proponents of the project.

3.4.3 Environmental Protection Rule- 1997 AD

The EPR provides a legal basis for the concerned authorities in regulating the Initial Environmental Examination (EIA) or/and Environmental Impact Assessment (EIA). It is apparent from this provision that any private or government agency who wishes to implement any of the proposals defined in the regulations must prepare EIA, as the case may be. Article 7(2) of the EPR made provision of publishing notice during the preparation of EIA report to collect the concerns of stakeholders such as DDC, VDC, school, health post, hospital etc.

3.4.5 National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Act (1973) marks the advent of comprehensive policy framework primarily for protecting biodiversity. Till now, the Act has been amended

five times. Particularly fourth (1993) and fifth (2017) amendment allows the participation of local people, benefit sharing in buffer zone and entrust to declare corridors outside protected areas. Mid-hill which is least connected by protected area management system but equally affected by human wildlife conflict may have connectivity through fifth amendments.

3.5 Guidelines/Directives

3.5.1 Forestry Sector IEE/EIA Guidelines 1995 AD

The forestry sector EIA guidelines aim at facilitating the sustainable use of forest resources for the socio-economic development and to meet the basic needs of the communities from forest products. The beneficial and adverse impacts of any development project in the forest area are to be identified and plan must be developed to minimize environmental damage, conserving genetic resources and bio-diversity.

3.5.2 National Environmental Impact Assessment Guidelines-1993 AD

The National Environmental Impact Assessment Guidelines, 2050 developed by the National planning commission in conjunction with IUCN, set out the process for the environmental review and management of infrastructure of projects in all sectors, and the respective roles of certain government agencies and project proponents. The guideline provides criteria for project screening and EIA. This includes preparation of Terms of Reference for EIA, methods of EIA report, impact identification and prediction, impact mitigation measures, impact monitoring, evaluation of impact studies, community participation and schedules and annexes. The EIA report must be concise; pay attention to significant environmental issues and impact; analyze extent and depth of impact commensurate with the nature of potential impact; and due consideration must be paid to the responsibilities of target users such as project proponent, designers and decision-makers.

The guidelines require the proponent to consider alternatives to the proposed project. The proponent must consider the alternatives of scale, technology, location, fuel, raw materials, design, time schedule and economic aspects.

3.5.3 Forest Products, Collection, Sale and Distribution Guidelines –2017 AD

The guidelines have specified various procedures and formats for getting approval for vegetation clearance, delineation of land for vegetation clearance, evaluation of the wood volume etc. and government offices and officials responsible for the approval. These provisions have a direct relevance to the development of the project and need compliance to these provisions.

3.5.4 Community Forest Inventory Guideline, 2072

The guideline for inventory of community forests advises to classify the forests into timber, trees, pole size trees and regeneration on the basis of diameter. Plants having diameter at breast height (DBH), i.e. 1.3 m above the ground, greater than 30 cm is considered as trees. Trees having DBH from 10 to 29.9 cm are categorized as poles and plants having less than 10 cm DBH belong to regeneration species. Besides, guideline has standard volume calculation, sampling intensity and other guiding information.

3.5.5 Wildlife Damage Relief Support Guidelines (2012)

Nepal government has developed and enacted this guideline to provide relief to people affected from loss and damages as a consequence of human wildlife damage. This may help to reduce poaching and retaliatory killing. The Guidelines cover 14 wild animals such as tiger, rhino, wild elephant, bear, common leopards, snow leopards, clouded leopards, wild dog, fox, wild boar, wild buffaloes, crocodile, bison and python and outlines the operational procedures.

3.6 International Conventions and Guiding Documents

3.6.1 ILO Convention Article, 169

Nepal ratified ILO convention No.169 on September 14, 2007. In 2007 the UN Declaration on the Rights of Indigenous peoples was adopted by the general assembly.

ILO Convention No.169 highlights the need to recognize indigenous and tribal people's specific knowledge, skills and technologies as the basis for their traditional economies and

self –determined development process. Article 1 of the convention provides definition of the tribal and indigenous people. Article-6 deals the consultation of the peoples concerned through appropriate procedure and in particular through their representative institutions, whenever consideration is being given to legislative or administrative measures which may affect them directly.

In Article 15 the rights of the people concerned to the natural resources pertaining to their lands shall be specifically safeguarded. These rights include the rights of these people to participate in the use, management and conservation of these resources. The use of the term lands include the concept of territories, which covers the total environment of the areas which the peoples concerned occupy or activities and shall receive fair compensation for any damages which they may sustain as a result of such activities.

Article 16(2) clearly mention that where the relocation of these peoples is considered necessary as an exceptional measure such relocation shall take place only with their free and inform consent. Where their consent cannot be obtained, such relocation shall take place only following appropriate procedures established by national laws and regulations, including public inquiries where appropriate, which provide the opportunity for effective representation of the peoples concerned. Article 16(3) mentions that wherever possible these peoples shall have the right to return their traditional land as soon as the grounds for relocation cease to exist. Article 16(5) elaborated the persons thus relocated shall be fully compensated for any resulting loss or injury

3.6.2 Convention on Biodiversity-1992 AD

Nepal ratified Convention of Biological Diversity on 23 November, 1993 though it was declared worldwide on 1992. This convention obligates Nepal to introduce appropriate procedures for EIA; introduce appropriate arrangement to conduct EIA; notify immediate potentially affected neighboring nations about biodiversity impacts; arrange for protection and conservation of biodiversity and, examine and enforce restoration and compensation of damage to biodiversity.

3.6.3 Convention on International Trade in Endangered Species of Wild Flora/Fauna (CITES), 1973

In CITES, the contracting States recognizes that wild fauna and flora in their many beautiful and varied forms are an irreplaceable part of the natural systems of the earth, which must be protected for this and the generation to come; Appendix II includes all species, which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival. Similarly, Annex-IX includes all species, which a party identified as being subject to regulation within jurisdiction for the purpose of preventing or restriction exploitation, and as needing the co-operation of other parties in the control of trade. Nepal is signatory to this agreement, which classified species according to criteria where access or control is important (e.g. I-species threatened with extinction; II-species which could become endangered; III-species that are protected).

CHAPTER: 4, BASELINE ENVIRONMENT

4.1 Physical Environment

4.1.1 Geography

According to the table number 22, 23, and 24, we can say that the project area lies on the Terai region whereas small portion of project area lies on Siwalik region. Terai area covers 2, 87,872 ha of land while siwalik covers 39,335 ha of land.

Table 9: Land types of project district

Mahottari (Area in ha)			Sarlahi (In ha)		
Siwalik	Terai	Total	Siwalik	Terai	Total
14,926	79,947	94,873	16,708	1,02,810	1,19,518

Source: District Profile of Nepal 2014/15

4.1.2 Meteorology & Climatic Information0

All the districts lie in the Terai region i.e tropical region and plain land. The major season of these areas is summer being the average temperature of 28 degree. Similarly average precipitation of project area is around 1025 mm. The existing climatic conditions along with information's on geographical settings of the two districts namely, Mahottari, and Sarlahi are given as follows:

Table 10: Climatic Condition

District	Air Temperature˚C		Precipitation (mm)
	Maximum	Minimum	
Mahottari	41.2	7.5	691
Sarlahi	40.0	5.0	1198

Source: District Profile of Nepal 2014/15

4.1.3 Drinking Water

Most of the people are dependent on hand pump for drinking water followed by tap, well, spout water and other respectively.

Table 11: Drinking water source

District	Tap/Pipe	Hand pump	Well	Spout Water	River/Stream	Other	Non-Stated
Mahattori	14.08	76.34	5.961.1	1.60.34	0.34	158	0.54
Sarlahi	11.77	77.22	7.30	0.23	0.52	1.90	1.06

Source: District Profile of Nepal 2014/15

Cultivated land covers 1, 97,706 ha of total land followed by forest covers 87,453 ha non-cultivated land 20,952, pasture land 6,170 ha respectively.

4.1.4 Geology

The soil weakly developed over small gravel and boulders is freely draining and has a long water deficit period November-May. The project area includes three ground water zones varying in depth from 5-80 m. About 20-30% of the project area is silty clay loams over sand (location?), 10-20% of the area is sandy clay loam over sand, and 30-40% of the area is loam sand over sand, sandy loam. This shows the major area is well tramped soil, where PH values lies from 5.1 to 6.4. Very coarse textured fine sand area consists only 10-15% of the project area whereas excessively coarse textured boulder is only 5-10% of the area. These results are based on the soil survey carried out in the SFDP in 1985.

4.2 Biological Environment

4.2.1 Flora

The most abundant species found in the project site is Eucalyptus. Other common species found in the area includes- Sissoo (Dalbergia sissoo), Sal (Shorea Robusta), Simal (Bombax Ceiba), Khair (Acacia catechu), Siris (Albizzia spp.), and Teak (Tectonia Grandis). Other miscellaneous species are also found in the project area. Some of the of trees, shrubs and herb species found in the project area are given below:

Table 12: Flora of SFDP

SN	Common Name	Scientific Name	Category
1	Eucalyptus	Eucalyptus cameldulensis	Tree species
2	Sagwon/Teak	Tectona grandis	Tree species
3	Sal	Shorea robusta	Tree species
4	Kadam	Anthocephalus cadamba	Tree species
5	Khair	Acacia catechu	Tree species
6	Sissoo	Dalbergia sissoo	Tree species
7	Siris	Albezia lebeek	Tree species
8	Simal	Bombax ceiba	Tree species
9	Asna	Terminalia termentosa	Tree species
10	Harro	Terminalia chebula	Tree species
11	Barro	Terminalia belerica	Tree species
12	Raj Brikch	Casia fistula	Tree species
13	Khamari	Gmelinia arborea	Tree species
14	Lampate	Duabanga grandiflora	Shrub Species
15	Raajbeli	Clerodendrum infortunatum	Shrub Species
16	Bitter Bush	Eupatorium oderatum	Shrub Species

Eucalyptus is the main plantation species and was planted to fulfill the overall project objective of establishing plantations of fast growing timber species to meet the then demands of fuel wood in central Nepal for industrial as well as for household consumption. Eucalyptus covers most area of 4803.8 ha followed by Sal regeneration, mixed species, teak and so on.

Since the early years of Project Implementation the regeneration of Sal in the plantation area was noticed to be plentiful in some of the blocks. The area covered by Sal is 1569.08 ha and it has 71blocks.

Teak is one of the main plantation species and has 23 blocks with an area of 341.11 ha. Besides main planation species other species like kadam, khair, Ipil-lipil, seemal Asna, karma have been planted on trial basis in the projects area. The miscellaneous species cover an area of 226.84 ha.

Due to epidemic of Sissoo, most of its plantation was dismantled and replaced by Eucalyptus, reducing Sissoo cover to few hundred hectares. Besides these plenty of natural regeneration of Sal and Teak is coming up profusely. At some of the places Eucalyptus sand Sissoo plantation, which were damaged by fire in the past, has been replaced by Sal regeneration.
The forest floor species found during biomass quantity estimation study were :

Table 13: Plant Species in Sample Sites of SFDP

SN	Local Name	*Scientific Name*	SN	Local Name	*Scientific Name*
1	Banmara	*Eupatorium adenophorum*	16	Kuro	*Bidens pilosa*
2	Siru	*Imperata cylindrical*	17	Pipala	*Piper longum*
3	Ban tarul	*Dioscorea sp.*	18	Bhuiamala	*Phyallanthus urinaria*
4	Fern	*Lycodium sp.*	19	Ghodtapre	*Centella asiatica*
5	Odal		20		*Diosperus parvifolius*
6	Galeni		21	Pade jhar	*Cymbopogan citratus*
7	Khareta	*Phyllanthus folius*	22	Dhotisaro	
8	Bhati	*Desmodium floribundium*	23	Laharesimi	
9	Tapre	*Cassica occidentalis*	24	Dudelahara	*Cissampelos pareira*
10	Datiwan	*Achyranthes bidentatus*	25	Kukurdiano	*Smilax macrophylla*
11	Bancho	*Eragrostis unioloides*	26	Maidal kanda	
12	Kharuki	*Argermon mexicana*	27	Aule	
13	Githa	*Dioscorea bulbofera*	28	Tatari	*Dilleria pentagyna*

14	Gandhejhar	*Argeratum sp.*	29	Sisnoo	*Urtica dioca*
15	Lajawati	*Mimosa pudica*			

Source: Biomass Estimation of Ground Vegetation at SFDP, Sarlahi 2017

4.2.2 Non-Timber Forest Products (NTFPs)

The people in the vicinity community of the project area are not very much aware of the medicinal, ethno-botanical and NTFP species. The NTFPs seen during the field visit was lemon grass, eucalyptus leaf, sajiwan, kurelo, timur and so on. List of NTFP found in the project site are given below:

Table 14: NTFP of SFDP

SN	English Name	Scientific Name	Category
1	Lemon grass	*Cymbopogon citratus*	
2	Eucalyptus leaf		Tree leaf
3	Sajiwan	*Moringa oleifera*	Shrub

4.2.3 Forest Floor Biomass Estimation

The forest floor estimation has been derived from the study of FPDB conducted by Bio Energy Project in 2017. A total of 21 sample plots were measured. Each plots were 500 square meter and were laid down systematically. Of the selected sample plots, as two plots fell over river and encroachment area, a total of 19 plots were considered for biomass estimation. The finding of fresh bio mass, dry bio mass and major plant species is presented in sections below.

a. Biomass

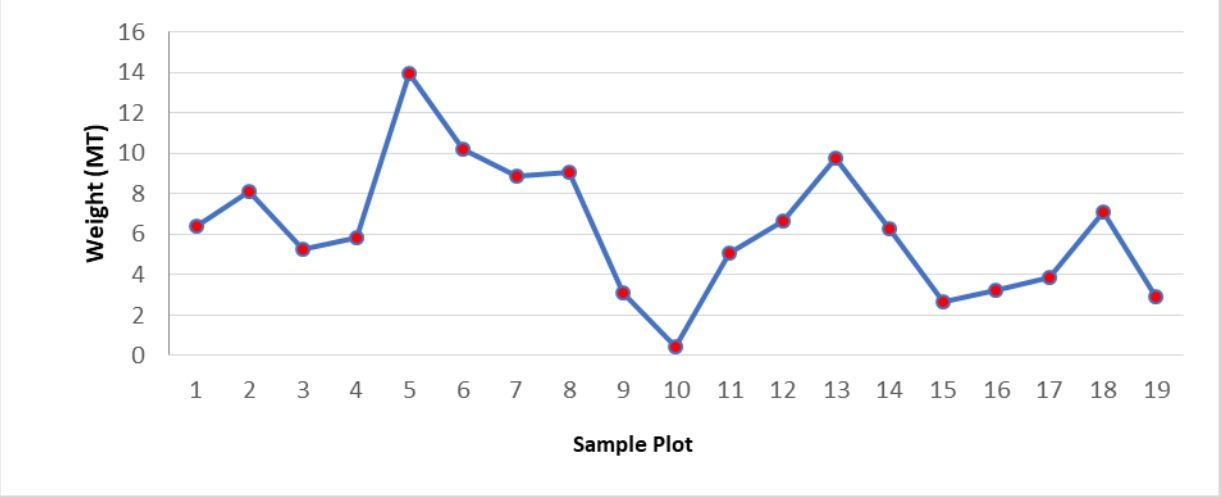
The ground vegetation in each sample plot was cut and weighed for biomass estimation. The maximum fresh weight of biomass was 693kg (sample plot no. 23) in 500 sq.m. area. The study area is densely covered by Eupatorium species (Banmara). Similarly, the least weight measured is 22kg (plot no. SNB2) and the main dominant species recorded was Impereata cylindrica (Siru). The total fresh weight in all 19 samples is 5930kg and average weight of

each plot (500 sq.m.) is 312kg. The fresh weight measurement of each sample is presented in Figure below

.

The bio-mass estimation of fresh samples was different in each plot. It depend on the intensity of the ground vegetation and species type. The higher percentage of ground vegetation has higher biomass while lower or scarce presence of ground vegetation has lower biomass. Sample area covered by Eupatorium Species (Banmara) has higher biomass while Impereata cylindrica (Siru) has lower bio mass. The pattern of biomass value in the sample plots is presented in the figure 3.

Figure 3 : Fresh weight of ground species

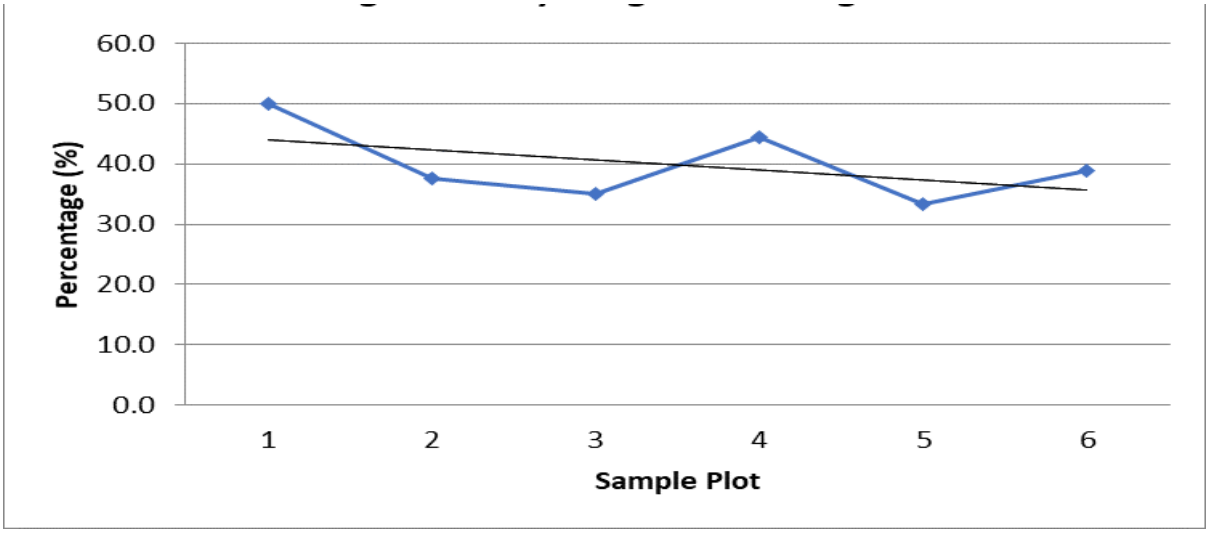


The highest value of fresh weight biomass is 13.9 tone with lowest value 0.44 tone. An average weight of forest floor biomass per hectare is 6.24 MT. It indicates that there is abundant number of ground vegetation which can be used for other purpose.

b. Bio Mass Estimation of Dry Sample

A total of 6 fresh samples were studied. The fresh samples measured on day 1 and day 2 were collected and placed at open dry area. After keeping them for 7 days for sun dry, the samples were weighed again. Average percentage of dry sample is found as 39.87%. It indicates that 60% moisture of fresh materials could be removed by sun drying. Measurement of each dry sample is presented in Figure 4.

Figure 4: Dry weight percentage



The study has concluded that forest floor biomass could provide an estimated 2.498 MT of sun dried biomass from the forest floor vegetation from every hectare of plantation forests in Sagarnath.

4.2.4 Fauna

There are diverse ranges of faunal species that are found in the project plantation region. The major fauna found in the project area are: Wild Boar, Deer, Monkey, Blue Bull, etc. Flagship Mammalian species. Some faunal species found in the project site are given below in Table 15.

Table 15: Faunal Species of SFDP

SN	Common Name	Scientific Name	IUCN Red list	Category

SN	Common Name	Scientific Name	IUCN Red list	Category
1	Wild Boar	Sus scrofa	Leat Concern	Mammal
2	Rehus Monkey	Macaca mulatta	Protected	Mammal
3	Blue Bull	Boselaphus tragocamelus	Least concern	Mammal
4	Asiatic Elephant	Elephaus maximus	Least concern	Mammal
5	common leopard	Panthera parades	Vulnerable A2cd ver 3.1	Mammal
6	Indian Nightjar	Caprimulgus indicus		Bird
7	Dusky eagleowl	Bubo coromandus		Bird
8	Whitetailed stonechat	Saxicola leucurus		Bird
9	Large adjutant storke	Leptoptilos dubius		Bird
10	Common gold eye			Bird
11	Barn owl	Tyto alba	Least concern	Bird
12	Black Spined Toad	Bufo melanostictus	Least Concern	Amphibian
13	Common Garden Lizard	Calotes versicolor		Reptile

4.3 Social, Economic and Cultural Environment

The description of existing Socio-economic and Cultural Environment of Project affected VDCs are presented hereunder. The data are based on the record of the District and VDC profile 2014/15 as well as from reconnaissance survey.

4.3.1 Demographic Pattern

Districts of SFDP is highly populated district having above 658 people per sqkm. A brief description demographic pattern is provided on table below:

Table 16: Demographic Pattern

District	Male	Female	Total	HH	HH Size	Density (per sqkm)
Mahottari	320,772	339,602	660,374	118,989	5.55	658.61
Sarlahi	416,999	414,067	831,067	142,702	5.82	660

Source: District Profile of Nepal 2014/15

4.3.2 Ethnicity

The project area possesses various races, castes and creeds with a religious harmony existing among the people. Yadav comprises of highest population with around 15.15% of total population followed by Muslim by 15% and other all ethnicity comprises of around 70%.

Table 17: Ethnicity of project site

District	Yadav	Musalman	Others
Mahottari	15.15%	13.36%	71.49%
Sarlahi	15.51%	7.89%	76.6%

Source District Profile of Nepal 2014/15

4.3.3 Religion and Culture

Most of the people are Hindu followed by Islam and Buddhist respectively. Table 17 below presents the data on religious beliefs of people.

Table 18: Religion

District	Hindu	Buddhist	Islam
Mahottari	84.24%	2.02%	13.34%
Sarlahi	85.56%	5.72%	7.88%

Source: District Profile of Nepal 2014/15

4.3.4 Education

Most of the people have only completed their primary education. Among the total population 210,321 people have completed their primary education followed by lower secondary 95,496, SLC 60,638, Secondary 52,237, Intermediate 26,433 and higher studies 12,146. 21,798 people have not done their schooling.

Table 19: Education

No school	Primary	Lower Secondary	Secondary	SLC	Intermediate	Higher Studies
21,798	210,321	95,496	52,237	60,638	26,433	12,146

Source District Profile of Nepal 2014/15

4.3.5 Energy

Most of the people use fire wood for cooking purposes. Among the total household 1, 82,982 household use fire woods for cooking followed by cow dung 83,021, kerosene 14,376, Lp gas 5,841 and biogas 1,817.

Table 20: **Energy use for cooking**

Fuel wood	Kerosene	LPG	Cow dung	Biogas
1,82,982	14,376	5,841	83,021	1,817

CHAPTER 5: PROPOSAL ALTERNATIVES

One of the important part of good environmental practice is the evaluation of its potential alternatives. In order to achieve this goal, the environmental and social considerations need to be brought into the planning. In case of this Project, a range of site alternatives was investigated and the lowest and highest impacts on engineering, environmental and land use of these routes were determined to select the best route.

A number of alternatives were considered from the desk study for the project. The project should consider following things for the sustainability.

- More Job opportunities for local people
- More wage rate as needed in the local area
- Occupational health and safety materials during works
- Less degradation during project period
- Involvement of local people
- Avoid settlements as far as possible

5.1 Alternatives Considered

Some of the major alternatives considered during the EIA studies are:

- No project option.
- With project option i.e. implementation of management plan

5.1.2 No Project Option

If the proposed project is not implemented then there will be no project induced loss/effects and benefits on vegetation and other project induced environmental and socio-economic impacts. No project options means putting a large area of plantation area into jeopardy. Various kinds of ecosystem services, major benefits and supplementry benefits will vanish. If there is no project implemented then there will be great loss to the national economy from its revenue, since each year harvesting are necessary and plantation are required, the condition of land would remain unproductive with stocked forests.

The local people being benefitted through seasonal employment will be deprived of these benefits. Enhanced timber quality will not be available. The condition of biodiversity will be

worse. The land encroachment might further increase. Plant disease would further multiply. Human interference would be more rampant.

Above all, it is evident that not implementing the project would be a worst decision because the country will be losing many tangible and intangible benefits.

5.1.2 With the Project

With the project means the implementation of the project, the option seems more suitable. The implementation of proposed project will provide many benefits instead of no project option. The implementation of project will help in National economy. Similarly the project will create different seasonal works to local people of an area. The economic activities will be increased throughout the project of an area. The implementation of project will help to enhance different infrastructure facilities in an area. Similarly local people capacity and their knowledge on forest management will be increased during the implementation of the project. Besides these the project will help to fulfill the demands of electricity poles in rural areas as well as timber in different regions of the country.

CHAPTER 6: IMPACTS PREDICTION AND ASSESSMENT

Sagarnath Forestry Development Project is a large intervention. The project is expected to bring about positive changes and significant positive impacts, however there might be negative impacts which vary to be high, medium or low and such impacts may be of site-specific, local, regional or of national nature. Furthermore, some of the impacts may be short-term, particularly related with operation phase, medium-term and long-terms. The following sections describe the likely beneficial and adverse impacts with benefits augmentation and adverse impacts mitigation measures of each impact identified or predicted.

6.1 Impacts Criterion

All the Impacts have been predicted after discussing among the study team and supported with quantified information of; likely changes, alteration, and losses; and are further assessed based on characteristics of existing condition and sensitivity of environmental components (physical- chemical, biological- ecological, and socio-economic & cultural).

The team identified significant positive and negative impacts, direct and indirect, and short term, medium term and long-term impacts relating to the aforementioned environmental impacts and grouped into following categories:

Table 21: **Environmental impacts categorization**

Category Type	Categories
Impact Quality	Adverse / Beneficial
Nature	Direct / Indirect
Magnitude	High / Moderate / Low
Extent	local/ Regional/ National/ TransBoundary
Timing / Duration	Short Term / Medium Term/ Long Term
Significance	Significant, insignificant, non-significant

The team has carried out the impact prediction by considering the magnitude, extent and duration of any impact in this EIA report. The Environmental impacts are evaluated on the

basis of guidelines given in the National EIA Guidelines (1993), based on the Magnitude, Extent & Duration of the impact. Scientific calculations, Experts' judgments and experiences from similar projects have been adopted for the quantification of the impacts.

Duration: If the impact lasts up to 1 year it is termed as short term (ST). If it continues for 1 to 5 years it is termed as Medium term (MT) and if it lasts beyond 5 years is considered as Long term (LT) (EIA, Guideline, 1993).

Extent: The impact which occurs inside the project is termed as Site Specific (SS) and which goes up to VDC level is termed as Local (L) and which goes up to more than two VDC level is termed as Regional (R).

Magnitude: Similarly, the impact which is irreversible is termed as High (H), which is in partly recoverable in long run is termed as Moderate (M) and which is reversible is termed as Low (L).

Impact Type: The impact which has direct effect is termed as Direct (D) and which has indirect effect is termed as Indirect (I).

The matrix method with numerical ranking, to evaluate the Impact, is used for the quantitative ranking of the predicted impacts. The numerical scale mentioned in the National EIA Guidelines- 1993 has been adopted. The numerical scales are as follow:

Table 22: Indicator criterion and Levels

Magnitude		**Extent**		**Duration**	
High	60	Regional	60	Long	20
Medium	20	Local	20	Medium	10
Low	10	Site Specific	10	Short	5

Significance: The combined score up to 44 is termed as Insignificant Impact (I); 45-74 is termed as Significant (S) and beyond 75 is termed as Very Significant (VS) impact

6.2. Positive Impacts

The management plan has been proposed to bring about many positive and beneficial impacts. The impacts that have discussed in the following headings.

6.2.1 Physical Environment

- Development of new infrastructure

The project helps to improve the existing infrastructures like roads, buildings and so on. For the efficient work of the project road has been upgraded and blacktopped which will be useful for all the surrounding communities. The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (90> 75).

- **Increase in Land values**

Development of new infrastructure in the project area will subsequently increase the value of land of community people. This is indirect benefits that communities will get from the project.

The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (90> 75).

6.2.2 Biological Environment

Reduce risk of Fire hazard

Cleaning, weeding in the forest land will eventually helps in decreasing the forest fire. This is one of the benefits. There is a annual forest management program in management plan for cleaning and weeding in different blocks which will remove the unwanted weeds and other species subsequently helping to reduce the wild fire.

The cleaning of forest floor every year by private organization helps reduce forest fire. This will be an innovative way to address the issue of forest fire. First, the removal of the forest floor biomass will provide royalty to the project. Second, it will reduce the forest fire management cost of SFDP as the potential hazardous fuel has been removed by a third party. The fire alert could be maintained at its minimal level for any unforeseen circumstances only.

The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (> 75).

- **Enhancement of Technical skills of Forest Management and Protection**

The Enhancement of technical skills through the project will be beneficial part as capacity and knowledge of local people in forest management practices as well as needs and importance of forest conservation will be more enhanced. Local people will develop their knowledge regarding the conservation of forest and beneficial uses of forest conservation.
The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (> 75).

- **Ecosystem Services and Carbon Sequestration**

As a semi-mechanized man made forest, SFDP is the only plantation with above 10 thousands hectares of area, the forest ecosystem is highly potential of providing quality services like timber, firewood, NTFPs and grasses. Major implementation program of the forest is plantation. More than 200 ha of land will be planted each year. This has direct impact on carbon sequestration which is one of the major global issues. Carbon sequestration will help to minimize the effect of climate change on global as well as local scenario.

Similarly, reduction on the frequency and intensity of forest fire will help reduce the emission from forest fire. Avoided emission from 30,000 Mt of biomass (since it is collected and taken out for other use) will amount to Emission Reduction of 38500 t. Co2 equivalent every year.
The impact is classified as direct, Regional (60) extent, Long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (140> 75).

- **Resource availability**

Local people will benefit through the project in terms of resource availability. Fodder, grass and fire wood will be available to local people in household level. The contribution of the project in terms of this resource availability will help local people in major means as te people can fulfill their lacking resources from the project sites.

The impact is classified as direct, Site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is Very Significant (90> 75).

6.2.3 Socio-Economic Environment

- **Employment opportunities**

During the project implementation time, the project will create employment opportunity for the locals and other people. For seasonal periods, around 500 rupees per day wage is envisaged during the thinning, cleaning, harvesting period of the project. Removing of forest floor biomass will create substantial full time employee (FTE) every year. The employment will be created on collection, handling and processing of the raw materials. This will create around 200 FTE additional employment opportunities in the chain of custody.

The impact is classified as direct, local (20) extent, High (60) in magnitude, and long term (20) duration in nature. Thus, the impact is Very Significant (100> 75).

- **Increase in Economic activities of local people**

During the project implementation phase there will be more economic transaction in an area. The transaction of the financial matters increase during the implementation phase because of increase of influx of the people in an area. The trade and business of local communities will be enhanced which will ultimately have positive impacts on economic activities of people.

The impact is classified as direct, site specific (10) extent, low (10) in magnitude, and long term (20) duration in nature. Thus, the impact is Very Significant (40>75).

- **Promotion of site**

There will of lot of outsiders visiting the project area due to various reasons like study purpose, learning visit from other site which will eventually helps in promoting the different areas of the site.

The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is **Very Significant (90> 75).**

6.3 Negative Impacts

6.3.1 Physical Environment

Soil Quality decline

The decline in soil quality due to the plantation of Masala has been felt by the local people. The plantation of Masala has declined the quality of soil in terms of production of other species. The soil quality has been declined slowly and the production of other tree species as well as agricultural crops has been diminished slowly.

The impact can be classified as direct, site specific (10) extent, long term term (20), and moderate (20) magnitude in nature. Thus, the impact **is significant (90>75).**

Extraction of sand and gravel from water sources

The extraction of the sand and gravel from the water sources is work in an area. The most important effects of extraction of sand and gravel in an area is on aquatic habitats are bed degradation and sedimentation, which can have substantial negative effects on aquatic life. Furthermore, movement of unstable substrates results in downstream sedimentation of habitats. The affected distance depends on the intensity of mining, particles sizes, stream flows, and channel morphology. Similarly instream gravel and sand extraction activities will have an impact upon the river's water quality. Impacts include increased short-term turbidity at the mining site due to resuspension of sediment, sedimentation due to stockpiling and dumping of excess mining materials and organic particulate matter, and oil spills or leakage from excavation machinery and transportation vehicles.

The impact can be classified as direct, site specific (10) extent, long term term (20), and moderate (20) magnitude in nature. Thus, **the impact is insignificant (50 < 75).**

Decline of grouuprndwater level

Community felt that the amount of water has reduced. One of the reasons could be the reason of plantation of eucalyptus, a fast growing species. Even though the communities view that eucalyptus reduces the amount of water, some people still grow this species due to the benefits that can be drawn from the fast growing species. One of the reasons behind depleting water can also be due to the on-going Climate Change. This needs to be studied in detail.

The impact can be classified as direct, site specific (10) extent, long term term (20), and high (60) magnitude in nature. Thus, the impact is **significant (90>75).**

Environmental Pollution and Solid waste

Noise pollution could be the one of the major impact in the project area. The use of machinery and during the transportation of the felled logs noise pollution and vibration will occur.

During the implementation for the activities like clear felling, thinning, plantation there will be use of lot of vehicles and machinery which are the major sources of air pollution. The emission of air are inevitable during the project operation is seen to be insignificant as the operations will not be done near the villages. But the passing of these vehicles causes little air pollution.

The impact can be classified as indirect, site specific (10) extent, medium term (10), and Moderate (20) magnitude in nature. Thus, the impact is **insignificant (40< 75)**

Fire hazard

Surrounding forest fire may spread to stock piling of biomass forest floor materials during collection will create big loss in biomass materials and forest.

The impact can be classified as indirect, site specific (10) extent, short term (5), and Moderate (20) magnitude in nature. Thus, the impact is **insignificant (45< 75)**

6.3.2 Biological Environment

- Human Wildlife Conflict (HWC)

The major issue due to the project implementation is wildlife. SFDP area is wildlife movement corridor link between north natural forest and southern plantation forests. Due to the increase and improvement of the forest's condition, Nilgai and spotted deer shelter use it corridor and as their habitats too. This can affect the adjoining villages's lives, their crops and livestock.

The impact is classified as direct, site specific (10) extent, long term (20), and high (60) magnitude in nature. Thus, the impact is **Very Significant (90> 75).**

- Habitat loss and loss of small vertebrate

During the clear felling of the blocks there will be habitat loss for those animals which are residing in the area. As the blocks will be replanted in another year with fast growing species the habitat loss is not long term. But, for the short duration of time these animals have to shift their shelter to another place. Similarly, during these forests management operation there is a possibilities of declining of small vertebrates from the area.

The impact is classified as direct, site specific (10) extent, short term (05), and high (60) magnitude in nature. Thus, the impact **is insignificant (65< 75).**

- Spreading of plant disease

The major concern of this project is plantation of exotic species. Major issues that could develop during the time frame in the spreading of new diseases in the native species and gradually declining of the new native species.

The impact can be classified as direct, site specific (10) extent, long term (20), and High (60) magnitude in nature. Thus, the impact is **Very significant (90>75).**

6.3.3 Socio-Economic and Cultural Environment

- Occupational safety

Occupational accident risks are very common during heavy works on forest. Activities such as use of heavy equipment and working in dangerous areas such as in the river sides, middle of forest may cause accidents and injuries. During the operation of heavy equipment for felling, thinning workers is always in danger.

The impact can be classified as direct, site specific (10) extent, long term (20), and High (60) magnitude in nature. Thus, the impact is **Very significant (90>75).**

- Impact on social structure, culture and traditional practises due to work force from outside of local area.

Due to the operation of the project, different outsiders will invade the community during the work phase. This could have negative impacts on the social structure, culture and traditional practises. The outsiders have their own norms and values as well as religion and culture.

The impact can be classified as direct, site specific (10) extent, long term (20), and Medium (20) magnitude in nature. Thus, the impact is **insignificant (50<75).**

CHAPTER 7: ENVIRONMENTAL MITIGATION MEASURES

In earlier chapters, impacts from the project interventions have been discussed. Besides having many beneficial impacts, there are some negative impacts which is mostly insignificant and manageable. The following chapter deals with mitigation measures.

7.1 Mitigation Measures for Physical Environment

The following table 21 is about the various impacts on physical environment and mitigation measures to reduce the impacts.

Table 23: Mitigation measures to impact on physical environment

SN	Impacts	Significance	Mitigation Measures for adverse Impacts
1	Soil Quality decline	Significant	• Other tree species like teak will be planted near to the settlement area. • Recharge ponds • Mulching and maintaining ground cover
2	Decline of groundwater level	90 (Significant)	• Water conservation ponds will be made for sufficient supply of water in the area
3	Environmental Pollution and Solid waste	40 (Insignificant)	• In some place nearby settlements, water sprinkle will be done to reduce the air pollution and dust in an area. But this will be carried out in seasonal basis i.e during dry and windy seasons, but the roads will be gradually gravelled to permanently check air pollution. • Similarly dustbin in every area will be placed by the project to collect the solid waste in proper manner and to dispose these solid wastes.

SN	Impacts	Significance	Mitigation Measures for adverse Impacts
4	Sand and Gravel	Insignificant (50)	• Sand and gravel collection will be restricted in areas nearby bridges •

7.2 Mitigation Measure for Biological Environment

The forest entity of SFDP is mostly biological, so that biological impacts are there. The following table 23 tries to address the impact that was predicted or identified in previous chapters.

Table 24: Mitigation measures for biological environment

SN	Impact	Significance level	Mitigation Measures
1	Human Wildlife Conflict (HWC)	90 (Very Significant)	• Awareness campaign will be done for livestock shed improvement in the settlement area • Stall feeding in the area will be enhanced.
	Habitat Loss and loss of small habitat	65 (Insignificant)	• Low human interference • Polyculture • Forest fire control • grazing control
2	Spreading of plant disease	(90) Very significant	• Immediate control of affected plants • Polyculture
3	Grazing	Insignificant	• Stall feeding • Live hedge fence • Fodder species promotion
4	Forest Fire	Insignificant (45)	• Control burning • Firefighting • maintenance of fire lines

SN	Impact	Significance level	Mitigation Measures
			• fire equipment and safety gear

7.3 Mitigation Measures for Socio-economic Environment

With increase in enterprise, and several technical and menial jobs, there would be socio-economic dynamics in the society. The following table 24 presents the mitigation measures against the identified impacts of the SFDP upon socio-economic environment.

Table 25: Mitigation measures for socio-economic environment

Issue No	Impact	Significant	Mitigation Measures
1	Occupational safety	90 (Significant)	• Awareness campaign • Capacity Building training • First aid • Insurance • Safety gear

7.4 Mitigation Costs

The cost for above mentoned mitigation measures are given in the following table. However some activities are also covered by the proposed management plan. The detailed management plan is presented in next chapter.

Table 26: **Cost for Mitigation Measures**

Type	Budget
Physical	40,00,000.00
Biological	38,00,000.00
Socioeconomic	21,00,000.00
Total	99,00,000.00

CHAPTER 8: ENVIRONMENTAL MANAGEMENT PLAN

8.1 General

With the proposed plan of activities and interventions, both positive and negative impacts will be there. The negative impacts are nominal and manageable however. This environmental plan is focused in reducing the negative impacts of the proposed management plan including the responsible agency to carry the mitigation measure reducing the negative impacts and making management plan more fruitful and more working. Moreover, this environmental management plan is focused in the following:

a) Enhancing positive impacts and reducing negative impacts
b) Monitoring the effectiveness of mitigation measures
c) Arranging for necessary environmental examination

8.2 Environmental Management Framework

The following table presents the detail mitigation measures along with allotted budgets. Some activities are also in the management plan so, the budgets are not mentioned for the activities.

Table: Mitigation measures and budgets

Table 27: Detailed cost of mitigation measures

Type	Impacts	Mitigation Measures	Budget	Remarks
Physical Impacts	Decline in Soil Quality	Polyculture	400,000.00	
		Fire control		Covered by management plan
		Grazing control	800,000.00	
		Maintain ground cover		Covered by management plan
	Decline in groundwater level	Conservation ponds	700,000.00	
		River banks protection (bioengineering)	700,000.00	
		Plantation		Covered by management plan
		Maintain ground cover		Covered by management plan

Type	Impacts	Mitigation Measures	Budget	Remarks
	Pollution and Solid waste	Improvement of Fire lines/forest roads		Covered by management plan
		Sprinkling nearby settlements during dry seasons	1,000,000.00	
		Maintenance of existing roads		
		Dustbins and pits	400,000.00	
		Establish units to make pellets		Covered by management plan
		Subtotal (A)	**4,000,000.00**	
Biological	Human Wildlife Conflict (HWC)	Awareness campaign		Covered by Management Plan
		Stall feeding	800,000.00	
		Improved shed	800,000.00	
	Habitat Loss and loss of small vertebrate	Low human interference		
		Polyculture	1,000,000.00	
		Forest fire control		
		Grazing control		
	Grazing	Stall feeding		
		Live hedge fence	600,000.00	
		Fodder species promotion	400,000.00	
	Fire	Control Burning		
		Fire fighter		Covered by Management Plan
		Maintenance of fireline		
		Fire equipment and Safety gears		
	Plant diseases	Immediate felling affected plants	200,000.00	
		Polyculture		
		Subtotal (B)	**3,800,000.00**	

Type	Impacts	Mitigation Measures	Budget	Remarks
Socioeconomic Impacts	Occupational Safety	Awareness Campaign		
		Safety gear		
		First aid	100000	
		Insurance	2000000	
		Awareness		
		Maintain law and orders		
		Subtotal (C)	2100000	
		Total (A+B+C)	**9,900,000.00**	

8.3 Environmental Monitoring Management Plan

Regular monitoring is required to ensure whether the management plan are effective and mitigation activities are actually reducing the impacts.

There will be 2 kinds of monitoring viz: Impact and compliance monitoring. Impact Monitoring is usually concerned with impacts caused by management plan implementation, which is physical, biological and socio-economic impacts whereas compliance monitoring is monitored whether concerned impacts are as prescribed in EIA plans or not. Following table presents the indicators for monitoring:

Table 28: Monitoring subjects and their indicators

	Monitoring Subjects	Indicators
a	Bioengineering	Reduced river cuts at Bioengineering
b	Fencing in plantation areas	no. of plants in plantation areas, increased greenery
c	Cleaning and maintenance of fire lines	Reduced fire events, efficiency in putting off fires
d	Live hedge fence	More greens,
e	Human-wildlife interactions	Reduced human wildlife conflicts, low

		human interference
f	Fodder species	no. of fodder species, increased greenery
g	Conservation ponds	no. of ponds, availability of water during winters, rainwater harvesting
h	Human-resource interactions	No. of meeting, and interactions

8.3.1 Manpower Required and Monitoring Cost

The manpower required for monitoring their specialization and periods are given in table 45 along with the proposed cost of monitoring.

Table 29: Table showing Details of Monitoring

Items	**Monitoring Team**	**Responsibility/TOR**	**Time/Period**	**Amount(NRs)**
Activity or Regular Monitoring	Staffs of SFDP	Annually prescribed activities their impacts	Activity implementation time	-
Compliance Monitoring	1-SFDO 1-FPDB 1- MoFE 1-MOITFE 1-CBOs,	Whether the prescribed activities are in line with the objectives. Providing corrective measures if otherwise.	Once in year	5,00,000

Impact monitoring (Third Party Monitoring)	Each one from MOFE, MOITFE, and Representative from each municipalities	Monitoring regular activities, their impacts. The impact monitoring comprises monitoring of the key baseline indicators whose pre-project baseline is well documented for a comparative environmental assessment in various stages of project development.	4th year, 7th year and 10th year	6,00,000
Total				**11,00,000.00**

The respective reports from monitoring will be recorded and used for correcting management activities.

CHAPTER 9: BENEFIT-COST ANALYSIS

9.1 Background

All kinds of developmental activities involves certain costs associated with its operation. Since, there are many competing activities that require investments, hence, every activities or project needs to consider its investments against its return. For a project to be viable economically, the internal rate of return has to be larger. The following chapter gives a brief pictures of cost and benefits analysis for.

9.2. Project Economic Benefit

The project economic benefits are divided into 2 different categories, direct benefits and supplementary benefits described briefly under following paragraphs.

9.2.1 Direct Revenue Creation

In the proposal of management plan, several activities have been proposed for annual management of the project. Harvesting of the timber from clear felling is a major source of direct revenue, however TSI and Thinning also generate revenue throught firewoods and poles. Total of 2610 ha have been the harvesting for 10 years, along with the harvesting, the details of the harvesting, thinning, TSi and their revenue generations is in the following table.

Timbers, logs and firewood are sold based on the Forest Products Sales and Distributions Guidelines 2073, however while analyzing the direct revenue part, the minimum pricing have been used. In addition, there are 2 nurseries which can produce a large amount of seedling. Seedling are not all planted in the clear felled sites, they are sold to public or public institutions.

9.2.2 Supplementary Benefits

Besides direct revenue creations, there are a number of supplementary benefits that makes Sagarnath more valuable and desirable project. There are greenbelts and wetlands whose services are very valuable. One of the prime benefits is the environmental services it provides, whose valuations is very hard to do. Its ecosystem services (regulatory, provisional) are very valuable,

giving habitats to several floras and faunas and some avian too, the list of flora and fauna are given in previous chapters.

Employment generation is another important factors. The staffing of SFDP itself is not enough while forest management and other activities are carried out annually, several skilled and semi-skilled manpower are required, which creates opportunity of employment.

There are many modern equipment like seasoning plant, distillation plants, and saw mills which will be operated by the involvement of private sectors. SFDP will be collecting the rent and other revenues from the usages of such machineries. This has been kept as supplementary benefits. Similarly, sand and gravel will be utilized from the various rivers are also benefits.

One of the major supplementary benefits that must be mentioned is its support to researches both long term and short term, which will be providing quality inputs to Sagarnath and academia as a whole. The research that we support annually will be based on operations of SFDP, which will help find out the pros and cons of existing operations, or also can give out the better ways of managing the plantation forest.

8.3 Project Cost

While preparing management plan, there are basically 2 kinds of activities proposed. One is core forest management activities and another is supporting activities. Forest management activities are cleaning, weeding, thinning, harvesting, coppicing, singling and TSI whereas others activities refer to HR training and capacity building, upgrading existing machineries, nurseries, building, and repairing and maintaining firebreaks and forest roads, construction of pond etc.

Forest management activities are not only cost bearing but it gives certain returns. Like with harvesting cost, there is products like logs, timber and firewood. Other works like weeding, cleaning, thinning are also ultimately for the better yield. Similarly, the cost of other activities are also contributing to betterment of forest condition and finally to the better yields.

Besides, there is regular administrative cost including salaries, stationeries, electricity. However, the cost of maintenance are not regular cost, as maintenance is not carried out annually. Maintenance and repair or upgrading have been planned once in a 3 or 5 year gap.

8.4 Summary of Benefit-Cost Analysis

Benefit-cost analysis of the management plan was carried out considering the proposed activities and expected forest products from different silviculture activities. The cost includes administrative cost and the cost of tending operation. The administrative cost includes training, salary, office expenses and machinery purchase and activities like fire control, nursery etc. Similarly, tending operations include plantation, replacement plantation, singling, weeding, cleaning, TSI, thinning and harvesting. At the same time, the plantation project generates benefits from TSI, thinning and harvesting. The unit costs of forest management activities are estimated from current year expenditure. Likewise, benefits in terms of timber and fuelwood were calculated based on the existing growing stock, and expected number of trees per ha during the harvesting period. This estimation assumes that only fuelwood is derived from thinning and TSI. This is the conservative estimation, and benefits may underestimate as there is a chance of having pole and timber production during silviculture treatments.

The present value (PV) of costs and benefits were estimated for the 10 year period in 10% discount rate. The selection of the discount rate is based on the rate of returns on debenture provided by the banks in Nepal at the time of the study. Based on these assumption, the estimated PV of costs for the plan period is NPR 793 million, and PV of benefits is NPR 1,281 million (Table 29 and 30).

The estimations also indicate that administrative cost dominates the cost headings, which shares 61% of the total cost over the time period. This is followed by thinning and harvesting. Replacement plantation and singling are minor activities, which share less than one percent of the total cost individually. Similarly, in benefits side, as expected harvesting produces the highest benefits which consist of almost 70% of the total benefits, followed by thinning (24%) and TSI (6%). The estimated benefit-cost ratio in the given conditions is 1.61.

If discount rate is reduced to five percent, which is equivalent to agriculture loan, then the PV of cost is NPR 928 million, and PV of benefits is NPR 1,481 million. The estimated benefit-cost ratio is 1.59.

Table 30: Costs of SFDP (Amounts in NRs .'000)

Year	Admin+Other cost	Thinning	Cleaning	Weeding	TSI	Harvesting	Plantation	Replacement plantation	Singling	**Total**
1	116,145.00	26,152.00	6,476.40	2,661.85	242.80	22,801.50	2,458.88	614.72	1,324.00	178,877.15
2	56,645.00	13,492.80	5,797.30	2,417.70	2,375.20	21,447.00	13,716.80	3,429.20	756.24	120,077.24
3	59,895.00	19,113.20	6,507.35	3,887.10	2,908.00	13,423.50	7,830.40	1,957.60	1,355.52	116,877.67
4	57,495.00	6,034.20	3,826.00	4,184.50	2,409.80	8,761.50	5,250.56	1,312.64	404.80	89,679.00
5	110,345.00	2,419.40	4,490.05	2,324.90	7,931.60	6,039.00	1,791.36	447.84	841.36	136,630.51
6	59,895.00	22,669.80	9,195.70	1,055.60	3,108.00	13,342.50	1,035.20	258.80	454.96	111,015.56
7	58,345.00	20,458.00	4,905.75	629.85	5,116.20	3,874.50	1,719.36	429.84	1,200.24	96,678.74
8	56,595.00	19,755.60	5,918.90	283.70	6,023.80	10,813.50	-	-	647.28	100,037.78
9	56,395.00	7,233.20	4,204.65	540.15	3,487.20	6,552.00	1,737.60	434.40	1,541.68	82,125.88
10	57,585.00	3,581.40	4,757.75	388.65	4,395.00	10,377.00	-	-	1,243.36	82,328.16
Present Value	485,601.26	101,055.40	38,561.50	14,377.42	23,432.95	87,578.09	28,992.36	7,248.09	6,549.21	**793,396.29**

Table 31: Benefits from SFDP (Amounts in NRs. '000)

Year	Thinning	TSI	Harvesting	Total
1	78,516.00	919.80	233,082.00	312,517.80
2	40,538.40	8,383.20	219,236.00	268,157.60
3	57,399.60	10,248.00	137,218.00	204,865.60
4	18,162.60	8,504.30	89,562.00	116,228.90
5	7,318.20	27,830.60	61,732.00	96,880.80
6	68,069.40	10,948.00	136,390.00	215,407.40
7	61,434.00	17,976.70	39,606.00	119,016.70
8	59,326.80	21,153.30	110,538.00	191,018.10
9	21,759.60	12,275.20	66,976.00	101,010.80
10	10,804.20	15,452.50	106,076.00	132,332.70
Present Value	303,571.75	82,488.45	895,242.67	**1,281,302.86**

CHAPTER 9: CONCLUSION & RECOMMENDATION

9.1 Conclusion

Through the implementation of the proposed management plan, more of the beneficial impacts are foreseen and little negative impacts are foreseen which are easily manageable, and doesn't require large preparation.

All mitigation measures as well as monitoring system prescribed for social, economic, cultural, biological and physical environmental impacts are necessary to be implemented. SFDP will be responsible for adopting these mitigation measures. Project management will co-ordinate between the project, government agencies, local community and other related line agencies involved in implementing the development of forest programme.

9.2 Recommendation

The mitigation measures should be thoroughly followed. The research that have been prescribed in management plan should be about impacts of the project while operating that will give the detail pictures of impacts, both negative and positive. The coordination shall be done with local, provincial and federal government. The capacity of the staffs regarding various silvicultural skills, record keeping, timber grading must be upgraded which is also prescribed in management plan. Effective monitoring required for the success of management.

Above all, it is recommended from EIA report that Sustainable Management Plan is a beneficial project which can largely benefit national economy, provide greater instance of plantation forests and bases for related research.

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