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Developing a participatory approach for roadside protection of rural roads in Nepal

Final Report

HELVETAS Swiss Intercooperation Nepal

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Cover Photo: Discussion with members of the local community interested in forming a RoW User Group in Bhajani, Kailali District
Photo by Ruth Schaffner, 2016

Quality assurance and review table			
Version	Author(s)	Reviewer(s)	Date

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ReCAP Database Details: [Project Title]			
Reference No:		**Location**	
Source of Proposal		**Procurement Method**	
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B: Logframe Indicators
(Note: The purpose of this section of the CR is to summarise the extent to which this activity has contributed to the ReCAP's higher level objectives. Where response is YES supporting documentation is required separate to the report)

Outcome	Question			Response *(Underline Answer)*
Sustainability	Did this project lead to any concrete examples of change, influenced by ReCAP research that will be applied to Km of road?			1. **YES,** *with XX km of Roads to be built* 2. No 3. Don't Know
	Were Partner Governments and/or other financiers involved in co-funding this research?			1. **YES,** *through Contributions in Kind (K)* **2. YES,** *through Core Contributions (C)* 3. No
	Type of Contribution: K – Funding of Trial Sections, Staff Time, Dissemination and Training C - Funding of Research Programme Core Costs, Research Contracts, Capacity Building and Knowledge Management	**Value of Contribution (in £ m)**	**Source:**	
Research and Uptake	Were any Peer-Reviewed Papers made available in open access format generated due to the implementation of this project?			1. **YES** 2. No

ReCAP Database Details: [Project Title]				
	1.3. Were any National Policies, Manuals, Guidelines and/or final research outputs been fully incorporated into Governmental/Ministerial Requirements, specifications and recommended good practice as a result of engineering research conducted during this project?			1. **YES** 2. No 3. Not Applicable If yes, provide Data
	1.4. Were any National Policies, Regulations and/or practises for Rural Transport Services been modified or introduced as a result of this project?			1. **YES** 2. No 3. Not Applicable If yes, provide Data
Knowledge Dissemination	3.1. Did this Activity result in a National Research Centre (NRC) being Linked to an electronic repository for rural transport Knowledge?			*4.* **YES**, *indicate which one* 5. No 6. Not Applicable
	3.2. Did this project Generate Knowledge Presented and discussed at a high level international development conference or debate?			1. **YES**, indicate name and date of conference 2. No 3. Not Applicable
	3.3. Was the knowledge generated by this project disseminated through workshops or dedicated training?			1. **YES**, indicate Theme, number of Participants and date of workshop 2. No 3. Not Applicable
Capacity Building	2.1. Did country-based African/Asian experts or institutions take lead roles during the implementation of this project?			1. Yes 1. **NO**
	Name	**Nationality**	**Position**	If yes, provide Data
	2.2. Was this project managed through a National Research Centre (NRC) and supported by ReCAP funding for technical assistance and capacity building?			1. **YES**, *with NRC being Operational-initiating, carrying out and producing papers from Research projects* 2. No
	2.3. Were female researchers involved in providing inputs at a senior technical level?			1. Yes 2. **NO**
	Name	**Position**	**Inputs**	If yes, provide Data

Abstract

With the aim to develop a participatory approach for roadside protection on rural roads in Nepal, an innovative approach is applied: To foster ownership by way of a Memorandum of Understanding and agreements between district authorities and local user groups.

The utilisation of RoW land along the roads of the District Road Core Network for poverty alleviation is a new concept. A clear legal provision for this purpose has not been enacted in Nepal so far. However, various policy and legal provisions have been endorsed in regard to plantation and to maintaining greenery in the RoW through local authorities. From this basis, appropriate legal instruments for the use of the RoW are developed.

Following investigations on legal, engineering and socio-economic conditions, suitable plants are chosen. Cost benefit analyses of the selected plants show that by involving the poorest of the poor in planting the RoW land for productive use their income can be considerably increased.

Detailed activities are proposed for the implement of this pilot project. Suggestions are given for a wider replication of the approach. A RoW Utilisation Manual is drafted, comprising the required legal, engineering, bio-engineering and economic aspects.

Key words

Rural roadside plantation, Right of Way, productive use, participatory approach, land policy, local self governance, cost benefit analysis, market chain

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Last but not the least, this report would not be complete without the information gained in discussions with farmers of Sukhad-Bhajani roadside of Kailali and Hile-Chhintang roadside of Dhankuta. The list of these individuals is too long to present here. We express our sincere gratitude to all of them.

Acronyms, Units and Currencies

Amt	Amount
B/C	Benefit Cost Ratio
Bigaha	Area of Land (1 Bigaha = 0.67 ha)
BS	Bikram Sambat (Nepali date)
CBO	Community-based Organisation
CE	Civil Engineer
CFD	Community Forest Division
CFUG	Community Forestry User Group
CIP	Community Irrigation Project
COI	Corridor of Impact
CoN	Constitution of Nepal
CPN (UML)	Communist Party of Nepal (Unified Marxist-Leninist)
CTC	Cut, Tear, Curl (a method of processing black tea)
CWDO	Child and Women Development Office
DADO	District Agricultural Development Office
DDC	District Development Committee
DDG	Deputy Director General
DFID	Department for International Development/UK
DFO	District Forest Office
DG	Director General
DNF	Dalit NGO Federation
DoA	Department of Agriculture
DoF	Department of Forest
DoLD	Department of Local Development
DoLIDAR	Department of Local Development and Agricultural Roads
DoR	Department of Roads
DPR	Detailed Project Report
DRCN	District Road Core Network
DRILP	District Decentralised Rural Infrastructure and Livelihood Project
DRSP	District Road Support Programme
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation and Watershed Management
DTMP	District Transport Master Plan
DTO	District Technical Office
DWSS	Department of Water Supply and Sanitation
EA	Electricity Act
EFLG	Environment Friendly Local Governance
EIA	Environmental Impact Assessment
ELAM	Informal Sector Enterprise Development and Employment Generation Programme HELVETAS
EPR	Environmental Protection Regulation
ER	Electricity Regulation
ESMF	Environmental and Social Management Framework
FA	Financial Analyst
FECOFUN	Federation of Community Forest Users Nepal
FGD	Focus Group Discussion
FNCCI	Federation of Nepalese Chambers of Commerce and Industry
FP	Forest Policy
FR	Forest Regulation
FS	Field Staff
GESU	Geo Environmental and Social Unit
GoN	Government of Nepal
HH	Household
HOTPA	Himalayan Orthodox Tea Producers Association
HQ	Headquarters

ICIMOD	International Center for Integrated Mountain Development
IEE	Initial Environmental Examination
IGA	Income Generating Activities
IR	Irrigation Regulation
IRR	Internal Rate of Return
IUCN	International Union for Conservation of Nature
LAcA	Land Acquisition Act
LAdA	Land Administration Act
LDO	Local Development Office
LE	Legal Expert
LILI	Local Infrastructure for Livelihood Improvement
LRA	Land Revenue Act
LRIP	Local Roads Improvement Programme
LRN	Local Road Network
LRUG	Local Road User Group
LSGA	Local-Self-Governance Act
LUP	Land-Use Policy
MoA	Memorandum of Agreement
MoEP	Ministry of Electric Power
MoFALD	Ministry of Federal Affairs and Local Development
MoFSC	Ministry of Forest and Soil Conservation
MoLD	Ministry of Local Development
MoLDFA	Ministry of Local Development and Federal Affairs
MoPE	Ministry of Population and Environment
MoPPW	Ministry of Physical Planning and Works
MoU	Memorandum of Understanding
MRED	Managing Risk through Economic Development
MS	Mild Steel
NCCSP	Nepal Climate Change Support Programme
NCP-M R	Nepal Communist Party-Maoists Revolutionary
NGO	Non-Governmental Organisation
NPV	Net Present Value
NRRS	Nepal Rural Road Standards
NRs	Nepalese Rupees
NTFP	Non-Timber Forest Products
ODF	Open Defecation Free
PMU	Programme Management Unit
PRA	Public Road Act
RAP	Rural Access Project
RCC	Reinforced Concrete
ReCAP	Research for Community Access Partnership
Ropani	Area of Land (1 ha = 20 Ropani, = 10'000 m^2)
RMG	Road Maintenance Group
RPP	Rastriya Prajatantra Party Nepal
RoW	Right of Way
RRRSDP	Rural Reconstruction and Rehabilitation Sector Development Programme
RTM	Regional Technical Manager
RVWRMP	Rural Village Water Resources Management Project
SDC	Swiss Agency for Development and Cooperation
SDE	Senior Divisional Engineer
SNRTP	Strengthening for National Rural Transport Programme
SOLVE	Society of Local Volunteer's Effort
SWOT	Strength, Weakness, Opportunities and Threats
TDA	Town Development Act
TL	Team Leader
ToR	Terms of Reference
UK	United Kingdom

US$	United States Dollar (US$ 1.00 ≈ 108 NRs)
VEECC	VDC level Energy, Environment & Climate Change
VDC	Village Development Committee
VPD	Vehicles per Day
WCO	Women and Children Offices
WIDMP	Water Induced Disaster Management Policy
WOCAT	World Overview of Conservation Approaches and Technologies
WSSDO	Women's Skills Development Organisation
WWF	World Wildlife Fund

Contents

List of Annexes

1 Executive summary

The construction of rural roads, with the objective of providing improved access to the rural population, has been one of the top priorities of the Government of Nepal. As a result, the construction of rural roads of various categories has been progressing at a rapid rate. Of these roads, about 21'500 km are included in the District Road Core Network (DRCN), which falls under the direct responsibility of the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR).

Legally, DRCN roads require a 20 m wide Right of Way (RoW). The total land of this RoW in Nepal amounts to be around 30'000 ha. It is estimated that nearly 21'000 ha of this RoW land could be planted for productive use in favour of poor communities for income generating activities.

The overall aim of this research is to analyse existing practices and to develop innovative approaches for the successful management of land within the RoW of the DRCN. This aim is to be achieved by identifying appropriate legal requirements, assessing engineering shortcomings and by recommending suitable plants for productive use based on comprehensive selection criteria, which include a thorough socio-economic analysis.

In this pilot project, the investigations was limited to one road each, in two districts only. At first, valuable information on legal provisions, road documents, roadside plantation and socio-economic preconditions was gathered through desk and literature review as well as interviews with government agencies and relevant stakeholders at national level. The inception week culminated in an inception workshop, where research methodologies, institutional conditions and selection criteria for the roads to be researched and the plants to be proposed were presented and discussed. At this workshop, the representatives of concerned government agencies, especially head and leading engineers of the DoLIDAR, chose the two districts in which to carry out the research, namely Kailali in far western Terai and Dhankuta in Nepal's eastern hills.

Field visits to the two selected districts were carried out. During stakeholder consultations with officers of the District Development Committee (DDC), with representatives of similar projects and with Village Development Committee (VDC) officers and the Municipality the pilot project was presented and discussed. The DRCN was screened on the basis of available documents and supported by stakeholder comments at district level in order to select one road in each district suitable for piloting. The choice fell on the Sukhad-Bhajani road in Kailali and on the Hile-Uttarpani-Chhintang-Jyamire road in Dhankuta.

A first reconnaissance survey along each road enabled the research team to preselect suitable road sections. Through field observations these sections were then screened with regard to road conditions, site conditions, plants being used in the area and the respective processing and marketing facilities. Thorough community investigations it was revealed that there is a feasible institutional setup and a willingness of the communities to participate in such a pilot project.

The collected information was analysed with regard to the four relevant topics of the research: In the first step, the legal adviser proposed the institutional set up for the project implementation together with a draft Memorandum of Understanding (MoU) and draft Memorandum of Agreement (MoA). For the engineering requirements details were worked out on design standards, cross sections, engineering structures and their costs. A list of potential plants for roadside plantation for productive use also covering bio-engineering requirements was compiled. Field observations and socio-economic considerations were combined with the financial analysis of a range of optional plants. On this basis, specific

plants for the pilot areas were proposed: Local banana for Kailali and broom grass for Dhankuta.

The results are presented and discussed in this Final Report. The main conclusions are:

- The concept of utilising the RoW land is new in Nepal. There is neither a formal institutional mechanism already in place, nor have any specific legal instruments yet been developed to support this concept. With the aim of signing a tripartite MoU for the use of the RoW land along a particular road section, it is essential to note that a wider consensus on matters related to benefit sharing mechanisms and the roles and responsibilities of the different government institutions such as VDCs, municipalities, DDCs, and DoLIDAR itself will be needed.
- There is already widespread experience on the use of bio-engineering plants for road side stabilisation, but there is scarce experience on road side plantation for productive use. On the basis of field observations, discussions with the local communities and considering socio-economic criteria, the team could – from a range of potential plants - identify suitable plants for productive use along the DRCN in Kailali and Dhankuta.
- If the pilot is to be a success, it is advisable not to choose plants on which information on costs and benefits are not available, or for which neither the skills for processing nor a market chain is yet in place. Not every plant can be used for plantation by the poorest of poor who lack farming and marketing experiences. Much rather, we recommend to select crops with a high return on investment. Such plantations must be strictly feasible, realisable and appropriate in the given context.
- The pilot itself is already innovative, and the research team assumes that there is no additional space for further innovative ideas regarding plant species, cultivation and marketing. Nevertheless, for a wider replication of the pilot project, and with the option to plant larger areas of RoW land, alternative utilisation options, technologies and approaches could be investigated.

Future activities are proposed on how to implement the pilot project in Kailali and Dhankuta. Suggestions andrecommendations on how to transfer the experiences of the pilot project towards a nationwide replication are supported by a draft RoW utilisation manual.

2 Background

The construction of rural roads, with the objective of providing improved access to the rural population, has been one of the top priorities of the Government of Nepal (GoN). As a result, the construction of rural roads of various categories - DRCN, Village Roads - has been progressing at a rapid rate. According to recent estimate provided by the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR), Nepal has constructed 50'944 km of rural roads up to present. Of these roads, about 21'500 km are categorised as District Core Road Network. This DRCN falls under the direct responsibility of the DoLIDAR.

Legally, DRCN roads require a 20 m wide RoW, 10 m on either side of the road centre-line. Considering this standard, the total land area available under the RoW of the DRCN amounts to approximately 30'335 ha. Assuming a conservative estimate of 70% of the DRCN's RoW land could be used productively, nearly 21'000 ha of land would be available to poor communities for Income Generating Activities. Allowing local poor households) to gain benefit from IGA on RoW land could increase their motivation to manage the RoW land on a sustainable basis.

Despite huge investment in the DRCN, the operation of these roads is not satisfactory. Still most of them operate during the dry season only. A key reason for this has been the inability to identify and establish a robust mechanism for the road maintenance that may include the proper use of the RoW land. Currently, a major part of the RoW has been encroached upon and used inappropriately, triggering soil erosion, landslides and road accidents. This situation has increased the liability for the GoN and has accelerated the deterioration of the road. Against this backdrop, identifying a new approach for sustainable management of the RoW land, linked to prospective income generating activities, is a significant Initiative.

The overall aim of the current project is to analyse existing practices and to develop innovative approaches for the successful management of land within the RoW of the DRCN. This aim is to be achieved by developing a concise RoW utilisation manual and by identifying appropriate legal requirements, as an essential basis for effective project implementation.

3 Research objectives

The research objectives of the research include:

- Identification of legal arrangements and agreements required between national, district and local level, in order to develop formats for MoU and MoA.
- Identification of pilot project districts and sites in mountainous, hill and plain regions of Nepal, in which a full pilot project is to be developed, for implementation under a subsequent phase of the project.
- Selection of suitable plant species based on bio-engineering requirements, existing local experience and complimentary literature review.
- Recommendations on how such plants can be planted, protected, maintained, harvested, processed and marketed.
- Design and introduction of suitable infrastructure, such as fencing, small retaining toe walls, road drainage or ground levelling to improve the land management. Assessment of the potential costs of such activities and infrastructure on behalf of DoLIDAR.
- Development of a business plan for DoLIDAR, including respective benefits versus all costs, which will support further replication of the project.

Capacity building was imbedded by including DoLIDAR, DDC and VDC officers in the stakeholder consultation process so that they are clear about the project. In addition, knowledge exchange and dissemination of the findings were done through two workshops - inception and final- organised by DoLIDAR in collaboration with ReCAP.

4 Methodology

The project methodology is based on the following main pillars:

- Desk and literature review
- Stakeholder consultations at national, district and local level, including inception workshop
- Field observations and assessments
- Analysis, reports and recommendations

The desk and literature review enabled an understanding of current national and international experiences on the use of RoW land, participatory measures and instruments, technical options, as well as legal provisions based on the national and local legal frameworks. The reviewed key documents is given in Chapter 5.

During the inception phase, stakeholder consultations were held on a national level, primarily directed towards the issue of determining feasible selection criteria and identifying appropriate districts for the pilot project (for the list of people consulted see Annex A). An inception workshop was then held, with the aim to disseminate the project concept to a wider group of stakeholders, to discuss and approve the devised methodology and to select the districts for the pilot project. Chaired by the DG of DoLIDAR, policy-makers and practitioners of the road sector participated in the workshop (see Annex B for the list of participants). Concluding an extensive discussion, it was decided on the two districts, namely on Kailali (Far Western Development Region, Terai) and Dhankuta (Eastern Development Region, hilly) in which to conduct the pilot project. The working methodologies and procedures, as given by the Terms of Reference (ToR) and confirmed by the team during the inception week, were fully agreed upon. Following the inception week, a specific road was then identified in each of the pilot districts, supported by DoLIDAR and DDC.

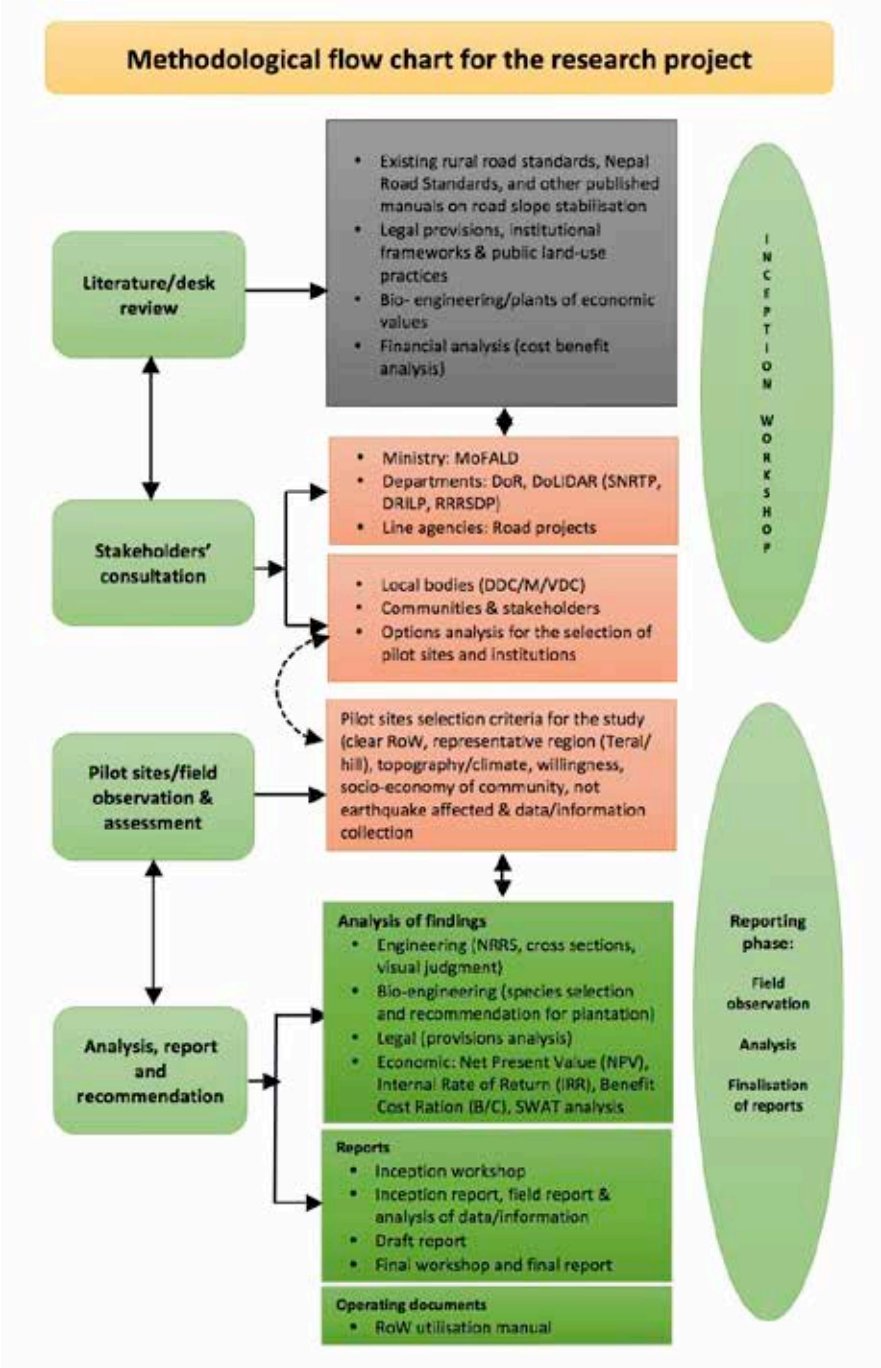
The research team visited the two selected districts to consult the district level and local stakeholder and to conduct the field observations and assessments. During the meetings at each of the two DDCoffices the legal issues, engineering and plantation for productive use as well as socio-economic matters of the region were discussed together with the respective officials and with representatives of concerned Non Government Organisations (NGOs). During reconnaissance visits to the selected roads potential sections for the planting activities were assessed and contacts with the communities, municipalities and road users were established. Two to three favourable road sections per district were then chosen by the team. These sections were visited a second time and surveyed in more detail, with the aim of identifying the most suitable section from all the team member's professional perspectives. During this second visit, the concerned village and municipality level offices and people were consulted and meetings with user groups ready to get involved in the pilot project were held. The field trip notes, including the list of people consulted at district and local level and maps of the selected road sections are given in Annexes C, C1 and D, D1 and the photo-documentations are given in Annexes E and F.

The flow chart in Figure 1 gives an overview of the research methodology. In the following section, the specific methodology applied for each of the four project components (legal framework, engineering, plantation and socio-economic analysis) is described.

4.1 Methodology for assessing the legal framework

Desk and literature review on legal and institutional issues: Nepal has developed land-use sector policies and various legal instruments on environmental protection and infrastructure development. Environmental friendly economic development and poverty alleviation is an important constitutional policy of the state.

Figure 1: Flow Chart illustrating the methodology of the research project



Major policies and legal instruments in the field of land-use, environmental protection and infrastructure development were analysed in order to explore the legal options for utilising RoW land for poverty alleviation. Other relevant publications of Department of Roads (DoR), DoLIDAR, the DDCs of the selected districts and HELVETAS were also reviewed.

Management plans and other relevant documents of community-based natural resource management groups (agriculture, forest, and water user groups) were reviewed with the aim to gain a local understanding as a basis to identify poor HHs and activities for the utilisation of public lands including RoW.

The institutional framework envisioned in the Local Self-Governance Act (LSGA) 1997, the Public Road Act (PRA) 1974 and the Forest Act 1993 for utilisation of the RoW was reviewed in order to analyse and explore the potential institutional setup for coordination, monitoring and implementation of income generation activities in the RoW for poverty alleviation. This knowledge forms the basis for district and local stakeholder consultations, which are instrumental for recommending an appropriate institutional mechanism for the future.

Stakeholder consultations at district and local level: District and community level meetings were organised in the selected districts, in which the institutional set up for implementing income generation activities for poverty alleviation by utilising the RoW was identified. A simple checklist and open-ended questionnaire had been developed as a basis for these meetings. All consultation meetings were organised in close coordination with DoLIDAR and the DDC and District Technical Office (DTO).

Analysis, reports and recommendations: A manual for the utilisation of the RoW including the formation of a User Group/Sub-Committee at local level was drafted. Formats for MoU and MoA were drafted which will form bases to set-up the contractual agreements between the DDCs and the concerned local communities and to settle the utilisation of the public land of RoW for plantation and income generation (see Annexes G and H).

4.2 Methodology for evaluating engineering measures

After the inception phase including the ***desk and literature review*** as well as ***stakeholder consultations*** at national level, the team met with the DDC and DTO to obtain technical information on the road sections identified for this pilot project. The pilot project is meant to be in a position to start implementing plantation and engineering works right after the research is completed. Therefore, the aim was to find suitable sections that would allow immediate plantation, without the need to construct additional slope support structures (except i.e. fencing).

Field observations and assessment: The team conducted a reconnaissance survey along the identified road sections with the aim to gain an overview of the road, the soil profile, the availability of construction material nearby and of other general information about the road and its alignment. On the basis of this reconnaissance survey, the most suitable section was selected, and a more detailed survey conducted on this section. Cross-sections are an instrumental basis for choosing plant species, designing toe wall and other retaining structures and designing fencing items during the preparation of the project proposal. However within the limited research period, it was not feasible to obtain cross sections of the roads by conducting detailed topographical surveys of the road using sophisticated equipment, such as a Total Station. Therefore, As-Build Drawings on cross sections of the respective road sections were obtained from the DDC. These were then verified in the field and any discrepancies documented. In cases where As-Built Drawings were not available, the

consultant team established basic cross sections (formation width of the roads, side drains, cut and fill slopes, etc.) during field inspection in 100 m intervals. Considering the topographical features of the roads, the established cross-sections and the types of plant species proposed for plantation, adequate civil engineering requirements were designed. The field survey of the selected road sections was supported by a detailed photo-documentation.

Analysis, reports and recommendations: As a basis for the cost-benefit analysis and resulting project recommendations, the approximate costs of the above proposed technical works were assessed. To this end, a rate analysis was carried out for each engineering item required. Unit rates were developed identifying the unit inputs of equipment, materials and labour. Then, respective costs were estimated as follows: Prevailing market prices for construction materials were collected from local suppliers and agencies. The cost of labour was based on district wage rates for various categories of manpower necessary for the execution of the work. Finally, detailed quantities were estimated from the established drawings. The resulting (total) costs were derived by multiplying the estimated quantities of each work item with the respective unit rate.

4.3 Methodology for plant selection

In a first step, a thorough ***desk and literature review*** was carried out in order to gather available information on roadside plantation, an issue that has been pursued in Nepal road construction for the last four decades. Since plantation for productive use is scarcely covered in the existing literature, it was necessary to also review publications on food and fodder plants of Nepal, and to look into on-going projects in the agricultural and forestry sectors. The desk study was followed by ***consultations with stakeholders at national level***, so that information on their experiences in related fields could be included.

The factors for assessing site conditions for plantation for productive use are similar to those used for site assessment in bio-engineering:

- altitude
- climate, e.g. temperature, rainfall
- orientation of slope
- soil type, fertility, moisture

A crucial step in the ***plant identification*** process is the preparation of criteria for plant selection. In general, the ***bio-engineering properties*** of the optional plants for roadside plantations must be considered. Thus the selected plant should include the ability to catch, armour, reinforce, anchor, support or drain a slope.

With regard to plants for ***productive use*** in particular, the above plant selection criteria common for bio-engineering were supplemented by socio-economic considerations such as:

- Occurrence in the area
- Suitability for roadside planting
- Availability of saplings, seeds, cuttings etc.
- Availability of nurseries
- Suitability for productive use
- Common or known species for productive use in the area
- Skills for cultivation developed or on the job assistance available
- Skills for processing cash crop (or organisation to implement process) in place

Based on the desk review and stakeholder consultations on national level, as well as on the practical experience of the consultant, a comprehensive list of plants to be considered was

composed by cross checking lists of plants recommended for bio-engineering with compilations of food and fodder plants of Nepal (refer to Annex I). This list was specified for the local conditions at the pilot sites, through discussions with stakeholders and communities at district and local level (DDC/VDC/communities) and through observations during the field visits (refer to Annex J). Finally, the plant selection must also have a practical approach since the proposal should be applicable by the user groups designated to do the plantings.

4.4 Methodology for the socio-economic analysis

For ***community mobilisation***, information was collected on the villages/municipalities and the settlements along the road. Existing institutions in the area were identified, e.g. Local Road User Group, Forest User Group, Irrigation Water User Group, Drinking Water User Group, as well as current users of RoW land. The list of members and their wellbeing ranking was collected, and the list of office bearers of such organizations. Meetings were organised with these communities. The interested people to participate in the program were identified. With the VDCs/Municipalities support options for the pilot project were discussed.

Data on ***costs and benefits*** were collected from primary and secondary sources.

For the costs, wage rates were used as per the rates fixed by the government, or based on data obtained from the VDC secretaries. Information not available at the district level offices was collected from the community level via in-depth interviews with the farmers, local merchants, key informants, the VDC secretary, and through focus group discussions (FGDs). Other norms were taken from secondary information, such as reviews on the results of previous studies in various Asian countries, as well as from reports or project documents on related activities in Nepal (e.g. river-side plantation).

Information particularly for the Hile-Chhintang road was gained from traders along the road, published documents, the tea estate and the tea coffee development board.

Information particularly for the Sukhad-Bhajani road in Kailali was obtained from the District Agricultural Development Office (DADO) and the Mercy Corps. In case of differences in rate the one used by the DADO is applied.

Benefits were estimated according to the type of the expected output. Only direct benefits were captured. Output and value of the products were estimated from the record of the DADO and other relevant I/NGOs offices, the tea estate, the tea / coffee development board and from published documents. Information on the nature of return, gestation period and life of plant or crop was obtained from the district level offices as well as from the villages.

The ***financial analysis*** is based on three (basic) criteria:

1. Net Present Value (NPV)
2. Internal Rate of Return (IRR)
3. Benefit Cost Ratio (B/C)

Additionally, a value chain and a Strength, Weakness, Opportunities and Threats (SWOT) analysis for the selected plants were conducted in order to show the comparative advantage of various alternative plants in the selected RoW section.

5 Review of key documents

5.1 Legal and institutional framework

Nepal has developed some land-use sector policies and various legal instruments on environmental protection and infrastructures development. Environmental friendly economic development and poverty alleviation is an important constitutional policy of the state. Therefore, the following major policies and legal instruments were analysed to explore the legal options of utilising the RoW for poverty alleviation:

To identify the ***legal opportunities*** for the utilisation of the RoW:

The Constitution of Nepal (CoN) 2015, the PRA 1974, the Land Acquisition Act (LAcA) 1977, the LSGA 1999, the Local Administration Act (LAdA) 1971, the Land Revenue Act (LRA) 1978 and the Town Development Act (TDA) 1998.

To identify the potential ***role and responsibilities of authorities and local communities*** in the implementation of this project:

The Forest Regulation (FR) 1995, the Environmental Protection Regulation (EPR) 1997, the Directives to provide forest for other purpose, the Strategy for Infrastructure Development and Operation within protected areas, the; Rural Road Maintenance Directives 2008, the Community Forestry Development Guideline (Revised 2015), the Program of Forest decade (10 year) Procedure 2015 and the National Road Standards/Nepal Rural Road Standards, revised 2015.

To explore the ***government's commitment towards providing policy support*** for roadside plantation and implementation of the proposed project in the future:

Land-Use Policy (LUP) 2012, Forest Policy (FP) 2015 and Forestry Strategy 2015

Based on the analysis of all abovementioned legal provisions, it has found that various provisions are given in the current laws and policies towards supporting the initiative proposed here.

5.2 Engineering

In the context of engineering, the key documents are the Nepal Rural Road Standard and the Nepal Road Standard.

The ***Nepal Rural Road Standard (NRRS)*** defines the classification and geometric design standards for the Local Road Network (LRN) to be followed by all those involved in the development of the road network, including User Committees, VDCs, DDCs/DTOs, DoLIDAR and its development partners. The NRRS classifies the roads as follows:

District Road Core Network: Important roads joining a VDC Headquarters (HQ)'s office or nearest economic centre to the district HQ, either via a neighbouring district HQ office or the Strategic Road Network.

Village Road: Smaller roads not falling under the DRCN category, including other Agriculture Roads. Village roads are further classified as Hill or Terai roads, based on the topography of the country.

The ***Nepal Road Standard*** provides recommendations on the side slopes of embankments and cuttings of road. For instance 1:2 (Vertical: Horizontal) for roads with an embankment height 4.5 to 12 m, and 1:2 to 1:1 for the cutting side slope in ordinary soil condition. But wherever possible flatter slopes are recommended for traffic safety.

In addition to the literature review, key individuals working in these areas were consulted in order to discuss issues such as the actual width of the RoW, and to obtain road project plans and As Built Drawings.

5.3 Plant selection for productive use

In regard to plant selection, focus was given particularly to bio-engineering experience. Hence the literature review considered existing bio-engineering manuals on previous efforts and approaches and their results. Nepal has excellent experiences in this field, especially concerning the combination of bio-engineering and small civil engineering structures.

The field of bio-engineering developed significantly during the decades of 1970 and 1980, based on experiences gained from the Lamosangu-Jiri and Dharan-Dhankuta road projects, which were piloting these issues at that time. These experiences were later taken up as effective low-cost slope stabilisation technologies on other roads in Nepal.

The Department of Road of the GoN has accumulated a wealth of knowledge in this field, best documented in the "Reference Manual and Site Handbook on Roadside Bio-engineering" by Howell (1999). HELVETAS Nepal developed guidelines/field manuals and documented best practices in "Vegetative Soil Conservation Measures, A Field Manual" by Meyer (1987), as part of the Tinau Watershed Project in Tansen. In the framework of the District Roads Support Programme (DRSP), Swiss Agency for Development Swiss Agency for Development and Cooperation (SDC) supported the development of instructive guidelines on 'Integrated Techniques for Slope Stabilisation in Rural Road Construction in Nepal' (Shankar, 2011).

The recent paper on "Community-based bio-engineering for eco-safe roadsides in Nepal" by the University of Lausanne, the International Union for Conservation of Nature (IUCN), Nepal and the Department of Soil Conservation and Watershed Management (DSCWM), GoN, gives a good insight on actual practices.

It became clear that even though there is much information available on roadside protection and stabilisation by bio-engineering measures, information on plantation for productive use is scarce, with the exception of some indications in the above mentioned International Centre for Integrated Mountain Development (ICIMOD) paper. Hence, it was very useful to also rely on compilations of food plants of Nepal, e.g. "An Introduction to Nepalese Food Plants" by Regmi (1982). It was also useful to look into on-going projects in the agricultural sector.

5.4 Socio-economic matters

Literature related to cost benefit analyses of RoW plantations is scant. However, some studies do discuss the costs and benefits of plantations on public lands, or commercial plantations of different forest species on private or public lands in various Asian Countries. Studies by Mamat et al. (2010), Ra and Kimsun (2012), Islam et al. (2012) and Maturana (2005) have conducted a cost benefit analysis on plantations using the NPV, the IRR and the B/C as indicators for decision-making or evaluating different alternatives. Guenat and Uyen (2011) have conducted a cost benefit analysis for interventions supported by the SDC in Vietnam through the PSARD project by using the same three indicators.

In Nepal, some NGOs and INGOs are supporting the farming of different crops and plants in the Terai and Hill region. The economic analyses for these studies are also based on the indicators of NPV, IRR and B/C ratio (ICIMOD, 2013a; Helvetas, 2015a, Pathak et. al., 2014).

6 Results and discussion

The legal arrangement on land tenure of the RoW and its utilisation is an important issue for this pilot project. Therefore, the constitutional and legal provisions, including regulatory provisions as well as policy frameworks, were carefully reviewed. The analysis of existing legal provisions on the utilisation of the RoW and the legal jurisdiction of local bodies revealed a consistency between the legal provisions of the PRA 1974 and the LSGA 1999, because both acts delegate the responsibility for the utilisation of the RoW to local bodies through local communities. During the consultations at various levels, it was identified that the willingness of stakeholders and local communities is strong and therefore, from a legal point of view, the environment for the implementation of this pilot project is conducive.

With a few exceptions, none of the district roads in Nepal have a clear RoW in place. To find roads with a clear 20 m RoW will be a major challenge during the wider replication of this project. Furthermore, the existing roadside furniture and structures are not in a good condition.For instance, existing side drains do not serve their purpose, and the slopes of the roads do not comply with the Nepal Rural Road Standards. Considering these aspects, if going for wider replication, the preparation of a detailed project report including a Bill of Quantities of the road to be selected would be the best way for minimizing the problems.

Along the flat areas of the road in Kailali, little bio-engineering is required, except for some cover against topsoil erosion. The road in Dhankuta leads along a ridge and at certain places with steeper slopes some bio-engineering support might be needed. Several plant species have the potential to be planted for productive use in the RoW. Based on the various selection criteria, the team proposes the most feasible options. On the Sukhad- Bhajani road of Kailali banana and sugarcane are the plants of choice. On the Hile-Chhintang road in Dhankuta the choice fell on amriso and tea.

During the socio-economic investigations a cost benefit analysis for the proposed plants was conducted, and the IRR and NPV calculated. A SWOT analysis and value chain analysis for two plants per district provided a good basis for decision-making. Based on these analyses, the team concludes to propose to plant local banana in Kailali and amriso in Dhankuta.

The following chapters provide detailed results on the four main aspects of this research - legal framework, engineering matters, plantation for productive use and socio-economic considerations.

The field trip notes including the list of people consulted at district and local level are given in Annex C and D, the photo-documentations for both districts are given in Annex E and F.

6.1 Legal and institutional mechanisms relating to the use of the RoW

Nepal has formulated various policy instruments to maintain socio-economic and environmental sustainability in the land-use sector including public road, forest, water, wetland and land (ICIMOD, 2000). Specific legislative instruments have also been enacted for the land-use sector. Utilisation of the RoW of any public roads of the DRCN for poverty alleviation and silent land reform is a new concept and therefore, a clear legal provision for this purpose has not been enacted so far.

6.1.1 Legal provisions on utilisation of RoW

It was found that various policy and legal provisions have incorporated policies for plantation in order to maintain greenery in the RoW through the local government and local communities (John Howell, 1999, GoN, 2015). The main policy and legal provisions in Nepal for the utilisation of the RoW are as follows:

6.1.1.1 Legal framework for RoW utilisation

CoN: According to the constitutional provision of Nepal provincial level roads fall under the jurisdiction of the province while local, rural and agricultural roads fall under the jurisdiction of the local government (Art. 57). Forest-related matters are included in the concurrent list of powers given in the Constitution.

LAcA, 1977: According to this act, if land ownership is acquired by the GoN, or any institution, no person shall construct any building, shed, wall, etc, on such land, or cultivate this land without the written approval of the GoN or the concerned institution. Similarly, in case any person constructs any building, shed, wall, etc., or cultivates the land in contravention of this provision, the GoN or the concerned institution may confiscate such structure, or the crop grown on that land, without paying compensation (Sect.32).

LRA, 1978: This act states that the road and roadside is a public and government land.

NRRS 2055 BS, revised 2071 BS (2015): This standard defines the area of the RoW. According to this standard, the area of the RoW depends on the importance of respective roads and possible future development. The recommended RoW and building line for various types of district roads (core network) is 20 m and the setback distance from the road-land boundary/RoW to the building line on either side is 6 m for district roads (core network). In case the existing RoW is wider than the value defined above, the existing available width shall be adopted as RoW. During the utilisation of the RoW by local communities for income generation, they should follow the DoLIDAR District Road Standards, 2014.

PRA, 1974: This act states that the DoR shall plant trees on the right and left hand sides of a public road, as per necessity. The act delegates the duty to take care of and protect the trees planted in the RoW to the concerned VDC or municipality. According to this act, the responsibility of the DoR is to trim the trees planted in the RoW and to remove such trees if they obstruct the movement of traffic. The act further states that the DoR can order any other actions mentioned in this act to be carried out by any other person or organisation as prescribed in the law (Sect.16). If a person roots out or cuts any tree planted in the RoW without permission, such person shall be punished with a fine of up to two thousand Rupees (Sect.30).

LSGA 1999: This act delegates various and sufficient duties, rights and responsibility to the local governments for the utilisation of the RoW. The act states that the Ward Committees under the municipality or VDC are responsible for keeping the roads neat and clean (Sect. 25). The VDC has the duty and power to prepare projects on tracks and trails as well as rural roads required within its area, and to implement the same and make arrangement for their maintenance and repair (Sect.28). The municipality or VDC has the power to hear and settle at first instance the cases related to encroachment on roads or way-outs (Sect.33). Roads that are not owned by other agencies are a property of the VDC, and the VDC can impose taxes or levies on the use of roadsides, within its area (Sect. 55, 68). The duty and power of the municipality is to ensure plantation on either side of the roads and other necessary places in the municipality area (Sect.96). Trees on either side of the roads are a property of the municipality (Sect. 134). The function, duty and power of the DDC is to prepare a master plan of district-level roads in the district development area (Sect. 189).

TDA, 1998: The Town Development Committee may classify the land within its jurisdiction for various purposes and this committee also has the authority to develop plans for the protection or conservation of the roadside land or RoW.

LAdA, 1971: The CDO has the authority to maintain peace in road related issues or conflicts including issues related to the use of the RoW (Sect. 6C). The CDO also has the authority to issue orders to control the free movement of cattle on the road including the RoW (Sect. 9).

FR, 1995: This act states that if local users or others have planted and protected trees on any public land outside the national forest area, or if the local users desire to plant trees on such land after constituting a user' group and obtaining the approval of the agency owning the land, on the condition that the concerned agency itself retains the ownership of the land, the District Forest Office (DFO) may grant recognition to such area as a Community Forest (Rule 26). According to the Community Forestry Development Guideline, Revised 2015, the DFO may recognise a forest at the roadside as a community forest only after getting approval from the owner of such roads. The Forest Decade (10 year) Procedure 2015 made a provision to provide seedlings/plants to involve communities or agencies in the plantation on roadsides.

EPR, 1997: An Initial Environmental Examination (IEE) report must be prepared for the construction of district roads, urban roads, rural roads and small feeder roads. Roadside plantation is an important mitigation measure to address environmental impacts of such roads (DoLIDAR, 2013; DoR 2013).

The GoN has formulated ***Directives to provide forest for other purpose (2063 BS)*** and a ***Strategy for infrastructure Development and Operation within Protected Areas (2065 BS).*** According to these instruments, national priority projects including roads must implement plantation projects in other areas as a compensation for forest loss, and must protect these plantations for five years before handing them over to forest agencies. Such activities can also be implemented through the DFO, or through affected local communities living along the roadsides.

Poverty Alleviation Fund-Vulnerable Community Development Plan/Operational Manual, 2006: The Poverty Alleviation Fund can provide support to vulnerable communities for poverty alleviation related income generation activities, such as community forestry or the utilisation of the RoW on agricultural roads under multi-community proposals.

Irrigation Rules 2000 as well as electricity related legal instruments also state that the RoW of irrigation channels and high-tension lines of electricity grids can be utilised by local communities for plantation and poverty alleviation purpose.

Finally, various legal arrangements have been developed in Nepal for the utilisation of the RoW of various public lands including riverbeds, irrigation channels and high-tension electricity lines. Such legal and procedural practices can also be replicated in the RoW of district roads for their utilisation towards poverty alleviation (ICIMOD, 2013). For an overview of the legal framework see Table 1.

6.1.1.2 Policy framework for the utilisation of the RoW

Some policy documents of the GoN have made specific provisions for the utilisation of the RoW:

The goal of the ***Land-use Policy, 2069 BS*** is to develop land-use plans for the utilisation of the RoW of main roads within 5 years of the commencement of this policy.

The GoN will promote the maintaining of green belts in the RoW, and these green belts will be conserved and managed by the local government (Strategy 8.4.3).

The ***FP, 2015*** also places a high emphasis on roadside plantation. Implementation of plantation activities on roadsides in order to maintain environmental friendly infrastructure is one of the important strategies of this policy.

The ***Water Induced Disaster Management Policy (WIDMP), 2015*** has also made a special provision for plantations in the RoW, with the aim to mitigate landslides and floods. These legal provisions, which apply to the utilisation of riverbeds towards generating income for poor and landless groups, may also be applied to the use of the RoW by poor HHs of local settlements.

6.1.1.3 Tenure arrangements for the utilisation of the RoW

The PRA, 1974 and the LSGA, 1999 are main legal instruments for the utilisation of the RoW of the DRCN as well as rural and agricultural roads in Nepal. The PRA specifies that the owner of the RoW is DoR, though DoR should mobilise the local government or any other institutions/communities for the plantation and its protection in the RoW. In this way, the land ownership over the RoW is vested with the DoR and only the use rights over the RoW may be handed over to the local government or local communities based on the contractual arrangements between DoR/DoLIDAR/DDC and the local communities.

In practice, the DoR has delegated its role and responsibilities to DoLIDAR for the utilisation of the RoW. DoLIDAR in turn has created an environment conducive for the DDC and other local governments to mobilise local communities to conserve and manage the RoW, because based on this procedural arrangement, the DDC is the main responsible local government for the management of the DCRN and its RoW.

According to PRA, the land ownership over the RoW is vested with the DoLIDAR/DDC and the LSGA has also given authority to local bodies for the management and utilisation of RoW. Therefore, without making formal contract with DoLIDAR/DDC and Municipality/VDC, no any communities, institutions and individual can use the land of RoW. Therefore, if any local communities are interested to use the RoW, they have to enter into a contractual process with DoLIDAR/DDC and Municipalities/VDC and in this process a tripartite MoU is one of the trustworthy options for local communities and government agencies. Similarly, after making such MoU, local communities and local bodies as well as relevant government agencies can conduct a MoA between/among them for the sustainability of a RoW utilisation programme. The template of MoU and MoA are proposed and prepared considering the existing legal provision of LSGA and experiences of local bodies and local communities who are implementing various local level community development activities based on such MoU and MoA. Such practices are also established in other sectors (channel, electricity line, wetlands, and riverside land) for the use of public land and RoW.

The CoN has given the rights to local governments to govern and manage their local, rural and agricultural roads. The LSGA, 1999 has also given significant power, duties and responsibilities to local governments (VDC/Municipalities/CDC) for the utilisation of the RoW. However, the LSGA has not given the respective land ownership rights over the RoW to the local governments. Accordingly, local governments can develop plans and programmes for the utilisation of the RoW by themselves or through local communities. Considering these legal provisions of the PRA and the LSGA, the DDC/Municipality/VDC and local communities can enter into a tripartite agreement such as a MoU (Annex G) and a MoA, Annex H) for the utilisation of the RoW through local communities with the aim of alleviating poverty and maintaining greenery.

During the consultation with various agencies and stakeholders including local communities, the issue was raised that the entitlement over the land of the RoW is still vested with land owners in cases where the government has not formally acquired the land of the RoW. In

Table 1: Legal matrix on the utilisation of RoW public land in Nepal

Public land	Legal instruments	Operating instruments	Contracting entities	Responsible government agencies	Implementing communities	Activities	Benefit sharing
Public land (owned by local bodies and other institutions)	FR, 1995 (Rule 26.2)	Bylaws of CFUGs and Forest Operational Plan	Owner of public land and CFUG	Owner of public land and DFO	CFUGS	Plantation, conservation and utilisation of products	Based on contract and operational plan
Riversides land	FR, 1993, 1995 (Sect. 31)	Operational plan approved by DFO	DFO and poor community based leasehold forest group	DFO	leasehold forest group	Plantation, river flood control, bio-engineering, cash crops	Based on approved lease certificate
Irrigation channels	IR, 2000 (Rule 12)	Community Forestry Work-Plan	Irrigation Water User Association, DFO and Irrigation Office	DFO and Irrigation Office	Irrigation Water User Association	Plantation of tree or NTFPs, use, marketing and income generation	Based on approved work-plan
RoW under high-tension lines	EA, 1992 (Sect. 24), ER, 1993 (Rule 50) and EPR, 1997	EIA report, Environmental Management Plan and Forest Management Plan	Local community (CFUG), DFO, project developers and contractor	DFO, project developers and contractor	Local community (CFUG), DFO	Harvesting of medicinal & aromatic plants in RoW of electricity line	100% income for poor communities (households)
Row of public road (land acquired for public interest)	PRA, 1974 (Sect. 16.4)	Plans of local bodies, agreement paper, operational plan	Local institution (communities), local bodies and DoLIDAR/DDC	Local bodies, DoR, DoLIDAR, DDC, DFO, Agricultural Offices	Poor groups, groups of landless people, local communities	Plantation, agro-forestry, agriculture (cash crops), bio-engineering	Based on agreement between communities and DoLIDAR

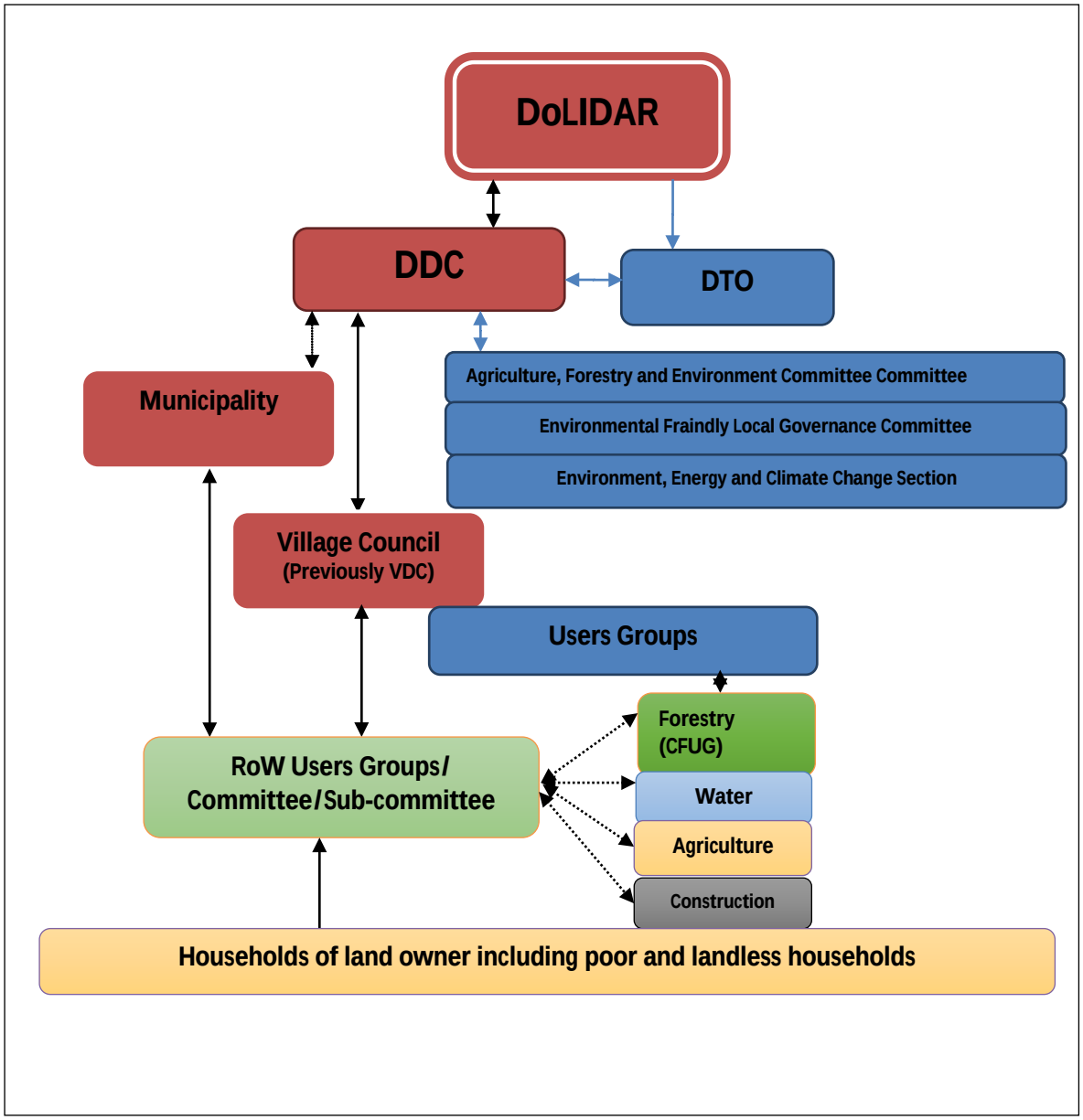
Source: Desk review 2016

such cases, it will be a complex venture to ensure access rights to poor or landless people in the land of the RoW with the aim of implementing income-generating activities.

6.1.1.4 Institutional mechanisms

The policy and legal framework has defined roles and responsibilities of various agencies in regard to the utilisation of the RoW at district and local level. The following institutional frameworks can play an active role for this purpose.

Figure 2: Proposed institutional mechanism (based on desk review and consultations)



National level: The Ministry of Federal Affairs and Local Development (MoFALD), Ministry of Electric Power (MoEP), DoLIDAR and the Alternative Energy Promotion Centre are the main responsible agencies at the national level for developing the policy and providing overall guidance for the implementation of the RoW and its utilisation (plans and programmes) at all levels.

District level: Each and every DDC has constituted two thematic committees, one on Environment, Energy and Climate Change and one on Forestry and Agriculture. Out of these committees, any one or both can provide policy guidance for the implementation of the RoW utilisation programme at district level. The Environmental Friendly Local Self-Governance Framework, 2014 is also a guiding instrument for local governments to work for the utilisation of the RoW through local communities. Accordingly, the DDC can play a coordinating role in the utilisation of the RoW based on the existing legal provisions of the LSGA, 1999 and the PRA, 1974.

The use of existing committees/institutions is recommended, rather than formulating new committees or institutional structures for this purpose at district level. Almost all agencies, stakeholders and local communities have favoured the use of existing local groups for the plantation along the RoW.

Local level: The Municipalities and VDC's have also already formed a thematic committee on Agriculture, Forest and Environment and this committee will be instrumental for monitoring and coordination at the municipality and VDC level. The Municipalities or VDC's can also initiate coordination at the local level for the management and utilisation of the RoW through local communities, considering the legal rights and responsibilities of the Municipality or VDC defined in the LSGA, 1999.

Community level: Poor and landless HHs have already been identified based on a well-being ranking which was carried out during the formation of Community Forestry User Groups (CFUG). Therefore CFUGs can facilitate in identifying poor HHs for the formation of a RoW User Sub-committee, which will be the institutional form to manage the use of the RoW for income generation. According to the local level stakeholder consultation, the Mahunial CFUG of Bhajani-Threeshakti Municiaplity in *Kailali*, as well as the Patal Panchapokhari CFUG in Chhintang VDC and the Newardhara-Chhanedanda CFUG in Aankhisalla VDC in *Dhankuta* are willing to form a RoW User Sub-committee for the use of the RoW. These CFUGs will also work on behalf of the RoW User Sub-committee to settle the formal agreements with concerned agencies including the DDC to receive support for this sub-committee. Cooperatives, farmers groups, women groups, drinking water and sanitation user groups and irrigation user groups have also formed at local level. These groups have not categorised the poor HHs based on a well-being ranking nor have they maintained a record of poor HHs. Nevertheless, these formal groups can also facilitate in identifying poor HHs and landless people for the formation of RoW user groups or committees.

Land-title holders or absentee land owners are not interested in providing the landless with access to their adjoining RoW, for them to use for their income generation. Therefore, negotiation between land-title holders (land providers) and non-land title-holders (poor HHs) is highly important during the formulation of RoW User Sub-committees at local level.

6.1.1.5 Role of agencies and stakeholders

Government agencies have a lot of experience in working with local level user groups related to agriculture, water, cash crop related cooperatives, soil and watershed conservation, and roads. Therefore, they can facilitate the formation of RoW User Groups/Sub-committees based on their experiences. Intermediary organisations may also play a role in facilitating the formation of RoW User Groups/Sub-committees.

The DDC has some experience on the utilisation of public land through different types of local communities/groups. Therefore the DDC can give their consent on the utilisation of the RoW to local communities through an agreement between the DDC and concerned local communities who are interested in using the RoW for maintaining greenery and generating

income. The local government is not interested in claiming any share of benefit generated from the utilisation of the RoW by local communities.

The DDC can play a role in policy development, and the Municipality or VDC may play an active role in monitoring the activities conducted by local communities while utilising the RoW. The Municipality or VDC should provide necessary support for the utilisation of the RoW through local communities, such as delineating the RoW, providing documents for product insurance, etc. The local government has a limited budget to support such activities, and this budget must be approved by the local government's annual council meeting.

Other government agencies at the district level, such as the DADO, the District Soil and Watershed Conservation Office, the DFO, the District Women and Child Development Office, the Drinking water related programme, the Climate Change related programmes as well as any road related projects can provide various means of support to local communities for them to utilise the RoW for income generation activities. It is also highly important to maintain/ensure governance in the RoW user groups or sub-committees.

6.1.2 Discussion on legal and institutional issues

During the current research, the relevant constitutional provisions, policies and legislative instruments were analysed with the aim to explore legal opportunities for the utilisation of the RoW for income generation activities by local communities. One of the important constitutional policies of Nepal is to provide land to poor and landless people for income and employment generation. These existing constitutional provisions have created an environment conducive for local communities to utilise the RoW to generate income and sustain their livelihood.

Harmonising legal provisions: no substantial conflict was found between the legal provisions of the PRA, 1974 and the LSGA, 1999, which are the most relevant legal instruments for regulating the utilisation of the RoW in Nepal. The PRA clearly states that the DoR/DoLIDAR may request local governments or any other institutions including local communities to carry out plantations on roads with the aim to maintain greenery and generate income. Similarly, the LSGA delegates the responsibility for the plantation and protection of roadsides to the local governments. And it allows the local governments to mobilise the local community for this purpose. The provisions of these two legal instruments can be implemented in a harmonised way, because they supplement each other and create synergies.

Principally, the DoR andDoLIDAR can assign the plantation of roadsides to any institution or local community. However, the procedural arrangements for this purpose are inadequate, because the GoN has yet to finalise the Public Road Regulation. Until this regulation is formulated and finalised, it is important to incorporate procedural arrangements into agreements between DoR/DoLIDAR/DDC and local communities, for the poor and landless HHs to utilise the RoW for income generation.

The LSGA gives sufficient roles, responsibilities and power to the local government for the plantation, protection and utilisation of the RoW through local communities. The local governments are also responsible for developing plans for this purpose. However, during the stakeholder consultations at district and local level, it was found that the local governments have not yet developed plans for roadside plantation and its utilisation. Therefore, it is important for the local government to move forward and develop such plans for the utilisation of RoW through local communities.

Supportive land laws: Land administration laws such as the LRA, 1978, the LAcA, 1977 and the TDA, 1998 have made a general provision for the protection and conservation of public

land including the RoW. The TDA further explains that the local government or town development committee is responsible for developing plans for roadside plantation and its protection through local communities.

Forestry and environmental laws: The FR, 1995 and the EPR, 1997 have also incorporated various provisions for the plantation and protection of the RoW through local communities. The FR has delegated to the DFO the responsibility of providing technical and other necessary support to those communities who are interested in managing roadside land as community forest. The GoN has declared a Forest Decade (2015-2025) and one important programme of this decade is to provide support to local communities for the plantation, protection and utilisation of roadside land for income generation to poor people. The DFO and District Soil and Watershed Conservation Office are responsible for implementing this Forest Decade program. During the discussion with these agencies at district level, their representatives clearly expressed that they have developed plans and programmes to provide support, such as plants and seedlings, to the local communities for this purpose.

Land tenure: The private land is already acquired for the RoW in Shukhad-Bhajani road in *Kailali* and most former titleholders support the use of the RoW by poor HHs for their poverty alleviation. However in *Dhankuta*, the landowners are not interested in involving poor HHs in the utilisation of the RoW; rather they are interested in using the RoW land by themselves. Therefore, the local communities, local governments and concerned agencies should facilitate a negotiation process between landowners and poor HHs during the implementation of the pilot project.

MoU and agreements: According to the PRA and the LSGA, the owner of the DCRN is DoLIDAR/DDC. Therefore, without getting a formal approval or consent from DoLIDAR/DDC, the local communities cannot utilise the land of the RoW. The LSGA has given the rights for the utilisation of the RoW to the Municipality/VDC. Therefore a tripartite MoU is required between the DDC, the Municipality/VDC and the local communities for the implementation of this pilot project in the RoW. After signing such a MoU, local communities can contract with various district and local level agencies in order to receive financial, technical and capacity building support in implementing activities under this pilot project (for draft MoU and MoA see Annexes G and H).

Legal provision on selected species: Banana, broom grass and tea are highly recommended species for cultivation in the RoW land. There is no legal restriction for the cultivation of these species in the RoW and indeed, they will not affect visibility and road safety.

Protection of the products of the RoW: Local communities are required to develop norms for the protection of production in the RoW land and they can also make a provision to impose fines to those people who violate these rules. The local communities may also develop norms to manage a grazing system, which is important to protect production in the RoW.

Conducive policies: The LUP, (2069 BS), the FP, 2015 and the WIDMP, 2015 are the most relevant sector policies for the promotion of roadside plantation and environmental friendly infrastructure development in Nepal. One important strategic policy of the FP is to maintain forestry or agro-forestry on the roadside for income generation. The Environmental Friendly Local Governance Framework, 2014 has also developed some indicators to assess progress in maintaining roadside greenery and income generation through its utilisation. It was found that the Ministry of Land Reform has not developed a specific programme for implementing the land use policy in the RoW of the DCRN. However, forestry agencies such as the DoR and

Community Forestry Division (CFD) have developed a national programme for the plantation of various species in the RoW, which may support income generation for poor people.

Willingness of stakeholders: The DDC and the Municipality/VDC in *Kailali* and *Dhankuta* have already constituted a thematic committee on agriculture, forestry and environment. An Environmental Friendly Local Governance Coordination Committee also exists at district level. In addition, a separate section on environment, energy and climate change is established under the DDC. Therefore, the willingness of local governments to support the implementation of this project in the future is assumed to be high. During the stakeholder consultation at the DDC meeting in Dhankuta, it was decided to coordinate these initiatives in the future (see minutes in Annex D).

Institutional framework: As a focal entity for this project, DoLIDAR is playing a constructive role in the execution of the pilot project. The existing Steering Committee is also active in providing guidance for the effective implementation of the project. However, there is no specific task team within DoLIDAR to manage the implementation. It is therefore recommended to establish a specific team in DoLIDAR for this purpose. Similarly, the DDC and other local bodies are responsible for implementing this project and monitoring respective activities. The DDC needs to play an active role in assigning staff or units who execute this project at local level.

The CFUGs are committed to support and form a sub-committee for the utilisation of the RoW in *Dhankuta*. CFUGs in *Kailali* are interested in supporting the formation of a committee as well, however, the HHs of freed bonded labour and landless people are interested in establishing their own separate group for the utilisation of the RoW. The CFUG will also facilitate the establishment of such a group during the implementation of pilot project. On the basis of the community level consultations, the team concluded that *a new group will form for the utilisation of RoW in Kailali and a sub-committee will be established under the CFUG in Dhankuta*.

Monitoring: The existing committee on agriculture, forestry and environment, which was constituted under the DDC and Municipality/VDC, has been given the role of monitoring the various development activities at local level. During the district and local level consultations, it was recommended that it would be good to delegate the responsibility for monitoring the pilot project to this committee at local level. Still the DoLIDAR will keep the overall responsibility for the monitoring of the project.

6.2 Results and discussion on engineering matters

6.2.1 Sukhad-Bhajani road in Kailali

After the discussion during the Inception Workshop, the former DTO Chief of Kailali informed the research team about the availability of a 20 m RoW on some roads in Kailali. Furthermore, he personally facilitated the provision of documents on land donation (transfer) from private to government for the road connecting Sukhad and Bhajani. This road belongs to the District Core Road Network (DCRN). Hence this road was considered to be appropriate for the pilot project in Kailali district.

The selected road is about 24 km long, starting at Sukhad bazar of Sukhad municipality on the East West Highway and ending at Bhajani, Trishakti municipality near the Indian border. The road operates and is under good condition. It has about 3.5 m carriage way and 0.5 - 0.75 m shoulder on either side of the road. Currently, road improvement is planned under the Strengthening of National Rural Transport Program (SNRTP). The detailed project report has already been developed including plans to enlarge the road to a width of 6.75 m and

including a side drain as per the site's condition. The land acquisition process to acquire the 20 m RoW is completed, however the RoW demarcation on ground is not in place.

Following the reconnaissance survey, the team chose the road section between km 22.215 and 23.340 for the implementation of the pilot project. The topography of the road along this section is primarily straight, with a gentle side slope. No major civil engineering structures are needed, except potentially fencing for the protection of roadside plants. This section of the road is almost flat with 3.44%, maximum grade, 80 m minimum radius of the horizontal curve, and 100% ordinary soil.

Selected road section on Sukhad-Bhajani road

Photo by Ruth Schaffner, 2016

Since the Detailed Project Report (DPR) of the road has been recently developed (see above), the cross sections follow the SNRTP/Nepal Rural Road Standards. Details of the cross sections and side slopes are given in the DPR prepared by DDC. For design parameters and DPR report dealing with this section see Annex K.

The area for the plantation was calculated considering the following parameters:

- Carriageway width: 3.75 m for traffic>100 Vehicles per Day (VPD)<400 VPD
- Shoulder: 1.5 m on either side of the road
- Side drain: 1 m (Type G drain as specified in DoLIDAR Technical Guidelines with adequate cover slabs for crossings)
- Lateral clearance between roadside object and the edge of the shoulder: 1 m (minimum for Terai roads)

At the meeting with the DDC office a few officials raised the issue of water clogging in certain locations of the selected road during the rainy season. During the site visit, it was indeed observed that the existing drain is not functioning, i.e. that most of the existing

drains are already clogged. This issue is considered in the above mentioned project report, stating that the DDC is planning to include one or both side drains as per the requirement.

Based on the above parameters, the total available width for the plantation will be 11.25 m, or 5.625 m on either side of the road. This width can be gained in sections where no side drains, parapet walls, retaining wall tops, extra widening in curve, etc. are needed. Considering the topography of the selected section, this requirement is fulfilled (see the cross sections given in Annex K).

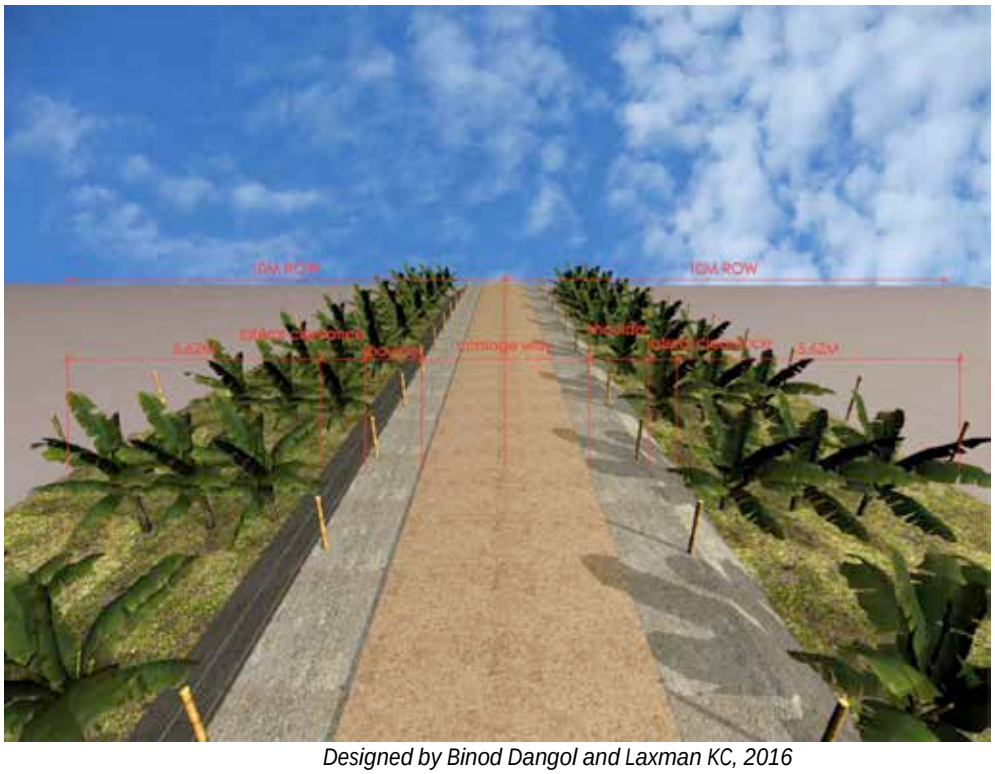
With a total road section length of 1.125 km and a width of 5.625 m on either side of the road, a total land area of 12'656 m^2 is available for the roadside plantation. If barbed fencing on both sides is consider of the plot, the total required wire length results in 4'500 m.

The cost of the fence was calculated using Mild Steel (MS) Angle poles (ISA 40x40x6) at an interval of 1.5 m, which is normally used in Nepal (e.g. by the Department of Water Supply and Sewerage for the protection of intake and reservoir tanks). Considering the unit rate of NRs 1'633.80 for the construction of 1 m barbed fencing, an amount of NRs 7'352'100 is required for the construction of 4'500 m length. The detailed cost and drawing for this expensive barbed fencing option is given in Annex K.

Considering the nature of the project, the above given cost for fencing is excessively high and may therefore not be a feasible option. Thus, other options including no fencing were also explored:

- Use barbed fencing with less barbed wire and posts
- Bamboo fencing
- No fencing or use of plants as a fence

Visualisation of the Kailali road stretch after pilot implementation



Designed by Binod Dangol and Laxman KC, 2016

Using only 3 rows of barbed wire at a 5 m post spacing interval amounts to a total of NRs 523.42 and NRs 427.12 per m, using Reinforced Concrete (RCC) and MS Angle poles, respectively.

During the field visit, it was observed that local people in Kailali are using bamboo as a fence for the protection of their plants near the roadside. Bamboo is cheaper and locally available. The cost of bamboo fencing would amount to NRs 287.62 per m. Considering the cost and nature of the project, bamboo fencing could be the most feasible option for this pilot. The detailed costs and drawings for the lower cost fencing options are given in Annex K.

Banana plantation is common along this road but only few of the villagers fence these plants for protection. Fencing may therefore not be required in all the cases.

6.2.2 Hile-Uttarpani-Chhintang-Jyamire road in Dhankuta

In the Dhankuta district with the Rural Reconstruction and Rehabilitation Sector Development Programme (RRRSDP) completed, a 10 m RoW has been acquired through the respective land acquisition process. At the beginning of the field trip, the Senior Divisional Engineer (SDE) of DoLIDAR, together with the DTO and the respective engineers, proposed to select the Hile-Uttarpani-Chhintang-Jyamire road for the pilot project.

The selected road is part of the District Core Road Network (DCRN). It is about 24 km long, starting at Hile and ending at Jyamire. Currently, the road operates under fairly good condition, with a 3.5 m carriage way and a 0.5 to 0.75 m shoulder on either side of the road. The RRRSDP team had tried to acquire 20 m (10 m in each side) ROW. But they could not achieve it. Now, none of the roads under DCRN have 20 m ROW in place. However, during the land acquisition process mentioned above, a width of 10 m RoW was acquired in most of the roads.

After the reconnaissance survey, the team chose two road sections for further consideration. One section lies between Samogaun School Danada, Chhintang VDC 6 and Ilaka police station (near Devisthan), with a length of about 1 km. The other section was chosen between Piple Danada Khoku VDC-1 and Panitar Danda near Aankhisalla Village with a total length of 1.15 km. The team presented the findings of the reconnaissance survey at the DDC meeting. The participants supported the teams' decision to follow up more closely on the two sections, which are off the villages and mainly lead through not very dense utis forest (see Annex L).

Team taking cross sections along the Devisthan-Chhintang section

Photo by Ruth Schaffner, 2016

The study team had explored with the DTO officials to get as build drawings of the selected road. However, due to the shortage of time, the team could not make a continued follow up. Instead cross sections of both sections were taken using a measuring tape and ranging rods for this study purpose.

Soil classification was done through visual judgment. From a slope stabilisation perspective, the topography of both sections is good. The existing slope appears to be stable with the exception of a few short locations. The surveyed cross sections of the road were verified against the NRRS, particularly regarding the slope. The detailed design parameters of this road section are given in Annex L.

Based on field survey and community interrogation the team chose the 1 km section between Samogaun School Danada, Chhintang VDC 6 and Ilaka police station for the pilot project implementation.

Selected road section on Hile-Chhintang road with utis-amriso intercropping

Photo by Ruth Schaffner, 2016

The area for the plantation was calculated considering the following parameters:

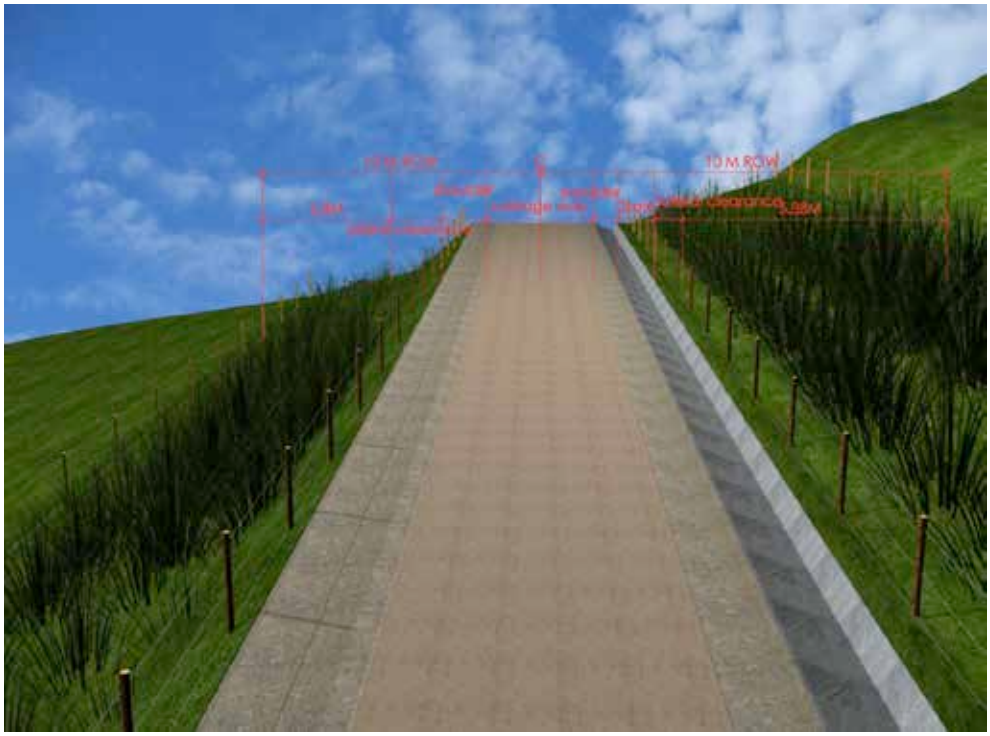
- Carriageway width: 3.75 m for traffic>100 VPD<400 VPD
- Shoulder width: 0.75 m on either side of the road
- Side drain: 1 m (kerb and channel type to enhance road safety)
- Lateral clearance between roadside object and the edge of the shoulder: 0.5 m (minimum for hill roads)

Based on the above parameters, the total available width for the plantation will be 12.75 m. Out of this, 5.875 m are on the hill side and 6.875 m on the valley side of the road, thus resulting in a total area for plantation of 12'750 m^2. This width can be gained in those locations where no parapet walls, retaining wall tops, extra widening in curve etc. are needed.

In this whole road section, the existing terrain favours the design of a side drain on one side of the road only, and without a parapet wall. A few retaining structures and extra widening at curve sections may be required, which will reduce some portion of land allocated for plantation. Furthermore there are a few rocky places where plantation is not possible. In sum, these limitations are not expected to exceed 20% of the total allocated land, and thus the total available area for the plantation is estimated to 10'200 m^2.

The existing cross sections of the road section were verified against the NRRS and the Nepal Road Standard. Some sections fulfil the above standards and some do not. Attempts were therefore made to reach the standards for all sections by trimming the hillside slope and providing retaining walls on the valley side. The amount of trim and retaining wall is based on the existing slope and the amount of deviation from the standards.

Visualisation of the Dhankuta road stretch after pilot implementation



Designed by Binod Dangol and Laxman KC, 2016

The detailed costs for the trimming and retaining structures are calculated using the current unit rate of the respective items for Dhankuta district. For the standard barbed fencing with MS angle poles and RCC posts the cost rate used by different agencies in Nepal was considered. Since the total length of the road section (for this community) is 1'000 m, a total of 4'000 m barbed fencing is required for both sides of the plantation. Considering the unit rate of NRs 1'750.62 for the construction of 1 m barbed fencing, an amount of NRs 7'002'480.00 is required for the installation of 4'000 m length. The detailed cost and drawing for the barbed fencing option is given in Annex L.

Considering the nature of the project, the above given cost for fencing is excessively high. Hence the research team explored other fencing options such as:

- Use barbed fencing with less ranges of barbed wire and posts
- Use bamboo fencing
- No fencing or use of amriso or other plants border line

For the option with fewer rows of barbed wire and posts, only 3 rows of barbed wire and a post spacing interval of 5 m was considered. This would amount to a total cost per m of NRs 626.34 when using MS angle poles; and a total cost per m of NRs 526.80 when using RCC poles.

In a few places on the road, the community has already started using bamboo as fencing, which is cheaper and locally available. The total cost for this option would amount to NRs 342.25 per m.

Fencing may not be required at all in some cases. In fact, amriso itself can be considered as fencing. In fact, in Dhankuta, amriso plantation is common, but none of the local villagers have been protecting these plantations with fencing. Thus, with or without bamboo fencing, amriso can be the recommended for plantation in this district.

The cost of additionally required civil engineering structures such as earthwork, gabion and other retaining structures has been calculated following the standards. The total cost for these structures amounts to NRs 6'223'722.38. The detailed drawing and calculation sheet is given in Annex L.

6.3 Plantation for productive use combined with bio-engineering benefit

A first and extensive collection of plants for roadside plantation was compiled on the basis of the literature review on bio-engineering and food and fodder plants, as well as by consulting on-going projects in the agricultural and forestry sectors. Following the discussions with stakeholders at national and district level, e.g. with the Geo Environmental and Social Unit (GESU) of DoR, with the Department of Agriculture (DoA) and with the forestry sector, this list was adjusted. The resulting list is conclusive for a nationwide approach, covering the various areas of Nepal (see Annex I).

The selected districts cover two different areas with regard to geographical region, altitude and climate. Kailali district lies in the Terai of the Far Western Development Region, while Dhankuta district lies in the Hills of the Eastern Development Region. For the two regions the potential plants for productive use are shortlisted in Annex J. Below, the findings for the two districts are presented separately.

6.3.1 Potential roadside plants for productive use along Kailali DRCN

Kailali lies in the generally flat Terai at altitudes of around 180 m asl. The subtropical climate in Dhangadhi is warm and temperate. May is the warmest month of the year with average temperatures of 31.1°C. January is the coldest month, with temperatures averaging 15.8°C. The yearly average temperature is 24.6°C. The driest month is November, with 6 mm of rain. Most of the precipitation falls in July, on average 534 mm. The annual precipitation is about 1'713 mm. See Annex M for the climate diagram.

6.3.1.1 Description of the area along Sukhad-Bhajani road

The selected Sukhad-Bhajani road is 24 km long and leads mostly through fertile wheat and paddy fields, intersected here and there with mustard plantations and plantations of local banana. At two sections, the road cuts through high stands of sal (*Shorea robusta*) forest, and along a river sugarcane is cultivated.

Several settlements have developed along the road, with the tendency to continue growing. This is true especially for the road heads, with the villages of Sukhad at the start and Bhajani at the end of the road. The houses very often do not give way to a section wide enough for the required RoW. Investigations revealed that land plotting has already started to some extent.

The fields generally do not extend up to the road, giving way along both roadsides to a

Typical RoW stretch along Sukhad-Bhajani road, with settlements

Photo by Ruth Schaffner, 2016

RoW stretch along Sukhad-Bhajani road with ditch

Photo by Ruth Schaffner, 2016

section of 2-5 m of land, consisting of deep gully-like ditches originating from road construction. The soil in these ditches is loamy and moist, since they tend to function as a drainage system. On many sections, the land along the road is cultivated by the road neighbours (some plots are even fenced), mainly with garlic, other vegetables, herbs (spices, medicinal) and often interspersed with rows of local banana, or rather seldom with poplar trees.

These relatively fertile lands along the road, in fact the whole potential RoW land here, would be very suitable for roadside plantation for productive use. Even more so as not much of a bio-engineering input is needed, except for some plant cover against topsoil erosion. However, the fact that land plotting has already started is one of the criteria which led to cancelling the two road sections at about km 4-7 and km 15-16, which were earmarked during the reconnaissance survey for the pilot project, even though there are strong issues in favour of these sections (good soil fertility, sunny exposition, a variety of potential plants to be used).

One homogenous road section outside of land plotting areas lies in a slightly hilly area covered with partly cleared sal forest, with sandy loamy road slopes caused by road construction. At a few places, road neighbours have planted rows of local banana trees, and their houses are adequately set back. This section was then chosen for the pilot roadside plantation, supported by the fact that the team also succeeded well in community mobilisation (see Chapter 6.4).

Local banana planted in the RoW on selected road section

Photo by Ruth Schaffner, 2016

6.3.1.2 Plant choice

As mentioned above, little bio-engineering is needed along the flat areas of the road, except for some slope stabilisation in the initial phase and cover against topsoil erosion. With

regard to climatic conditions and socio-economic considerations, the following plants were considered to be feasible for plantation along the Sukhad-Bhajani road:

Banana

Banana is a high-value agricultural product and a major fruit in Nepal in terms of the potential growing area, production and domestic consumption. In Kailali, banana is already well commercialised, with both an increase in the number of commercial plantations and the size of current plantations. Most of the district is climatically suitable for growing banana and therefore the production potential is high (ICIMOD, 2015).

Banana grows in a wide range of soils. The plants have numerous (200–500) fibrous roots. In well drained, deep, and fertile soils, roots may extend 1.5 m deep and 4.9 m laterally. Each stalk grows rapidly until flowering. This makes banana an excellent slope stabiliser and topsoil coverer, well suited for plantation on the shallow slopes along the selected road section. Maintenance is limited to some weeding after the first one or two rainy seasons and to removing the stalks after fruit harvest.

Banana is a persistent plant often used in tropical/subtropical managed agro forestry settings. Many cultivars are particularly susceptible to certain pests. Local or indigenous selections are generally more useful and tolerant of local conditions, and have lower input requirements (compost, fertilizer, water) to obtain satisfactory yields (Nelson et al., 2006). Also the RoW sections are relatively narrow bands; there won't be a negative effect which could occur in monocultures.

Planting time is best at the start of the rainy season. Fencing of the plants should not be necessary, or can be done by adding plants with fencing properties like, e.g. kadam (Jatropha curcas). It was also briefly discussed to grow rows of grass in order to protect the banana trees from being grazed. However, experiences with grass planting for bio-engineering show that grass slopes tend to attract grazing animals (ICIMOD, 2015).

Banana is traditionally grown in mixed cropping systems throughout the tropical/subtropical regions. It is often associated with a wide range of tropical lowland forest plants. The plant is used as crop shade, mulch or living fence. Since banana is an average to good competitor, it could also be intercropped with lemon grass in order to enhance bio-engineering capacity of the RoW plantation (see discussion below).

Sugarcane

Sugarcane grows best in warm, sunny, frost-free weather. It needs fertile, well-drained soils and at least 1'500 mm of rain per year, or access to irrigation. Planting time is at the start of the rainy season. Sugarcane plants will take approximately 7-9 months to mature and be ready for consumption. At harvest it stands 2-4 m tall (Organic Farms Nepal, 2016a).

"Organic Farms Nepal" promotes sugarcane production since this is a valuable cash crop, which helps improve the economic condition of local farmers. Nowadays, there are some sugar mills in Nepal and people have started commercial sugarcane farming in nearby areas. Besides, many individual farmers in Nepal produce small-scale sugarcane to generate income. Most of these small-scale sugarcane farmers sell their sugarcane on the local market to produce juice or as chewing candy. "Organic Farms Nepal" therefore also investigated into existing means of running or reviving abandoned sugar mills and of setting up functioning marketing chains (Organic Farms Nepal, 2016a).

However, this idea is not yet fully developed to a marketable standard. Besides, sugarcane is a water intensive crop, and there is no intention to establish an extensive irrigation facility for the pilot phase along the RoW land. With this in mind, sugarcane will not be a feasible

option for plantation along the roadside slopes of our pilot project. The cost benefit analysis in Chapter 6.4 confirms this decision.

Lemon grass (Cymbopogon citratus, C. flexuosus)

Lemon grass is a perennial and intensely fragrant grass, native to Asia and widely cultivated in Nepal for medicinal and cosmetic products. There are several types of lemon grass; *C. microtheca* and *C. pendulus* are used in bio-engineering. Lemon grass is easily grown along roads, especially also along steeper road slopes. With its roots it stabilises the slope and with the leaves it protects from topsoil erosion. It can be grown at altitudes from Terai to 1'500 m, where it tolerates also dryer conditions. If planted in dense rows, maintenance can be done by harvesting the stalks after monsoon.

Planting season is before the start of the monsoon. Propagation is done via seeds or slip cuttings. Intercropping with banana is possible, especially with young banana plantations in order to stabilise the slopes and cover the bare roadsides against topsoil erosion as long as the young banana trees cannot take over this bio-engineering function. To enhance slope protection Howell (1999) suggests trying to achieve plantation of mixed ages. That means that not all plants need to be replaced at the same time and there will always be some strong, healthy plants protecting the slope.

The Informal Sector Enterprise Development and Employment Generation Programme HELVETAS (ELAM) project found that the Kailali district has suitable geographical and climatic conditions for the cultivation and commercial expansion of essential oil enterprises for e.g., lemon grass, citronella, Palmorosa on community forestry land, and Mentha and chamomile on private lands. In a pilot phase, however, it was found that the need for technical backstopping, marketing and management support of the farmers is still high (HELVETAS, 2016d).

Mentha

Mentha, also called peppermint, grows easily without high requirements regarding soil properties and cultivation. It is grown to produce menthol oil, which is used industrially as a fragrance component in soaps, detergents, toothpastes and cosmetics or perfumes (Down To Earth, 2016).

Due to its strong flavour, Mentha is not liked by grazing animals. Hence it would provide an excellent topsoil cover and at the same time protect the young banana trees from being grazed. This fact supports the use of Mentha for mixed banana cum Mentha plantations, in order to prevent topsoil erosion. However, since like sugarcane, Mentha is water intensive, it is not a feasible crop for the roadside slopes of the pilot, where there is no intention of establishing complex irrigation facilities.

Turmeric (Curcuma longa)

Turmeric is a potential crop for income generation and employment creation. The product is mostly used in daily cooking.

The ELAM project has piloted oil extraction from turmeric leaves and selling this oil on national and international markets, in partnership with the private industry of Natural Herbal Pvt Ltd, Bara and Kathmandu. The main objective of this pilot was to evaluate the market opportunity of turmeric leaves oil and to enhance the market value of the turmeric sub-sector so that turmeric resource based micro entrepreneurs can earn more income (HELVETAS, 2016c).

Turmeric cultivation by farmers has been expanding at an increasing rate, due to increasing market demand. The Terai and Mid-hill areas are those regions where mass quantity of raw

turmeric is produced by small farmers or forest user groups. After successful completion of product development and tests in a few districts, the promotion of turmeric production appears to be promising (HELVETAS, 2016c). However, since processing mechanisms and market chains are not yet in place today, this cash crop is not recommended for the current pilot project.

6.3.2 Potential roadside plants for productive use along Dhankuta DRCN

The selected Hile-Chhintang road in the district of Dhankuta lies in the Eastern hills of Nepal at altitudes of about 300-2'500 m asl. The temperate climate is warm and moderate. The warmest month is June with an average temperature of 25.2°C; the coldest month is January with an average temperature of 13.4°C. The average annual temperature is 20.6°C. The average annual precipitation is 1'002 mm. The lowest precipitation is 6 mm in December. In summer, precipitation is explicitly higher than in winter with highest precipitation of 256 mm in July. See climate diagram in Annex M.

6.3.2.1 Description of the area along Hile-Uttarpani-Chhintang-Jyamire road in Dhankuta

The Hile-Chhintang road is 24 km long and leads mostly along a Southwest-stretching ridge. It lies at altitudes of about 1'200-2'000 m asl. The terrain is moderately steep and cultivation alternates, with tea plantations, terraced fields and forested areas with mainly utis (*Alnus nepalensis*) and chilaune (*Schima wallichii*) plus amriso (*Thysanolaena maxima*) in the underbrush.

The road leads through some villages, which mainly lie along the saddles of the ridge picture. With the exception of the first few road kilometers no land plotting appears to have started.

If not taken over by the few houses and their forecourts, the RoW land consists of a rather steep 1-3 m high road cut on the mountainside and a gentler slope on the valley side. The land above or below these slopes consists of rather rough soils. It is either forested, or then often intercropped with amriso.

Utis and amriso along a RoW stretch on Hile Chhintang road

Photo by Ruth Schaffner, 2016

In the more fertile and flatter areas, the RoW land is terraced and cultivated by the road neighbours, mostly with vegetables.

RoW stretch along Hile Chintang road with fields and houses

Photo by Ruth Schaffner, 2016

On the first 2-3 km a quite homogenous road section leads through tea plantations. After the reconnaissance survey by the team, this section was earmarked for roadside plantation. However, investigations revealed that the landowner has started plotting this land - which is not surprising considering the proximity to thriving Hile - and from this point of view, the area is not suitable for the pilot.

6.3.2.2 Plant choice

The road leads along a ridge. Hence there are no very high mountain-side slopes, and valley side slopes are rather flat. At certain places some bio-engineering support might be needed, e.g. armouring or reinforcing of steeper slopes, or supporting high slope edges.

With regard to site conditions as well as climate and socio-economic considerations, the following plants are considered feasible for plantation along the Hile-Chhintang road:

Amriso (Thysanolaena maxima), broom grass

Amriso belongs to the family of grasses or Poaceae. It grows naturally in Nepal at altitudes from the Terai up to 2'000 m asl, mostly on moist Northern slopes, but it can also tolerate dryer and stony areas. It is easily propagated from rhizome cuttings and is thus a popular non-timber forest product. It is easy to cultivate with little labour and investment input, needing only very limited maintenance. Amriso gives the farmer a high economic return, thus enhancing the livelihoods of poor and marginalised communities dependent on forest products (WWF Nepal, 2013; Organic Farms Nepal, 2016b).

Planting time is in June and July. Once planted, amriso can be used from the first year of growth, and it lasts for many years. The culms are collected and used to make sweeping brooms, the leaves provide excellent fodder and the stems provide fuel.

Amriso has mat-like roots that bind the soil firmly, stabilising a slope and preventing soil

Amriso along Hile Chintang road

Photo by Ruth Schaffner, 2016

erosion. Thus, planting amriso is an efficient method of rehabilitating degraded land and an effective way of stabilising eroding slopes. For an even better slope stabilisation and to prevent landslides, amriso is also planted in combination with tree species.

Hariyo Ban Programme, supported by World Wildlife Fund (WWF) Nepal has gained good experiences in stabilising landslides with amriso along the Mugling-Narayanghat highway (WWF Nepal, 2013). Similarly so, the DRSP-III developed "Integrated Techniques for Slope Stabilisation in Rural Road Construction in Nepal" where amriso was extensively used (Shankar, 2011). It was also found that amriso helps reduce the growth of invasive plant species like banmara (*Eupatorium adenophorum*) or tite pate (*Artemisia sp*).

For the local communities to further benefit from amriso plantations, district or local institutions such as Cottage and Small Industries Development Committees, in coordination with DFO, could train community members in broom making. In the coming years, such trainees could make brooms and sell these, which would help them earn three times more income than by selling amriso culms directly. The yield and thus the profits would gradually increase in the upcoming years. For an in depth socio-economic analysis of amriso see Chapter 6.4.

Tea (Camellia sinensis)

The temperate climate along the selected road is favourable for tea planting. Tea is an adaptable plant, although it grows best in climates with wet growing seasons. Tea shrubs require fertile mountain soil rich in humus, and their cultivation needs well-drained land. Mountain slopes with heavy rainfall during the growing season but no stagnancy of water are good for tea cultivation (Important India, 2013).

Nepal grows mainly 3 types of tea, i.e.*Camelia assamica* and *C. assamica spp lasiocalyx* for cut, tear, curl (CTC), and *Camellia sinensis* for orthodox tea. Nepali orthodox tea is

somewhat similar to Darjeeling tea in its appearance, aroma and fruity taste. The reason for this similarity is that the Eastern zones of Nepal, which are the main tea producing regions of Nepal, feature similar geographical and topographical conditions as the Darjeeling area. However, Nepal's tea does stand apart from the Darjeeling tea. Tea connoisseurs consider some of the teas from Nepal to be much better than the Darjeeling tea in its aroma, fusion, taste and colour. The biodiversity, topography and the soils rich in organic matter place Nepal tea in a unique position (NTCDB, 2016).

The GoN has approved and implemented the National Tea Policy, 2000 as per the intention of the National Tea and Coffee Development Board Act, 1992. The aim is to develop tea as a sustainable source of income, enhancing employment opportunities and the earning of foreign currencies. An increased participation of the private sector in the production, processing and commercial transaction of tea encourages the sustainable and systematic utilisation of available resources and opportunities in the country (NTCDB, 2016).

The investigations of the research team however showed that it would not be very rewarding to plant tea along the quite narrow land areas of the RoW on the Hile-Chhintang road. Also the skills for tea production are not generally known. A full return can only be expected after five years. And small-scale producers strongly depend on the tea estates, who set up the prices for the leaves. Thus, tea is not recommended for participatory planting along the RoW here. For an in-depth socio-economic analysis of tea, see Chapter 6.4.

Utis (Alnus nepalensis), nepalese alder

Utis is a pioneer species. It grows well in full light but will also tolerate shade. At lower altitudes, it occurs in moist sites, such as near rivers, but it will also colonise rocky sites and landslides or land abandoned after cultivation. Utis occurs naturally in both pure and mixed forest stands and is common in streambeds, near streams, in ravines and in drier forests. It grows preferably in humid, cool or subtropical mountain areas with high rainfall, at altitudes of 1'000-3'000 m asl. Utis prefers moist and well-drained soils, including loam and loamy-sandy gravel, sand and clay. It does not require high soil fertility but prefers permeable soils. The plant is nitrogen fixing, and thus a soil improver (Orwa, 2009).

Utis is a well-known species used in bio-engineering that gives stability to slopes which tend to slip and erode. Its seeds are also broadcasted to stabilise landslide areas. As a fast growing tree, utis is commonly used for fuel-wood, timber, furniture and leaf litter. It has a high market demand, especially by plywood and match factories. The timber is used for construction, and is suitable for boxes, splints and matches, poles, general carpentry, and furniture parts. Even though the wood has a low fuel value, it is an important source of firewood and charcoal.

Considering its ecological and economic importance, utis has been selected by IUCN as a potential species for their Forests Restoration Programme. It is one of the hill communities' most preferred forest tree species. Over the past 25 years, this species has been extensively planted throughout Nepal (IUCN, 2014). See also Kharel and Mulder, 1983; Barakoti, 2005; Laminchhaney, 1995.

Even though utis is also very popular along the Hile-Chhintang road and the market chain appears to be in place, it is not proposed for the RoW plantations. The gestation period is over 10 years, and the return will not be as rewarding as e.g., from amriso plantations.

The forest people suggested choosing other forest trees such as chilaune (*Schima wallichii*), but the growth of chilaune is even slower than that of utis, and a proper marketing chain does not appear to be in place.

The agricultural sector suggested growing alainchi (*Amomum aromaticum*, cardamom) for income generation. The cultivation of cardamom in combination with utis is a commonly

practiced intercrop in the Central Himalayas. The team however did not follow up this suggestion, as alainchi is not commonly grown in the rather dry pilot area. Its cultivation would require more knowledge input, along with more fertile and moist soils or irrigation facilities.

Bamboo grows abundantly along the Dhankuta-Hile road, most probably from former bio-engineering activities along this road. However, the team felt that bamboo grows high and dense, and if planted in the RoW, would too much obstruct the visibility along the quite narrow Hile-Chhintang road.

6.4 Socio-economic analysis of the pilot areas in Kailali and in Dhankuta

Discussion with CFUG at Bhajani

Photo by Ruth Schaffner, 2016

6.4.1 Sukhad-Bhajani road in Kailali

In all areas of this road, there are community forests and CFUG with their well-being ranked for all members. Mostly Tharu communities settle on the roadside.

6.4.1.1 Bhajani Municipality road section (ca. km 22-23)

More than 250 HHs of freed bonded labour and 146 HHs of landless people have settled along the roadside of this section near the Mahuniyal Community Forestry area. These people have received around 0.066-0.099 ha of land for their housing and livelihood. They are among the poorest of the poor and are ready to organise a group for the purpose of planting on the RoW. The chairman and secretary of the CFUG, as well as the Municipality are also ready to support such an organisation of the poorest of the poor. As this group is homogenous in terms of land ownership and other positions, it could be an important group for organising and managing the RoW along the Sukhad-Bhajani road.

6.4.1.2 Haripur section of the road (ca. Km 6-7, Ghoda-Ghodi Municipality)

A second road section considered suitable in terms of the quality of land situated along the road and the prospect of plantation is the Haripur section of Ghoda-Ghodi Municipality. A mixed community is settled along the road. This area is part of the Gauri Shankar Community Forestry Group consisting of 125 HHs, and is connected with the productive land area.

The people residing near the road are relatively rich, while the poor live a little further away from the road. Some of the rich landowners are currently not using their land and do not live in the village. The poor would be ready to work in the RoW, however they are reluctant to do so since they assume that the neighbours of the road may not allow them to work there.

The area is near Sukhad, a growing town of Ghoda-Ghodi Municipality, and many new buildings are currently being constructed here. Mr. Hari Ram Chaudhary, Chairman of Gaurishankar Community Forestry User Group, assumes that the land area along the road will be land plotted and sold for housing purposes. From these plots there is a prospect of road linkage to the house, and the RoW will be used in order to connect the houses to the road. Due to this urbanisation process, the land value is increasing and hence the landowner will be reluctant to provide the land to other people for the purpose of plantation on their land. Thus the team decided to cancel this section for pilot implementation.

6.4.1.3 Socio economic analysis of banana plantation

Introduction

During our district level consultation in Kailali, the district horticulture development officer at the DADO suggested local banana as a suitable plant for roadside plantation in order to generate income for the poor. He also gave us details of the current situation in the Sukhad-Bhajani road and explained that banana is being planted by the farmers and is useful for income generation. He also provided us with estimates of cost and return of banana plantation in Kailali and ensured that it is the most beneficial product for the poor farmers and suitable for plantation in the proposed land area.

Banana is an important fruit to generate income in Nepal. It is a high-value agricultural product and a major fruit in Nepal in terms of the potential growing area, production, and domestic consumption. It is currently grown in 68 districts out of 75 districts, and the total area of banana plantations in 2012/2013 was 11'864 ha, with a total production of about 182'005 t (HELVETAS, 2016a). Although there is great potential for banana production in Nepal, there are few commercial banana plantations and the current productivity is low. According to the Ministry of Agriculture, the current average productivity is 13.2 t per ha, with maximum yields reaching up to 20 t per ha. Demand for bananas in Nepal currently exceeds the total national production. According to the Trade and Export Promotion Centre of the Government of Nepal, in 2011/12 27'878 t of bananas were imported from India to meet the domestic demand, particularly in urban and peri-urban areas (ICIMOD, 2015).

The climate of Kailali district is suitable for the cultivation of banana. It can be cultivated on small plots of land. A study shows that NRs 6'000-10'000 of income can be generated from 0.033 ha of land area planted with banana (HELVETAS, 2016a). All parts of the banana can be used, i.e. fruit for eating or selling in the market, the stem can be used for paper or fibre production.

Considering the fact that marketing of banana fruits is only fully profitable for the more delicate improved banana varieties, a new approach was introduced by the ELAM project towards promoting local banana varieties. These are well adapted to the region, a known

species for productive use in the area, and with cultivation skills already developed by the local farmers (HELVETAS, 2016a).

After harvesting the banana fruits, the stems are usually considered as a waste product. In 2012, the ELAM team came up with the idea of using banana stems to produce paper. They explored information on technologies, paper making processes, machines, as well as market and business plans. Indeed, a few practices have already been initiated in the Philippines and in Tamil Nadu of India, but it appears to be very difficult to apply their technologies and paper making processes to Nepal. On that note, the innovation team decided to use Nepali hand-made paper technologies to produce paper from banana stems. In the same way, ELAM has been evaluating the idea of using banana fibre to produce cloth (HELVETAS, 2016a). ELAM was also involved in innovative and promising approaches of establishing tissue culture based banana nurseries (HELVETAS, 2016b).

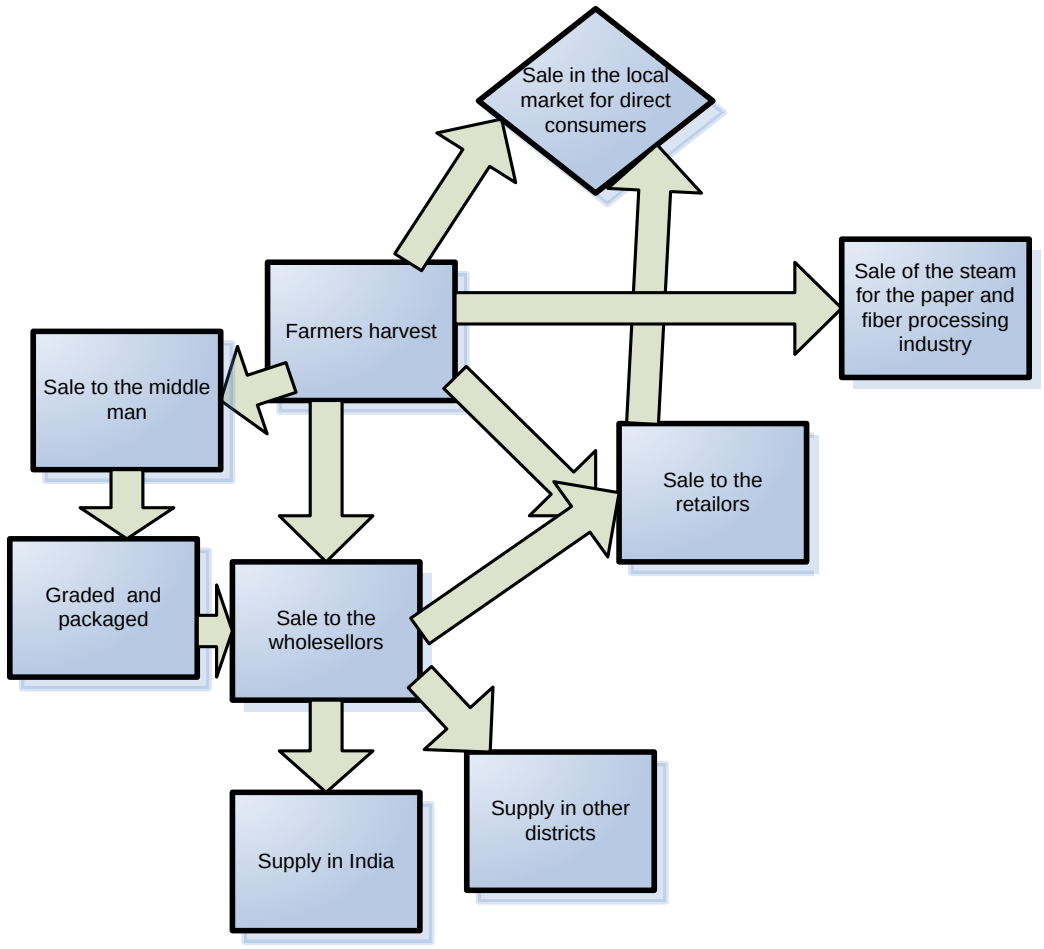
In the years following these initiatives, the ELAM project has been developing a banana farming value chain for enterprise development and job creation in banana paper making, in eight districts of the Terai. In the meantime, the market chain for banana paper is successfully in place (see Chapter 6.4).

In the Morang district, in the framework of "Nepal Development Marketplace 2008", a Fact Finding Study implemented a project to support micro enterprises in manufacturing various products from waste banana stumps, such as fibre for cloth (Manandhar, 2010).

Value chain analysis

Banana is sold by the producers to consumers, retailers, wholesalers, middlemen and

Figure 3: Value chain of banana in Kailali (Source: Field study 2016)



processors. Small farmers sell directly to consumers and sometimes also to retailers. Large farmers usually sell to wholesalers, processors or middleman depending on the situation. Banana can also be exported to India, as the Kailali district is near to the border of India. Middlemen add some value by grading and packaging the banana and then selling to the wholesalers. Wholesalers sell either to retailers or to other districts, or they export to India. Figure 3 shows the value chain of banana plantation in Kailali.

Cost benefit analysis

The total area available for plantation is 1.265 ha. According to ELAM, the banana stem can also be sold for paper and fibre production. However, information on the price of the stem could not be obtained. The cost and benefit estimation is based on the following assumptions; details are presented in Annex N.

- Land is free of cost and the opportunity cost of land is not included in the analysis
- The cost and return is estimated considering only direct costs and direct returns
- The analysis is based on data of costs and returns provided by the DADO office of Kailali and the wage rate given by DDC, Kailali
- The total number of plants will be 1'600 per bigha (0.67 ha)
- The average price of banana will be NRs 250/ghari
- The banana plant will provide a return in about 12-14 months of plantation
- All banana plants will give fruit
- It is assumed that a onetime plantation of banana provides a 5 year benefit, and that a new plantation is required in the 6th year for a better return

The banana stem can also give some return, however it is not included in the benefit as no information on the price is available.

Table 2: Cost benefit analysis of banana in Kailali

Items	**Scenario 1** (without fencing cost)	**Scenario 2** (with total fencing cost; bamboo poles)	**Scenario 3** (only labour cost of fencing with bamboo poles)
NPV (NRs)	1'666'320	372'034	1'195'336
B/C	2.39	1.15	1.72
IRR	456% (4.56)	9% (0.09)	57% (0.57)

Source: District Agriculture Development Office, Kailali, DDC, Kailali

Table 2 shows three scenarios, revealing a positive NPV in all scenarios. With nearly NRs 1.7 million, the NPC is highest in Scenario 1 without fencing costs. With NRs 0.37 million it is lowest in Scenario 2 with all costs for fencing the pilot area with bamboo poles. The B/C is greater than one in all scenarios, highest in first scenario and lowest in second scenario, lower than in Scenario 3 considering only labour costs of fencing. These parameters show that banana plantation is beneficial for the small farmers on the RoW in Kailali.

SWOT analysis

Table 3 shows the SWOT analysis of banana plantation in the RoW of Sukhad-Bhajani road.

There are some weaknesses and threats, in which the district level institutions and Non-Governmental Organisation (NGO) can play a catalytic role for improvement. Research conducted in the horticulture office or in the Nepal Agricultural Research Council may help

cure the new disease observed currently in banana. Nursery and cultivation techniques can be disseminated by the extension service of the district level offices.

Due to a growing number of processing industries for paper and fibre production from banana stems, the importance of banana plantation as an income generating activity will increase in the future. Since the climate is suitable and land is available, banana is considered to be the best option for plantation in the RoW of Kailali, as a source of reducing poverty of the poorest of poor.

Table 3: SWOT analysis of banana in Kailali

Strengths	**Weaknesses**
Suitable climate and soil condition Traditionally cultivated Attractive to cultivate due to possibility of marketing Well established market available Possibility to use the stem and other parts of the plant for making paper and fibre Availability of local resource persons trained by HELVETAS Various processing centres for fibre and paper are available	Lack of proper knowledge and techniques in cultivation and nursery management New diseases are observed Lack of nursery in the selected area Insufficient awareness regarding the use of stem and other parts of the plant for paper and fibre production
Opportunities	**Threats**
Possibility of increase in area and productivity Potential national and international market for fruits Market for stem and other parts of the plant for fibre and paper production available High demand of both fruit and stem High potential for reducing poverty and malnutrition	Possibility of fluctuation in price Possibility of unknown disease

Source: Field study 2016

6.4.1.4 Socio economic analysis of sugarcane plantation

Introduction

We consulted NGOs working in Kailali. Mercy Corps is working with the poor for sugarcane riverside plantations. They provided us with a cost benefit analysis of sugarcane. From their experience working with poor riverside farmers, plantation of sugarcane could also be a profitable business for RoW plantations on Sukhad-Bhajani road.

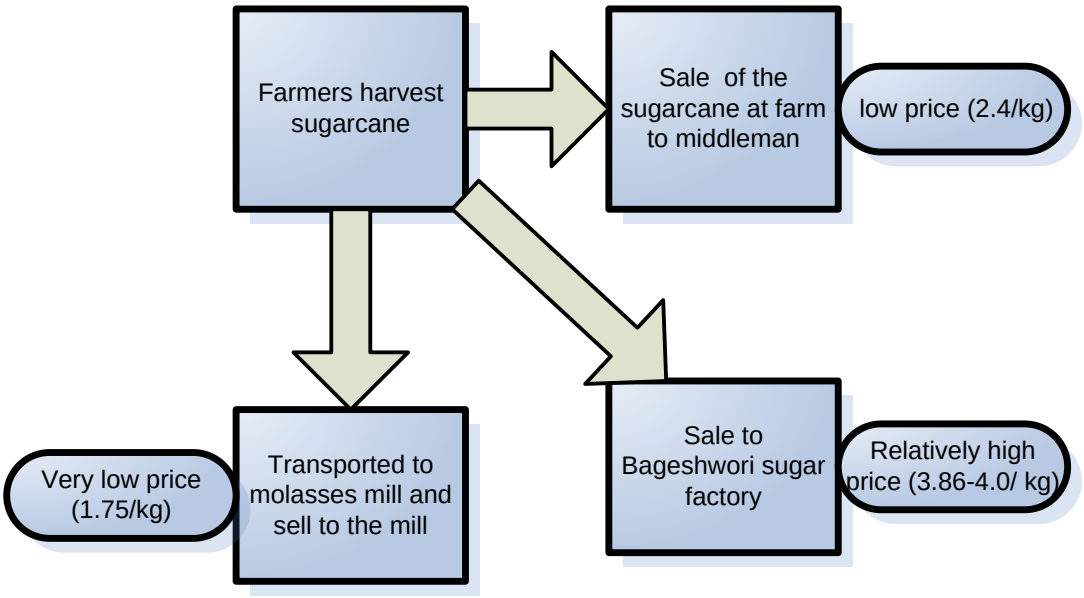
Sugarcane is the largest commercial crop in Nepal. In 1985 the sugarcane area was 2'310 ha and the production was 558'340 t. In 2013, the area increased to 64'483 ha and the production to 2'930'000 t. The production and productivity of sugarcane continues increasing but it is still low compared to neighbouring countries. At present there are twelve sugar factories operating in the country and they are running at their full crushing capacity, producing approximately seventy five percent of the country's sugar requirements (Organic Farms Nepal, 2016a).

Value chain analysis

Limited options are available for the producers of sugarcane to sell their product. The farmers can either sell these at large sugar factories or at small molasses mills. The price

they receive at molasses mills is relatively low compared to the price at sugar factories. There are also middlemen who collect sugarcane from the farmers' fields to sell them to the factory with some margin. The following value chain (Figure 4) shows that farmers would benefit from selling their product at the recently established Bageshwori sugar factory at the border of Kailali and Kanchanpur, instead of selling to middlemen.

Figure 4: Value chain of sugarcane in Kailali (Source: Field study 2016)



Cost benefit analysis

The cost benefit analysis for sugarcane is based on data received by Mercy Corps. This NGO supports farmers in planting sugarcane in riverbeds, and in increasing their return from the product. Some of the data such as the wage rate, the number of workers required, and other information were verified with the district level offices. The total area available for plantation is 1.265 ha. The cost benefit analysis is based on following assumptions; details are presented in Annex N.

- Land is free of cost and the opportunity cost of land is not included in the analysis
- The cost and return is estimated considering only direct costs and benefits
- The average price of sugarcane will be NRs 320/100 kg
- The sugarcane will provide a return after about 12 months of plantation
- It is assumed that a one-time plantation of sugarcane provides a 3 year benefit and that the crop will be replanted in the 4th year
- The production will be low in the third year
- The wage rate is calculated considering the norms of the DDC, Kailali

Table 4: Cost benefit analysis of sugarcane in Kailali

Items	**Scenario 1** (without fencing cost)	**Scenario 2** (with total fencing cost; bamboo poles)	**Scenario 3** (only labour cost of fencing with bamboo poles)
NPV (NRs)	278'318	-1'015'968	-192'666
B/C	2	0.3	0.7
IRR	596%	NA	-22%

Source: Mercy Corps Kailali and DDC, Kailali

Table 4 shows that plantation of sugarcane is a profitable business if only plantation costs are considered, excluding fencing costs (Scenario 1). If fencing costs are included, the NPR is negative and the B/C less than one. In case all fencing costs are included, it is not possible to estimate the IRR, the B/C is only 0.3 and the NPV has a very high negative value (Senario 2).

SWOT analysis

Table 5 shows the SWOT analysis of sugarcane in Kailali.

Table 5: SWOT analysis of sugarcane in Kailali

Strengths	**Weaknesses**
Suitable in the climate Marketing is possible since sugar factory is located nearby Demand is high since industry is newly established Important cash crop Availability of research and extension services	Lack of proper knowledge and technique in cultivation Lack of collective marketing practices since there is no sugarcane plantation around the village Insufficient infrastructure Small area of land for cultivation of sugarcane Irrigation required 3 times/year Insufficient awareness and knowledge about the market
Opportunities	**Threats**
NGOs are working in the same area for riverbed faming of sugarcane Chances of increase in area and productivity Potential for reducing poverty	Possibility of fluctuation in price Monopoly of the purchaser

Source: Field study 2016

6.4.1.5 Socio economic analysis of lemon grass plantation

Introduction

Lemon grass is one of the important herbal plants being cultivated by the community

forestry users group and other farmers in *Kailali* district. It is a high-value non timber forest product to generate income in Nepal. Its oil is used for the production of different cosmetics. The leaves are used as herbal tea. The products are highly demanded in Europe and other western countries. It can be harvested 2-3 times in the first year and 4 to 5 times in the subsequent years (ANSAB and SNV, 2003). All the parts of the plants can be commercially utilized. It does not need fencing since none of the animals like this and there is no scope of damage of this plant by the animals.

Value chain analysis

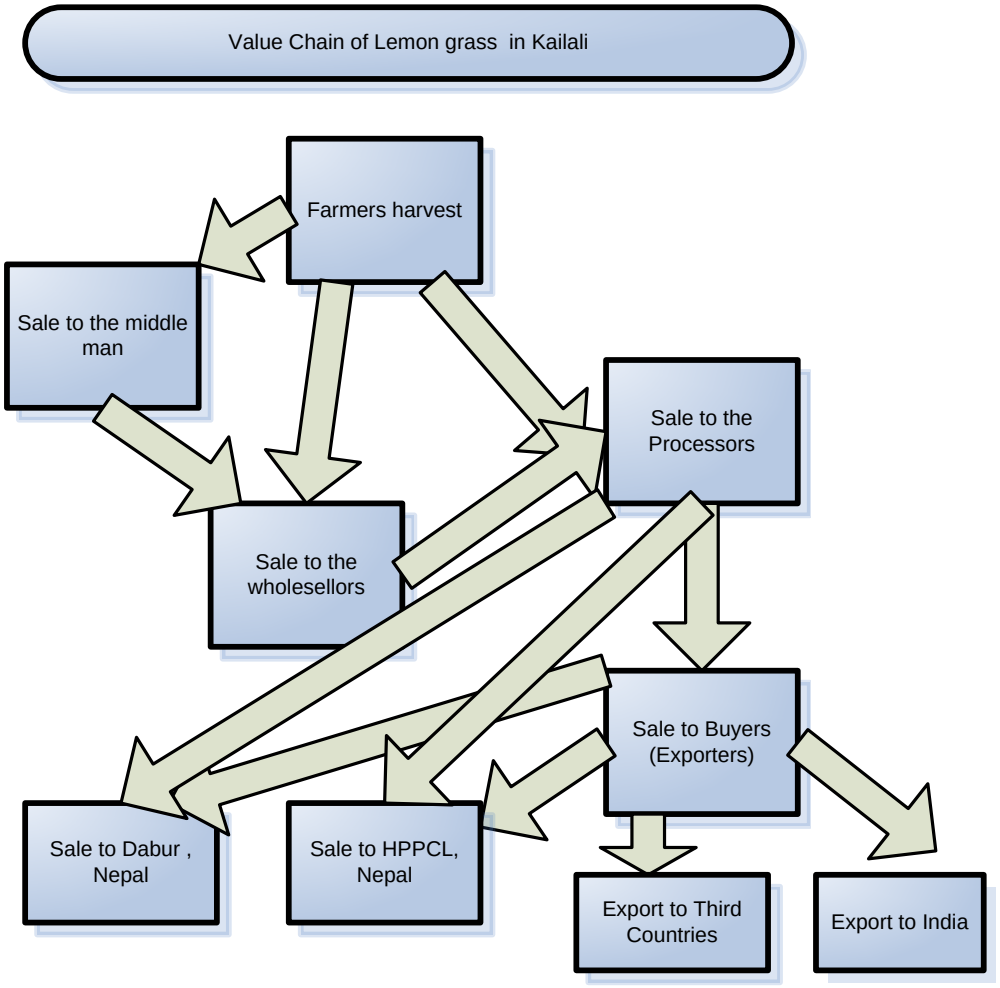
The ELAM project found that the Kailali district has suitable geographical and climatic conditions for the commercial expansion of essential oil enterprises for lemon grass on community forestry land. In a pilot phase, around 364 HHs were involved in the cultivation and production of essential oil bearing plants in the district. But the need for technical backstopping, marketing and management support of the HHs is still high (HELVETAS, 2016d).

One lemon grass variety (Cymbopogon flexuosus) flourishes as natural undergrowth of pine trees in Eastern Bhutan. Farmer groups there engage in the collection of lemon grass and they distil this into high value essential oil (Biobhutan, 2016). It was not possible in the

framework of this research to further investigate into the respective production and marketing process in Bhutan.

In Nepal lemon grass is sold by the producers to retailers, wholesalers, middlemen and processors depending on the situation. The processors sell it to the national users and exporters. The major part of the final product is exported to India, Europe and other countries. Nearly 60 to 70 % of the total product is exported. About 30 to 40 % are internally used by **Dabur Nepal Pvt Ltd** and Herbal Production and Processing Co. Ltd. (Elam HELVETAS, 2012). The value chain is presented in the following figure.

Figure 5: Value chain of Lemon grass in Kailali (Source: Field study 2016)



Cost benefit analysis

The total area available for plantation is 1.265 ha. The cost and benefit estimation is based on the following assumptions; details are presented in Annex N.

- Land is free of cost and the opportunity cost of land is not included in the analysis
- The cost and return is estimated considering only direct costs and direct returns
- The analysis is based on data of costs and returns from the information received from Elam HELVETAS Incorporation, Herbal production and processing company

limited and Asian Network for Sustainable Agriculture and Bio-diversity (ANSAB) and SNV Nepal

- The required total number of slip cuttings will be 25000 per hectare of land
- The average price of oil will be NRs 1500/liter
- The plant will provide a return in 3-4 months in first year and 2-3 months in subsequent years up to 5 years
- It is assumed that a onetime plantation of lemon grass provides a 5 year benefit, and that a new plantation is required in the 6th year for a better return
- Wage rate is taken as per the rate fixed by DDC Kailali for the year 2015/16

Table 6: Cost benefit analysis of banana in *Kailali*

Items	**Scenario 1** (without fencing cost)	**Scenario 2** (with total fencing cost; bamboo poles)	**Scenario 3** (only labour cost of fencing with bamboo poles)
NPV (NRs)	212070	-962829	-258914
B/C	1.6	0.3	0.77
IRR	2.06 (206%)	NA	-0.12

Source: Herbal Production and Processing Co.Ltd 2002, Elam HELVETAS Incorporation, 2012, and ANSAB and SNV, 2003, DDC Kailali

Table 2 shows three scenarios, revealing a positive NPV only in the first scenario. With nearly NRs 0.2 million, the NPV is highest in Scenario 1 without fencing costs. The NPV ration is negative in scenario 2 and 3. The B/C is greater than one without fencing cost. In the remaining cases the B/C ratio is less than one. These parameters show that lemon grass plantation is suitable only when there is no need of fencing.

SWOT analysis

Table 7 shows the SWOT analysis of lemon grass plantation in the RoW of *Sukhad-Bhajani* road.

Table 7: SWOT analysis of banana in Kailali

Strengths	**Weaknesses**
Suitable climate and soil condition Farmers have initiated cultivation Attractive to cultivate due to possibility of processing and sale in international market Well established market chain available Various processing centres are available Short gestation period	Lack of proper knowledge and techniques in cultivation Lack of nursery in the selected area
Opportunities	**Threats**
Possibility of increase in area and productivity Potential national and international market for the oil High demand by processing agencies High potential for reducing poverty through increase in income High potential for increase in return with organic production and branding	Possibility of fluctuation in price Possibility of price cartel by the exporters and risk of fixing low price for the producers Damage due to forest fire

Suitable in plantation in forest area and community forest area	

Source: *Elam HELVETAS, 2012, Field study, 2016*

There are some weaknesses and threats, in which the district level institutions and NGO can play a catalytic role for improvement. Nursery and cultivation techniques can be disseminated by the extension service of the district level offices.

Due to a growing number of processing industries for oil extraction from the lemon grass in the *Kailali* and *Kanchanpur* districts, the importance of lemon grass plantation as an income generating activity will increase in the future. Currently in *Kailali* there are seven distillation units for lemon grass processing (Elam HELVETAS, 2012). The climate is suitable and land is available. Thus lemon grass can be considered as another plant option in the RoW of the chosen section of *Kailali* as a source for poverty reduction.

6.4.1.6 Discussion of the above considered plants from a socio-economic point of view

Though sugarcane plantation has a B/C greater than one if fencing costs are excluded, it requires irrigation three times per year and the product must be transported to the factory. Plantation on a small area of the RoW may therefore not be attractive for the farmers.

In Kailali between the two plants, banana appears to be more viable than sugarcane. For banana, the B/C is greater than one in all the scenarios and the NPV is positive. For sugarcane, the B/C is greater than one, only when the cost of fencing is not considered. For banana, there will be additional benefits, assuming the value of IRR and B/C will further improve.

Lemon grass plantation is beneficial only in case when there is no fencing cost. Normally lemon grass does not need fencing since it is not harmed by domestic as well as wild animals. Without fencing cost the B/C is greater than one and NPV is above 2.

In Kailali roughly 400 HHs are road neighbours living within 1 km of the road. This is a special case, as these HHs have been resettled by the GoN. It is suggested to select the 20-50 most willing HHs for the plantation and management of the RoW, since not all HHs may be willing to participate.

The annual average income for banana (in NPV) for the user group in Kailali, excluding fencing costs, would be about NRs 333'264. If the user group is formed with 25 HHs, one HH would receive NRs 13'331 annually. This amount corresponds to the primary school expenses expected for one child considering that the books are free and there is no tuition fee up to class 10.

From lemon grass plantation the annual net present value of income for the group would be NRs 42'414. The per household income for the users with 25 households will be about NRs 1'700, i.e. considerably less than from banana plantation. Lemon grass is suitable for intercropping with banana. If intercropping is applied, half the income from each of the crops can be counted. This would come up to about NRs 7'500 per HH. It is clear that the highest income is generated by planting banana only along the full RoW area.

The ELAM project also found that the need for technical backstopping, marketing and management support of the HHs for lemon grass is still high (HELVETAS, 2016d). Considering the lack of these experiences, it is not feasible to propose lemon grass for plantation on the pilot sites. However, if going for a wider replication of the pilot project, it is worthwhile to consider mixed banana cum medicinal/aromatic herb intercropping, in order to stabilise the slopes and cover the bare roadsides against topsoil erosion as long as the young banana trees cannot take over this bio-engineering function.

6.4.2 Hile-Uttarpani-Chhintang-Jyamire road in Dhankuta

In Dhankuta, those HHs located far from the roadside are not very interested in working along the RoW away from their home. In this area, also the labour shortage situation could pose a problem, as most of the young generation have migrated out of the area in search of jobs and livelihood.

6.4.2.1 Devisthan-Chhintang section (ca. km 21-22)

The people living in the area are a homogenous group, i.e. mostly from the Rai community.

Those people living near the road are presently utilising the land for their own benefit. They are ready to join the group and to utilise the RoW for collective plantation. There is a possibility of joining both the neighbours of the road and the poorest of the community. The CFUG has already prepared a well-being ranking. According to the user group's secretary the

Discussion with CFUG of Devisthan-Chhintang section

Photo by Ruth Schaffner, 2016

income does not vary much among the HHs of the village. The villagers are ready to form a sub-committee within the forest user group for the purpose of plantation in the RoW. They prefer broom grass as important income generating plantation along the RoW. As a secondary option they consider tea plantation, if the DDC covers part of the initial costs of plants and other expenses.

6.4.2.2 Aankhisalla Village section (ca. km 11-13)

In Aankhisalla area the population is mixed. This area is slightly more developed in terms of market and the land along the road appears to be relatively more valuable than that of Chhintang. Land owners who were present in the discussion are reluctant to work in the group. The other HHs are not sure whether the land owners will be ready to provide the land for the group's plantation. The Newardhara and Chiyane Danda CFUG's chairman was also

present in the discussion. The CFUG is ready to support the organisation of a sub-committee within the CFUG, for the purpose of plantation in the RoW.

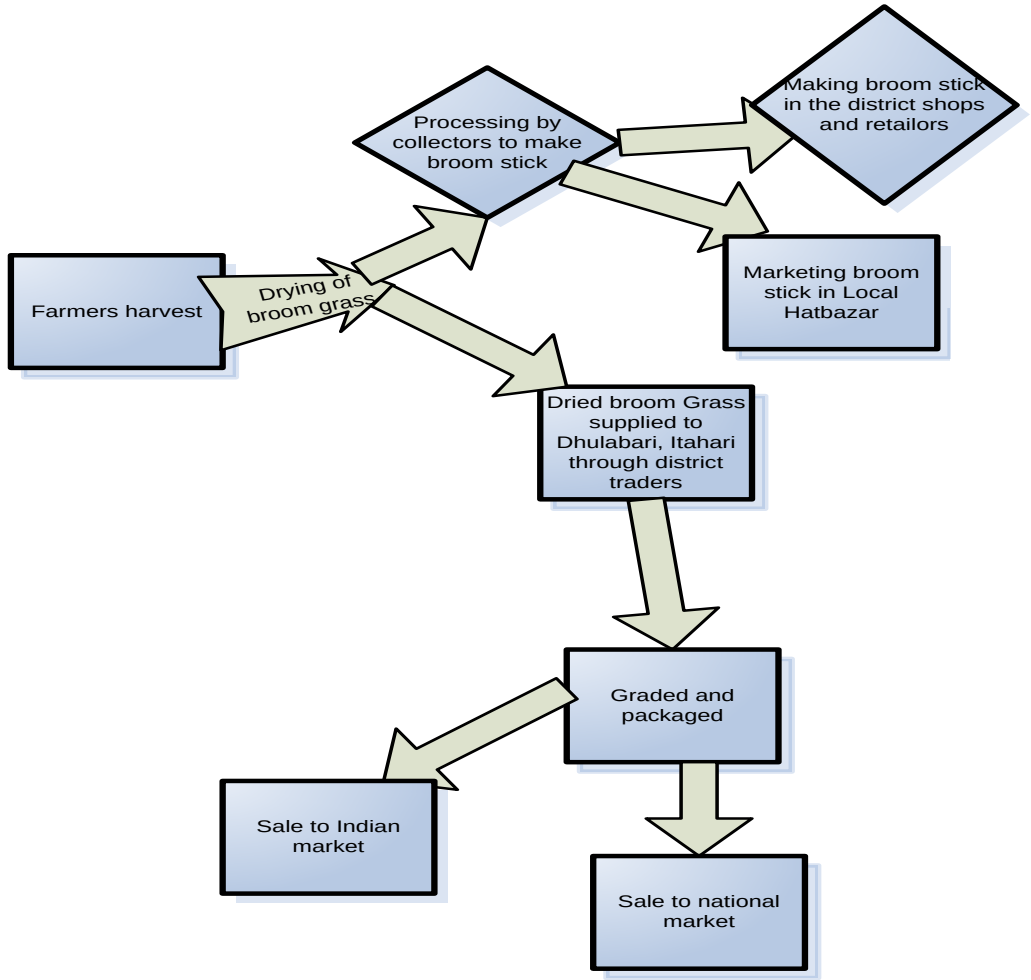
It is also possible to use the well-being ranking prepared by the CFUGs for the purpose of selecting the poorest of the poor from among the villagers. The villagers' first choice for plantation is broom grass. However, they are also interested in planting tea, if initial support is available from the DDC. In Aankhisalla area the population is mixed.

6.4.2.3 Socio economic analysis of amriso plantation

Introduction

Cultivation of broom-grass is comparatively easy and requires low financial input. It can be grown on marginal land, wasteland and fallow land. Planting can be done by seeds or rhizomes. People also collect and transplant wild seedlings for propagation, but it is better to

Figure 6: Value chain of broom grass in Dhankuta (Source: Field study 2016)



get quality seedlings from reputed nurseries. For hilly areas, planting at a spacing of 1.5x2.0 m is recommended and so, about 2'500-4'000 plants are required for one ha. Considering this, it was assumed that 2'500 plants are required for one ha of land in Dhankuta. The culms arise centrifugally during the peak growing season (April to July) and bear inflorescence (panicle) on shoot apex at the end of vegetative growth. The inflorescence that is about 30-90 cm long is used as broom (Bisht and Ahlawat, 1998 and Pathak et al, 2014).

Value chain analysis

Figure 6 shows the value chain of broom grass in Dhankuta. Amriso cultivation is being increasingly developed and promoted as a profitable enterprise in Nepal. Plantation of broom grass has a rotation of 6 years, during which 5 crops are harvested per plot (Bisht and Ahlawat, 1998).

Cost benefit analysis

The tentative cost for cultivation, yield and economic returns of broom grass cultivation is estimated in order to understand its economic potentials. This cost may vary according to labour efficiency, wages, soil fertility, cultural practices, market price and demand, and access to markets (Bisht and Ahlawat, 1998 Pathak et al, 2014). The cost benefit analysis is based on the following assumptions:

- Land area is assumed to be free of cost
- Plantation of broom grass has a rotation of 6 years in which 5 crops are harvested within one plot of plantation
- Discount rate is 10%
- 2'500 tussock are planted in 1 ha of land area in the hills
- The farmer gets a price of NRs 35 for one broom
- 35 culms are used for one broom
- The value of leaves for fodder and the use of stalks as fuel wood or raw material for paper or furniture production are not added to the benefit stream
- The wage rate fixed by the DDC is NRs 470/day. However, the cost and benefit considering NRs 500/day are calculated, as indicated by the villagers and the VDC secretary during the field research

The above assumptions are based on available literature (Pathak et al, 2014; Bisht and Ahlawat, 1998) and the field research. Table 8 shows the costs and benefits of amriso plantation in Hile Chhintang road. The total plantation area is 1.275 ha. Details on the estimation of the costs and benefits are presented in Annex N.

Table 8: Cost benefit analysis of amriso in Dhankuta

Items	**Scenario 1** (without fencing cost)	**Scenario 2** (with total fencing cost; bamboo poles)	**Scenario 3** (only labour cost of fencing with bamboo poles)
NPV (NRs)	1'313'642	-50'355	698'543
B/C	8	0.96	2.05
IRR	1'066%	9%	40%

Source: Field research 2016; Bisht and Ahlawat, 1998; and Pathak et al, 2014

In Scenario 1, the NPV is about NRs 1.3 million, the B/C is 8 and the IRR is about 1'066% (10.66). The high IRR is mainly due to the low fixed cost of planting broom grass. In fact, with the exception of the fencing, no fixed cost occurs when planting broom grass. In the second scenario the NPV is negative, the B/C is less than one and the IRR is only 9% (0.09). In the third scenario, the NPV is nearly 0.7 million, the B/C is 2.05 and the IRR is 40% (0.4).

SWOT analysis

The climate of the Hile-Chhintang area is suitable for broom grass plantation, and this plant is traditionally cultivated by the farmers. It is an attractive crop since it provides good return.

Brooms are required in each house and therefore, there is sufficient demand throughout the country and even in India. Hence marketing is not a problem.

The majority of the production is from subsistence farming and from dispersed collection in the community forest and state managed forest. Broom grass is a high volume crop and there is glut in the market during the harvesting season, which reduces the local price. Wholesale trading of brooms is a highly monopolised activity. The major portion of income goes to the traders and middlemen. Hence, there is a scope of increasing the benefit of farmers if the marketing mechanism is improved by the district level agencies.

Furthermore, the demand for broom grass in the area of production is relatively low, as other alternatives of brooms are also locally available. Therefore, a system of cooperative marketing needs to be developed in order to improve the economy of people and region. The CFUGs can play an effective role in this venture. Table 9 shows the Strengths, Weakness, Opportunities and Threats for the plantation of broom grass in Hile-Chhintang road in Dhankuta.

The SWOT analysis shows that there is a possibility of adding value by improving the marketing mechanism and through support by the government agencies. Research on the disease, support for collective marketing and provision of extension services for quality seeds and nursery, support in broom making etc. may help farmers to further increase their income from broom grass plantation.

Table 9: SWOT analysis of amriso in Dhankuta

Strengths	**Weaknesses**
Climatic suitability Traditionally cultivated Attractive cultivation due to high prospect of marketing and high income Grows well on slopes and marginal land Well established value chain and availability of traders High demand in the market Focus of the government as income generating activity Availability of research and extension services	Lack of proper knowledge and technique in cultivation and nursery management No solution yet against the broom grass flower disease Lack of collective broom grass marketing Insufficient availability of quality seeds Insufficient knowledge about the marketing and processing of the broom grass
Opportunities	**Threats**
Possibility of increase in area and productivity Option for internal and international market Large demand and further scope for increase in supply High potential for reducing poverty Some Community Based Organisations (CBO) are working and providing support	Dramatic price fluctuation Volatile Indian market

Source: Field research, 2016 and Pathak et al, 2014

During the district level consultations with the Federation of Community Forestry Users Nepal (FECOFUN), the Society of Local Volunteer's Effort (SOLVE) and the DFO in Dhankuta, it was agreed that amriso is among the best alternatives for roadside plantation on Hile-Chhintang road and that herbal plants are also suitable. According to the SDO of the soil conservation office, amriso is the best plant in terms of income generation and control of soil erosion. The office is ready to provide baby plants for amriso plantation free of cost to farmers.

6.4.2.4 Socio economic analysis of tea

Introduction

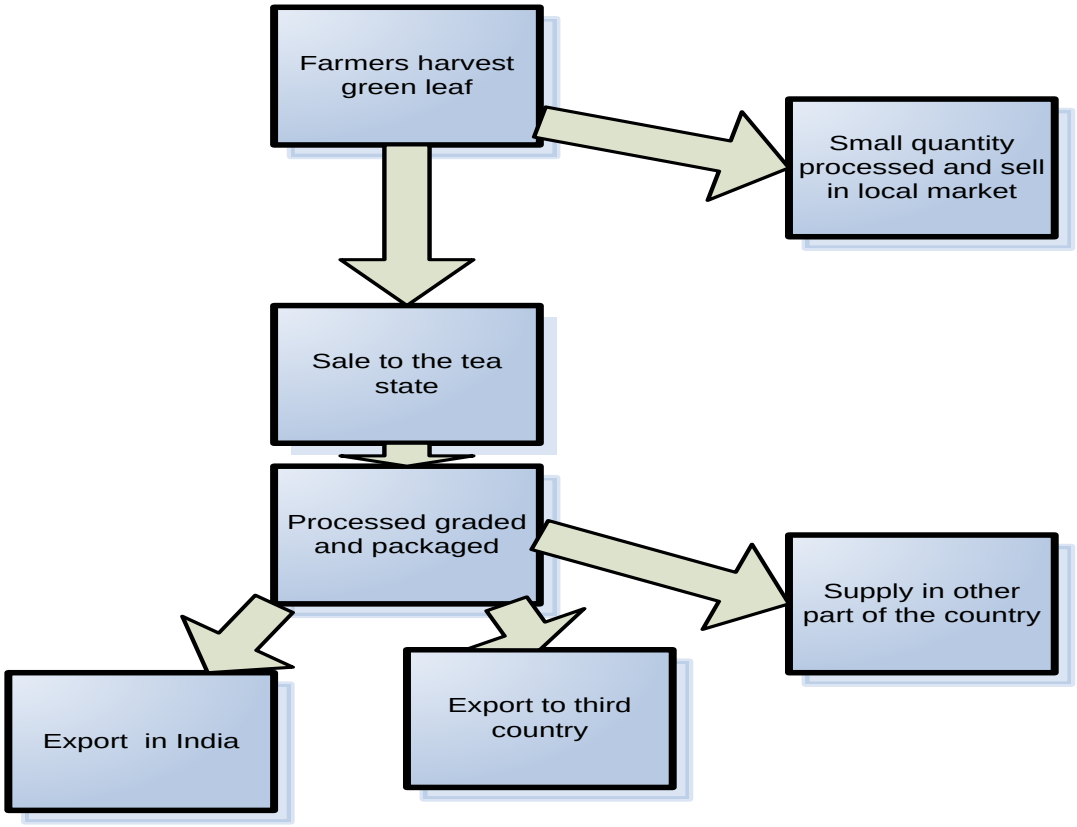
Plantation of tea is another option suggested by the farmers. While CTC tea is produced mainly in the Terai, the hilly region of Dhankuta is one of Nepal's important areas of orthodox tea production. Orthodox tea refers to the process, where the tea is hand-processed, or rolled in machines which mimic the hand rolling technique. In Nepal, orthodox tea is produced and processed in the hilly regions at an altitude ranging from 1'000 m asl to 2'000 m asl. In the past, Nepal's tea exports amounted to only about 100–150 t per annum. However, due to the liberalisation introduced about a decade ago, Nepal's tea industry has witnessed an exponential rise in tea exports, today amounting to 4'000–5'000 t per annum (Thapa, 2005). Tea is considered a self-dependent cash crop in agro forestry practice and the most important example of long term sustainable farming (KC, 2011).

According to Gurashe Tea Estate, Nepal's tea is mainly exported to India, Pakistan, Australia, Germany, France, Poland, the Netherlands, Japan, Belgium and the US. The Himalayan Orthodox Tea Producers Association (HOTPA), the association of orthodox tea producers of Nepal, realising the potential of the Nepalese orthodox tea in the global market, has been adopting various measures to improve the quality and marketing of orthodox tea (KC, 2011).

Value chain analysis

In Dhankuta, tea is mostly produced and processed by the tea estate. Small farmers also produce tea leaf and sell this to the tea estate. After plantation it takes at least four to five years until the return is sufficient. Figure 7 shows the value chain of tea plantation in Dhankuta.

Figure 7: Value chain of tea plantation in Dhankuta (Source: Field study 2016)



Source: Field research Dhankuta (2016); discussion in Gurase Tea Estate; discussion with the Tea and Coffee Development Board, Kathmandu

Cost benefit analysis

Table 10 shows the summary of costs and benefits of tea plantation on the Hile-Chhintang road, particularly for the area of the Devisthan-Chhintang section. The total plantation area is 1.275 ha. The cost benefit analysis is based on the following assumptions, which are drawn from the reviewed literature; details are presented in Annex N.

- No cost for land area
- The number of plants per ha of land will be 14'000
- The return from the plantation is expected only after 5 years
- The amount of green leaf per plant is 50 g
- The wage rate is NRs 228 per day
- The price of green tea leaf is NRs 56 per kg

Three scenarios are presented in Table 10. The NPV is negative for all scenarios; the highest negative value occurs when all fencing costs are included. The B/C is less than one for all three scenarios. It is lowest (0.34) when all fencing costs are included and it is only 0.55 when no fencing costs are included. It was not possible to calculate the value of IRR, as a negative NPV is expected for many years and this negative value is relatively high, even after

Table 10: Cost benefit analysis of tea plantation in Dhankuta

Items	**Scenario 1** (without fencing cost)	**Scenario 2** (with total fencing cost; bamboo poles)	**Scenario 3** (only labour cost of fencing with bamboo poles)
NPV (NRs)	-1'024'687	-2'393'697	-1'569'931
B/C	0.55	0.34	0.44
IRR	NA	NA	NA

Source: Field research (2016); Gurashe Tea Estate; Tea Coffee Development Board; Nepal Gazette (2016)

50 years. Based on this analysis, the team does not consider tea planting to be economically viable in the RoW in Dhankuta since in all scenarios the NPV is negative and the B/C is less than one.

SWOT analysis

The SWOT analysis for tea plantation in Dhankuta is given in Table 11.

Table 11: SWOT analysis of tea plantation in Dhankuta

Strengths	**Weaknesses**
Suitable climate Cultivation is practised in the nearby area Prospect of marketing Prospect of government extension services	Lack of proper knowledge and techniques in cultivation and nursery management Insufficient awareness Only prospect of selling green leaf Low bargaining power when selling the leaf Long gestation period Relatively high cost

Opportunities	Threats
Prospect of selling organic green tea in the international market High demand in national and international market Possibility of selling at a high price High quality product can be produced	Volatile price of green leaf Monopoly of the buyer Difficulty in processing and marketing for small producers Unprofitable business if only green leaf is sold Many farmers in Ilam stopped cultivation because they could not cover the cost with the price of leaf

Source: Field study 2016

Tea plantation is suitable in the climate of Hile-Chhintang area. The market for orthodox tea is very high and Dhankuta is one of the best areas for producing orthodox tea in Nepal. However, cultivating a small area just for the purpose of selling green leaf is not profitable for the farmers, and the profit only comes after a long time. In order to earn more profit, processing and export to the international market would be required. Farmers planting on a plot of just 1 ha cannot manage such a processing and marketing mechanism. The purchase of green leaf is in the monopoly of the purchaser. Only a few tea estates purchase the green leaf. The gestation period for the tea is very long. It is difficult for small farmers to wait for a long gestation period before achieving income.

6.4.2.5 Discussion of the above considered plants from a socio-economic point of view

Of the two plants analysed, only amriso is economically viable for plantation in the RoW of Dhankuta. In addition to the income from the sale of the broom, there are other benefits of this crop, such as fodder for livestock, firewood, furniture or paper making from the stalks, or income from the sale of saplings for plantation (Gautam, 2015). Due to a lack of information on the exact price of these products, the value of these products has not been included in the cost benefit analysis.

Fencing costs are relatively high even with bamboo poles. It is assumed that amriso may not need fencing since none of the farmers along the Hile-Chhintang road have fenced their amriso plots. If fencing is required, it is recommended that the DDC provides the necessary material support.

The annual net average income (in NPV) for the user group in Dhankuta generated by broom grass plantation would amount to NRs 262'725, without fencing cost. If the user group is formed by 25 HHs, one HH would receive NRs 10'509 annually. This amount corresponds to the primary school expenses expected for one child considering that the books are free and there is no tuition fee up to class 10.

7 Conclusions

The focus of the research project was placed on two districts - Kailali in far western Terai and Dhankuta in Nepal's Eastern hills. In each district, one road was selected and within these two selected roads, only a short section each of about 1 km length was chosen for the pilot implementation. In other words, the pilot project covers only a very small area of Nepal's large road network. With this in mind, the amount of information which has been collected/obtained during the course of the research is considerable: Firstly, during the desk review and national-level consultations in Kathmandu and later during the two field visits - one in each district. The team therefore feels that the proposed future activities can be confidently taken up and used as a basis for the wider replication of the project.

The concept of utilising the RoW land is new in Nepal. The literature review and the interaction with key individuals revealed that neither is there not a formal institutional mechanism already in place, nor have any specific legal instruments yet been developed to support this concept. However, there are a handful of experiences in Nepal, where public land has been used by local communities for income generating activities or at large for the benefit of the locals. Indeed, during the field visits it turned out that road neighbours or community forestry groups are already cultivating every available fertile land plot along the roadsides.

However with the aim of signing a tripartite MoU for the use of the RoW land along a particular road section, it is essential to note that a wider consensus on matters related to benefit sharing mechanisms and the roles and responsibilities of the different government institutions such as VDCs, municipalities, DDCs, and DoLIDAR itself will be needed.

The research also showed that there is already widespread experience on the use of bio-engineering plants for roadside stabilisation, but there is scarce experience on roadside plantation for productive use. On the basis of field observations, discussions with the local communities and considering socio-economic criteria, the team could – from a range of potential plants - identify suitable plants for productive use which also satisfy bio-engineering requirements along the DRCN in Kailali and Dhankuta.

We want the pilot project to be successful. Therefore it is advisable not to choose plants on which information on costs and benefits are not available, or for which neither the skills for processing nor a market chain is yet in place. Not every plant can be used for plantation by the poorest of poor, who lack farming and marketing experiences. Much rather, it is recommended to select crops with a high return on investment. Such plantations must be strictly feasible, realisable and appropriate in the given context. The pilot itself is already innovative, and the team believes there is no additional space for further innovative ideas regarding plant species, cultivation and marketing.

Only for wider replication of the pilot project, and with the option to plant larger areas of RoW land, alternative utilisation options, technologies and approaches could be investigated. One feasible option is to combine contract farming of medicinal and aromatic plants with an entrepreneur managed distillation unit for the production of essential oils. In the future, the district level line agencies can provide support for the selection of further plant species in the RoW with low production costs and a high marketing value.

The following chapters provide detailed results on the four main topics of this research – legal framework, engineering matters, plantation for productive use and socio-economic considerations.

7.1 Conclusions on legal and institutional matters

Nepal has developed different land-use sector policies and various legal instruments on environmental protection and infrastructures development. Environmental friendly economic development and poverty alleviation is an important constitutional policy of the state. However, it was found that agencies, stakeholders and local communities are hardly aware of the existing legal provisions on the utilisation of RoW land. However, there are many local practices going on at community level for the utilisation of public lands (such as riverbed farming, RoW of irrigation channels or electricity lines) for income generation activities to poor and landless families.

The majority of stakeholders appear to prefer using existing institutional structures at district and VDC/Municipality level for the coordination and monitoring of the use of such land. The Environmental Friendly Local Governance Committee and thematic committees on agriculture, forestry and environment are highly recommended institutional structures at district and VDC/Municipality level. For the management of the RoW for income generating activities, the poor HHs as well as the roadside landowners are interested in forming a sub-committee under existing registered groups related to agriculture, forestry or water. In fact, the majority of HHs recommended forming a RoW User Group/Sub-committee under the CFUGs.

According to the stakeholder consultations in Kailali, the members of the local community suggest to name such a group a "RoW User Group". In Dhankuta, they recommended to form a "RoW User Sub-Committee" under the existing CFUG. Therefore, the team suggests to name the respective groups *RoW User Group and RoW Sub-committee for Kailali and Dhankuta,* respectively.

The willingness of the local government (DDC, Municipality and VDC) to coordinate the implementation of this project between landowners and poor/landless HHs is high. The authorities of the DDCs have expressed their consent to sign a formal contract or MoU between the DDC and local communities, if the local communities are interested to use the RoW land for maintaining plantations and generating income. However, the authorities have recommended following a rigorous process in order to develop consensus between landowners and poor HHs during the formation of the RoW User Group/Sub-committee and the consecutive implementation of income generation activities. In the course of this process, the access rights of landowners must be considered.

7.2 Conclusions on engineering requirements for roadside plantation

In Nepal there are two major government agencies, i.e. DoR and DoLIDAR, responsible for the construction and maintenance of roads. The DoR focuses mainly on the construction of strategic road networks, whereas the DoLIDAR is responsible for undertaking infrastructure development programmes in accordance with decentralisation policies set forth by the Government of Nepal's National Strategy for Rural Infrastructure Development. Thus, DoLIDAR focuses on building technical capacity and competences with the local authorities (i.e. DDC), while also ensuring their participation in the construction and maintenance of rural roads.

Generally, DoLIDAR focuses on the construction, rehabilitation and maintenance of the district core road network (DCRN) that intends to connect all the VDC headquarters to the DDC headquarters.

Due to a lack of adequate funding there has been a huge backlog of maintenance of the already constructed DRCN, and as a result large proportions of the roads are in a poor condition, hardly maintained, and partly requiring rehabilitation. The condition of a large

number of bridges has also worsened during the last decade due to the political conflict and an absolute lack of government attention and maintenance. There are some projects within DoLIDAR such as SNRTP who address these issues, but these initiatives do not cover the whole country.

In addition to the literature review, key individuals working in these areas were consulted. Various issues such as the actual width of the RoW and the availability of As Built Drawing were discussed. These interactions revealed that it is difficult to find roads with a 20 m clear RoW, except for a few such as the Sukkad – Bhajani Road in Kailai. However, there are some roads constructed by DoLIDAR/DDC through projects namely RRRSDP and DRLIP, which have a 10 m RoW.

Generally roads in the hilly region pass through steep mountains, and the required carriageway width is acquired by cutting the upslope, and filling the down slope using the same materials as far as possible for balancing the soil mass. The amount of cut and fill, and the quantity and type of retaining structures required, depend on the topography of the specific locations considered. Thus, it is important to note that it is not always feasible to use the whole section of the RoW for plantation activities.

In hilly regions it may practically not be possible to consider plantation on more than 80% of the available land. In some cases, gabion or masonry structures may also be needed, in order to maintain a slope, to clear existing side drains etc. For instance, on one of the pilot project sites in Dhankuta, there is virtually no side drain. Furthermore, in most cases the existing side slopes both at hill and valley side do not meet the standard established by the Nepal Rural Road Standards. Since the road section considered for this pilot is short, it is proposed to bring the slope to the standard as specified in the NRRS. Due to high costs, such a correction may not be possible in a wider replication of the project. The team therefore recommends the DoLDIAR/DDC to develop a comprehensive inventory with a ranking of all projects for phase wise consideration.

The situation of the DCRN in the Terai region is somewhat different. Here, the roads are generally constructed with an embankment. The height of the embankment and its slope, and whether side drains are provided on one or both sides, depends on the topography of the specific location under consideration. In Kailali, the height of the embankment is almost 1 m, with gentle slopes on both sides, and no side drain is required. This allows using a maximum area of the RoW for plantation. If the topography demands side drains on one or both sides of the road, and cross drainage and culverts etc., the available area will decrease. Thus also the Terai, from a practical perspective, not 100% of the RoW area can be used for plantation.

Virtually, the wider replication of the proposed project is not possible without the existence of a specific strategy of the concerned government agencies. At the national level, DoLIDAR and other concerned agencies should focus on developing a clear strategy including a revision of the existing Nepal Rural Road Standard for the utilisation of the RoW land. The costs for plantation and necessary engineering structures should be included in the bill of quantities (BOQ) during the preparation of the DPR, for both new constructions as well as for the improvement of existing ones. Furthermore, research should be carried out to identify different low cost engineering solutions (such as low cost fencing) suitable for different topographical regions so that the local agencies can adopt these during the implementation of their projects. From the safety point of view, the side drain should be forgiving in nature. Thus, roadside furniture (such as side drains) should be developed in a way so that these will not hurt much in case of an accident. For the Hile-Chhintang road tick-type drains are proposed that allow pulling out a vehicle easily in case of such an accident.

Mobilising local people as a Road Maintenance Group (RMG) is a common measure in DoLIDAR and the DDCs. Generally people with a low income level and residing near the roadside work as a RMG. RoW utilisation through roadside plantation should be linked with the road maintenance in order to ensure its sustainability.

7.3 Roadside plantation for productive use combined with bio-engineering

Local banana for the Sukhed-Bhajani road in Kailali

With regard to site conditions, various sections along this road would be suitable for roadside plantation. However it is advisable to avoid land plotting areas near villages. The road neighbours here would not be ready to give their land away to be planted by user groups. Therefore, the Bhajani Municipality road section at about km 22-23 was selected for the pilot project.

On the relatively small RoW areas along the selected road section, the plant of choice is the local banana. It is already a common and well-known crop in the area and the skills for cultivation are developed. There are banana nurseries in Tikapur and Fulbari from where farmers can purchase the saplings. Also the marketing chain is well in place. Planting time is best at the start of the rainy season. Except for the first few months after plantation or during a very dry season no irrigation should be needed.

Local banana on Sukhad-Bhajani road

Photo by Ruth Schaffner, 2016

Since in this flat area no high bio-engineering input is required, banana with its excellent rooting system is a suitable crop for roadside plantation. Banana is fast growing, also quickly providing topsoil cover to prevent erosion. For this purpose the planting of grasses or herbs can also be considered. However as discussed in Chapter 6.3, this is no option for the time being, since the skills for planting, processing and marketing are not in place, neither for medicinal nor aromatic herbs. However, banana-lemon grass intercropping might be an

option, when further replication of the project is planned with a larger area to be covered and if training can be provided to interested user groups. In such a case, also nurseries might be needed to provide the larger amount of plants required. Still it has to be considered that in the Terai the highest yield is produced by planting banana only.

To enhance slope protection Howell (1999) suggests trying to achieve plantation of mixed ages. That means that not all plants need to be harvested and replaced at the same time and there will always be some strong, healthy plants protecting the slope. If this is done along the RoW area, a certain reduction of return must be expected.

Amriso (broom grass) for the Hile Chhitang road in Dhankuta

During the reconnaissance survey the team earmarked three sections along the road suitable for roadside plantation for productive use. For political and socio-economic reasons (for the discussion of this see Chapter 6.3.2.1), the road section between the Samogaun School at Danada and the Ilaka police station is proposed for the pilot project. It leads through open utis forest with quite dense understory. The slopes need some trimming and clearing from unwanted vegetation, and not all the steeper slopes will be suited for plantation.

The plant of choice here is amriso. Saplings are freely available from forest user groups. Alternatively, the district headquarters, via the office of soil conservation, can coordinate the provision of saplings to the group free of cost if needed.

Amriso is a common and very well-known species for productive use in area, the skills for cultivation are developed and the skills for processing the cash crop are in place. When planted during the rainy season no irrigation is required.

New amriso plantation near Aankhisalla, no fencing

Photo by Ruth Schaffner, 2016

Amriso is widely used as bio-engineering plant throughout the hills of Nepal. Hence its double role of slope stabilising and providing income as a cash crop is fulfilled. Based on bio-engineering experiences, fencing for amriso is not required. Protection can be regulated by involving the user groups. After plantation only minimum maintenance is required.

For the relatively small area of the pilot project no new nursery needs to be set up. For further replication of a larger-scale project, a nursery might be needed, in combination with training to the farmers, so that they can develop the nursery, initiate and maintain the plantations properly and generate a better return with lower costs for their product.

For a further replication on larger areas amriso-utis intercropping can be considered, or alternatively, establishing tea plantations. This would have to be complemented with specific training.

7.4 Conclusions from a socio-economic viewpoint

It is advisable for DoLIDAR to maintain coordination with FECOFUN at the national level for the development of institutions responsible for plantation on the RoW of district roads. FECOFUN have a strong network at district level and linkages at village level with forest user groups. In this way, already established institutions at the grass root level can be used as a basis for the institutional setup required for the utilisation of the RoW.

Adaption of more labour intensive techniques and employment for the poor for the construction of roads is desirable. Although labour in the villages seems to become scarce due to the out-migration to the Golf states and other countries, the poorest of the poor who are still in the village can get an opportunity to work if more labour intensive techniques are used. Such techniques may also support the preservation of soil and the prevention of landslides along the roadside.

In the context of house building activities along the roadside, there is a need to coordinate these with the local government, so that no construction occurs in the RoW area and access roads are only built in designated areas.

District line agencies may provide extension services to support plantations in the RoW for a certain period. Training for planting and improvement of the marketing mechanism may help the RoW User Group/Sub-committee to receive a best value on their product. A coordinated arrangement with local dealers, wholesalers or special cooperatives would allow the users to sell the products of the RoW at a fixed price so that they will not be reluctant to start plantation and be harmed by price fluctuations. The local government may also encourage plantation by providing market information related to the sale of product residues (e.g. banana stems for paper or fibre making; or the residue of broom grass for paper making). The DoLIDAR and the DDC can support the farmers in branding their products of the RoW for added value.

The local government should also disseminate success stories of plantations on the RoW.

The willingness of farmers to participate in the program is very important. It appears that it is mostly road neighbours who are ready to participate; but it is not everywhere possible to find poorest of the poor as road neighbours. So it would be better to select poor from among those farmers who are neighbours of the road.

The project provides very small pilot areas only, and therefore the return might be too small if too many beneficiaries participate. As the areas under the RoW are not so large, it is recommended for the farmers to select 20-40 farmers from among themselves. It may also be useful to form two sub-groups for the utilisation of the right and left part of the RoW. In Kailali there are nearly 400 HHs as road neighbours in the 1 km section. This is a special case, as these HHs have been resettled by the government. From among these, it is recommended

to select only 20-50 willing HHs for the plantation and management of RoW, since not all HHs may be willing to participate.

The additional annual average income (in NPV) for the RoW User Group in Kailali, without fencing cost, would be about NRs 333'264. If the User Group is formed with 25 HHs, one HH would receive NRs 13'331 annually. This amount could e.g. support sending to school one additional child, covering the general expenses and considering the fact that books are free and there is no tuition fee up to class 10. The annual net average income (in NPV) for the RoW User Sub-committee in Dhankuta, without fencing cost, would be about NRs 262'725. If this Sub-Committee is formed with 25 HHs, one HH would receive NRs 10'509 annually.

8 Proposed future activities

Based on a review and analysis of comparable projects of other institutions in Nepal, as well as on the solicitation of stakeholders' opinion during the field survey and key informant interviews, a tentative framework for future activities has been conceptualised. Key milestones on institutional and legal arrangements, plantation and engineering inputs and on relevant social economic requirements are suggested in Figure 8.

It is essential to note that before successfully sign a Tripartite MoU for a particular road section, a wide consensus will be needed on matters related to benefit sharing mechanisms as well as on the roles and responsibilities of the various government institutions involved, such as the VDCs, Municipalities, DDCs, and DoLIDAR itself.

8.1 Preparations at national and district level

Acceptance of the report and draft manual by DoLIDAR/ReCAP

The report of the current research as well as the draft manual developed for the utilisation of the RoW of roads will be finalised and consecutively owned by DoLIDAR. This ownership arrangement is considered to be a first important step towards moving the concept of the utilisation of the RoW for income generating activities forward.

Procurement of a service provider by ReCAP

Upon acceptance of the Final Report, ReCAP will engage a service provider for the next phase of the pilot research, i.e. to continue consultations and ensure compliance of tasks and activities agreed by the concerned stakeholders.

Formation of a project-implementing Task Force at DoLIDAR/DDC for the cooperation with the service provider

DoLIDAR shall constitute a task force, or mandate an existing task force, to support and cooperate with the service provider of ReCAP, specifically in the cooperation with the DDC/DTO in carrying out periodic consultations with government ministries, departments, corporations and non-governmental entities relevant to this project. The task force shall support training needs assessments and other relevant capacity building activities, both at national and local level.

Interaction with concerned stakeholders, to develop the required institutional setup at national, district and local level

The service provider, with the support of the task force, shall take the lead in establishing the institutional set up required for the implementation of the project concept at national, district and local level. The service provider, with the help of the task force and other stakeholders, shall also explore the availability of suitable RoW land, and facilitate the process of acquiring the official 20 m RoW on district roads. It shall take the lead in mobilising personal and financial resources both from private and public sectors.

Finalisation of institutional setup at national, district and local level and deployment of respective professionals

A dedicated unit with a clear vision, mission, strategy and well-formulated objectives shall be established at national, district and local level. If needed, a separate operational manual can be developed as guidance for this purpose.

Figure 8: Key milestones for proposed future activities

S.No.	Descriptions	Year / Month																							
		2073												2074											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
0	Acceptance of the report and draft manual by DoLIDAR/ReCAP																								
1	Preparation of pilot project implementation at site																								
1.1	Procurement of service provider by ReCAP																								
1.2	Formation of task force at DoLIDAR/DDC for cooperation with service provider																								
1.3	Interaction with concerned stakeholders for developing necessary institutional setup at national, district and local level																								
1.4	Finalisation of institutional setup at national, district and local level and deployment of necessary professionals																								
1.5	Design and conduct capacity building activities																								
2	**Pilot project implementation at site**																								
2.1	Interaction with community identified during the research																								
2.2	Finalisation of road section in consultation with community																								
2.3	Negotiation with community for cost and benefit sharing mechanism																								
2.4	Tripartite MoU among DoLIDAR/DDC and Community																								
2.5	MoAs in between the DDC and Community																								
2.6	Training to the locals if needed																								
2.7	Baseline study on socio-economic condition																								
2.8	Walkover survey along the selected road section to identify the locations for physical intervention and plantations																								
2.9	Order/collect construction material and plant material																								
2.10	Develop water management if required																								
2.11	Execute engineering and plantation works at site																								
2.12	Completion of plantation																								
2.13	Regular maintenance																								
2.14	Introduce marketing chain																								
2.15	Regular monitoring and supervision of works by the DDC/DoLIDAR and VDC/Municipality																								
3	Mid-term and final evaluation																								
4	Documentation about the process																								
5	Wider replication																								

Design and conduct capacity building activities

It is essential to assess the types of capacity development activities that will be needed at the national, district, local and community level. This can be achieved through a questionnaire survey with the local community in general, through interaction with key individuals, by training unit heads or those individuals who are responsible for human resource development, or by conducting trainings at national, district or local level. Based on the findings of this assessment, respective training programs should be carried out, either based on existing or newly/specifically designed sources.

8.2 Business plan for the implementation of roadside plantation

A simple business analysis is presented in the subsequent section. The total area in the selected road section for piloting is 1.275 ha in Dhankuta and about 1.265 ha in Kailali. Broom grass and banana are selected for plantation in Dhankuta and Kailali respectively. Table 12 shows the business prospect of the selected plants.
Table 13 shows the production plan with different activities and related costs, for the plantation of selected plants in the road section. In the table, 3 scenarios are presented. Scenario 1 includes only the cost for the cultivation of the selected plants. Scenario 2 includes the cost of fencing considering bamboo poles for fencing. In scenario 3, only labour cost required for the fencing are included.
Table 14 shows the return from the plantation in the RoW of the selected road section in both districts. It is assumed that amriso and banana plants need to be replaced in the 6th year for better return. Instruments required for banana plantations are power sprayer, sucker extraction instrument, hasiya and kodalo. The three tables indicate that plantation of amriso in Dhankuta and banana in Kailali is profitable and suitable for poverty reduction of the poorest of the poor in the selected area. However, plantation of amriso in Dhankuta will not be viable, if all costs of fencing are included. Usually, forest user groups do not apply fences at their amriso plantations in Dhankuta.

Table 12: Business analysis for selected plants

S.No	Items	Dhankuta	Kailali
1	Type of the product selected	amriso (1.275 ha)	banana (1.265 ha)
2	Targeted market (for detail see the value chain analysis)	Local collector, middleman, Hile traders, Birtamod wholesalers, Itahari wholesalers, Indian importers	Local consumers, retailers, wholesalers, middle man, processing industries, export to *India*
3	Production and sale target	More than 10'000 t of broom grass exported in 2012/13 to India (Pathak, et al, 2014). Huge demand of broom grass as it needs to be replaced at least in 4-6 months for each household in Nepal and India.	Huge amount is going out to import banana from India. 27'878 t of bananas were imported in Nepal during 2011/12 from India (ICIMOD, 2015). This shows that there is a gap of demand and supply in the country. So there is a high prospect of market for sale of the product.

Sources: Pathak et al 2014; ICIMOD 2014; Field study, 2016

Table 13: Production plan for selected plants

Items	**Dhankuta**			**Kailali**		
Area	1.275 ha			1.265 ha		
Plants	**Broom grass (amriso)**			**Banana**		
Costs	Scenario 1	Scenario 2	Scenario 3	Scenario 1	Scenario 2	Scenario 3
Cost for fixed inputs (in NRs)	no inputs required	1'369'010	54'5244	67'593	1'361'879	538'577
Fertilizer	13'000	13'000	13'000	134'430	134'430	134'430
Land prepare Land pit digging	20'000	20'000	20'000	30'209	30'209	30'209
Seedling	12'752	12'752	12'752	120'836	120'836	120'836
Insecticides and Pesticides	0	0	0	28'321	28'321	28'321
Irrigation	0	0	0	28'321	28'321	28'321
Rental cost for tractor	0	0	0	6'042	6'042	6'042
Other labour cost	39,963	39'963	39'963	42'953	42'953	42'953
Support material	0	0	0	30'209	30'209	30'209
Transportation	0	0	0	18'881	18'881	18'881
Total cost in Year 1	85'715	1'454'725	630'959	507'794	1802081	978'779
Additional cost in Year 2	39'888	39'888	39'888	252'906	252'906	252'906
Additional Cost in Year 3	39'888	39'888	39'888	252'906	252'906	252'906
Additional cost in Year 4	39'888	39'888	39'888	252'906	252'906	252'906
Additional cost in Year 5	39'888	39'888	39'888	252'906	252'906	252'906
Total cost	245'267	1'614'277	790'511	1'519'418	2'813'705	1'990'403

Sources: Pathak et al 2014, Bisht et al, 1998, DDC Dhankuta, DADO office Kailali, DDC Kailali; Field study, 2016

Add. Table 13 cont.: Production plan for selected plants

Items	**Kailali**		
Area	1.265 ha		
Plants	**Lemon Grass**		
Costs	Scenario	Scenario 2	Scenario 3
Fencing cost (in NRs)	NA	1294286	470984
Fertilizer	12650	12650	12650
Land preparation	11069	11069	11069
Plantation	14168	14168	14168
Seedling	7906	7906	7906
Irrigation	2530	2530	2530
Weeding and harvesting	19039	19039	19039
Processing	13915	13915	13915
Total cost in Year 1	81276	1375562	552260
Additional cost in Year 2	54394	54394	54394
Additional Cost in Year 3	54394	54394	54394
Additional cost in Year 4	54394	54394	54394
Additional cost in Year 5	54394	54394	54394
Total cost	298232	1592518	552260

Sources: Herbal Production and Processing Co. Ltd. 2002, Elam Helvetas, 2012, ANSAB and SNV, 2003, DDC Kailali

Table 14: Return from the plantations

Item	**Amriso** (amount in NRs)	**Banana** (amount in NRs)	**Lemon grass** (amount in NRs)
Price	NRs 35/broom	NRs 250/ghari	1500/Lit
1	57'384	755'224	85387.5
2	191'280	755'224	127132.5
3	717'300	755'224	127132.5
4	573'840	755'224	127132.5
5	573'840	755'224	127132.5
Total	2'113'644	3'776'120	593917.5
NPV in Scenario 1	1'304'551	1'666'320	212070
NPV in Scenario 2	-55'368	372'034	-962829
NPV in Scenario 3	698'543	1'195'336	-258914
IRR scenario 1	746%	456%	2.06 (206%)
IRR scenario 2	9%	9%	NA
IRR scenario 3	40%	57%	-0.12
B/C ratio scenario 1	8	2.39	1.6
B/C ratio scenario 2	0.96	1.15	0.3
B/C ratio scenario 3	2.05	1.72	0.77

Sources: Pathak et al 2014; Bisht et al, 1998, DDC Dhankuta; Herbal Production and Processing Co. Ltd. 2002, Elam Helvetas, 2012; ANSAB and SNV, 2003; DDC Kailali; DADO office Kailali; Field study, 2016

8.3 Pilot project implementation at site

Interaction with the community identified during the research

Interaction with the local community is the first step towards successfully implementing this pilot project. The service provider together with the DTO and DDC counterparts shall visit the community identified during the research period (see Annexes C and D). The main objective of this visit is to share with the community the project objectives, the planned activities, and the roles and responsibilities of the concerned stakeholders including the local people. The visit shall help understand the existing situation and the needs of the community, and to identify challenges that may occur during project implementation.

Finalisation of road section in consultation with the community

The specific section of the road a particular community has been allocated must be finalised, including a clear demarcation of the start/end points and the RoW edge line. This shall be done in consultation with the local people, political parties and other people relevant as per the local situation, such as representatives from the VDCs, Municipalities, etc. For this decision, it is essential to develop a common consensus including the necessary legal obligations.

Negotiation with the community for cost and benefit sharing mechanism

Since a large number of HHs are being involved on a single section of road, it is most important to establish specific guidelines on how to select the partaking HHs and how to share the benefit from the proposed project among them. Ideally, the selection of partaking HHs is based on those HHs interested in the utilisation of the RoW, since not all HHs may be interested. Issues such as the duration of the project, types of plants to be planted, roles and responsibilities of each stakeholder including the government counterpart should be clearly defined and mutually agreed upon, before signing the contractual documents.

Tripartite MoU between the DoLIDAR/DDC and the Community

According to the existing provision of the PRA the DoLIDAR/DDC owns the land of the RoW, including the roadside, which will be utilised for this pilot project. To some extent, the LSGA also delegates roles and responsibilities to the VDCs/Municipalities, such as the protection of production including trees along the roadside. The local communities must therefore obtain a formal consent or approval from the local government, to utilise the RoW land under this pilot project, based on a tripartite MoU between DoLIDAR/DDC, the VDC/Municipality and the local community. These parties need to enter into a formal process for arranging a MoU among them before implementing project activities at the local level. The DDC can facilitate the required arrangement process (see Annex G for a model MoU).

Agreement between the DDC/Municipality/VDC and the Community

The LSGA has made a provision for local communities to implement local level development and income generating activities. Accordingly, local bodies can implement this project through local communities. The local bodies can provide financial, technical and capacity building support to local communities based on the particular contract or MoA between local bodies and local communities. Local bodies and local communities need to enter into a formal agreement process in order to receive support from local bodies to implement this pilot project (see Annex H for a sample MoA).

Providing training to the locals

Capacity building and training of the participants of the contracted user groups (e.g. the RoW User Group and RoW Sub-committee for Kailali and Dhankuta respectively) should be organised before starting the project. The types of training and capacity building activities the local community requires need to be identified during the interaction phase. It is advisable to provide training on plantation, maintenance, harvesting and marketing mechanisms in order to enable the user to produce a high value with low costs.

Baseline study on socio-economic conditions

The main objective of the baseline study is to capture pre-project baseline information on the target beneficiaries. The specific objectives of this baseline study are to:

- Gain an understanding of the prevailing socio-economic conditions of the project beneficiaries
- Provide a starting point of comparison for final evaluations

While conducting the baseline study, a wide range of appropriate tools and methodologies can be used to measure the status of social-economic, physical, environmental and human assets of the targeted communities or HHs.

Walkover survey along the selected road section to identify the locations for physical intervention and plantation

Before implementing any physical measure, the service provider together with the task force and in coordination with the contracted user group, should conduct a reconnaissance survey of the whole road section chosen for this pilot. The purpose of this survey is to identify locations for physical interventions, for example specific sites where gabion installations, masonry/dry wall constructions, and other physical interventions may be needed. It is equally important to mark the location for the plantations and to estimate the required plant quantities.

Collecting construction material and organising plant material

The local people will collect the required amount of construction material on site. The DDC/DoLIDAR or its representative is responsible for ensuring the quality and quantity of the materials to be collected, defining locations for its deposition, etc. The user group will collect the required plant material from defined areas (e.g. from banana nurseries in Tikapur and Fulbari, or amriso saplings from CFUGs or via the office of soil conservation in Dhankuta).

Develop water management

The amount of water required for the plantation primarily depends on the plant species and the season considered for its plantation. In most cases, a certain volume of water will be required for watering the plants at planting time, or during the construction of, e.g. stone masonry work. In this situation, the contracted user group with the help of DDC/DoLIDAR or its representative should be ready to set up water management facilities before starting the construction activities. In Kailali, the RoW User Group may decide to hire a water pump for the required period. This is a usual practice in Kailali and the cost per hour is reasonable. In Dhankuta, the road section passes through a village and it is possible to tap water from there. A temporary water provision from this piped supply can be considered, especially during the construction period.

Completion of physical works on site

Before starting any plantation, all physical construction activities should be completed. The surface of the slopes must be trimmed to a smooth profile, with no vertical or overhanging areas. All loose material must be removed from the slope surface (for site preparation details see Roadside Bio-Engineering, Site Handbook, Howell, DoR 1999).

Completion of plantation

Before planting, cut unwanted weeds and remove debris or fill surface irregularities. Dig pits before planting. Carefully plant the amriso slips or banana saplings in the pit, filling the soil carefully around the roots. If available, mix a handful of compost with the soil. Water the young plants a couple of times if there is no rain.

Regular maintenance

The local contracted user group is responsible for plant care after plantation: Watering during dry spells in the first season, mulching, weeding of unwanted plants, and protection. Harvesting of amriso culms is possible one year after plantation. The amriso stalks can be cut for fodder every year. Removal of old amriso plants after about 5 years shall enhance productivity. A first banana harvest may be possible after one and a half years. Old banana stems are removed after harvest, and if possible these stems should be further processed for, e.g. papermaking as discussed in Chapter 6.4. If banana is intercropped with lemon grass, this grass can be cut from the second year of growth.

Support for marketing the product

The service provider with his team should develop a plan and programme to support the local community in marketing their product. The types of support required may be identified during the baseline study or during the training needs assessment.

Regular monitoring and supervision of works by the VDC/Municipality, DDC/DoLIDAR

Two steps of monitoring and evaluating the achievement of project milestones are proposed. First, an internal evaluation shall measure the implementation of activities and their impacts on an on-going basis (proposed: quarterly basis). The service provider together

with his team will be responsible for conducting this quarterly internal project evaluation. The evaluation format should contain measurement criteria, indicators, activities and the scale of impact created by the project activities. If available, existing formats can be used for this purpose.

Mid-term and final evaluation

The main aim of the mid-term and final evaluation shall be to systematically compare the concrete results achieved through the project and its underlying working mechanisms against the proposed outcomes. The funding agency ReCAP or DoLIDAR may hire an external expert to conduct these monitoring and evaluation studies. The criteria for the external evaluation can be developed in coordination with ReCAP, containing at least such criteria as the number of activities implemented, the number of people trained, extent of awareness raised in the project areas, number of policy makers included particularly in the utilisation of the RoW.

Documentation of the pilot project implementation

It is essential to observe and assess the changes and impacts brought about by the project, both in the technical and socio economic field, to analyse why and how the observed changes have happened, and to which extend the project has contributed to these changes. This information is relevant for the implementing agency (DoLIDAR/DDC) to identify key lessons and recommendations for future considerations. To achieve such an assessment, the clients should record the project process from the beginning to the end.

8.4 Complement and finalise Draft RoW Utilisation Manual

Based on the experiences from the pilot project implementation, the service provider with his team will be able to finalise the Draft RoW Utilisation Manual so that DoLIDAR will hold a reliable instrument for the replication of the participatory approach for roadside protection of rural roads in Nepal.

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