**IUFRO Research Group 3.08 Small-scale Forestry Conference**

# Small-scale and Community Forestry and the Changing Nature of Forest Landscapes

**11 – 15 October 2015**

**Sunshine Coast, Australia**

# Conference Proceedings

Edited by John Meadows, Stephen Harrison and John Herbohn

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**Brief note on the booklet**

Welcome! This Proceedings booklet contains selected papers from the IUFRO Research Group 3.08 2015 Conference on Small-scale and Community Forestry and the Changing Nature of Forest Landscapes. The conference was organised by members of the Tropical Forests and People Research Centre at the University of the Sunshine Coast, with financial and logistical support from the University of the Sunshine Coast (USC), the Australian Centre for International Agricultural Research (ACIAR) and IUFRO including through the organisation's Special Program for Developing Capacities (SPDC).

The conference was a great success and the largest ever hosted by the IUFRO Small-scale Forestry Research Group. Over 95 presentations were made in the plenary sessions and topically themed concurrent sessions held over four days. The presentations explored in detail many of the complex socioeconomic and environmental issues, challenges and opportunities for the management of small-scale and community forests across the world. Over 100 delegates came from 21 countries from throughout Europe, Asia, the Pacific and the Americas. The resulting mix of people provided an exciting opportunity to explore different ideas and draw from a diverse range of experiences and perspectives.

This booklet includes the full papers from a small sample of the presentations given at the conference. The 16 papers comprise a range of topics covered in the themed presentation sessions, including Agroforestry Systems, Community Forestry, Forest Planting Stock, Timber Harvesting and Marketing, Forest Ownership, Extension and Incentive Programs, and Forest Governance.

Note that minimal review and editing of these papers has been undertaken. As with the abstracts published in the Conference Book of Abstracts, editing of these papers has been largely restricted to formatting for their presentation in a consistent style. While some editing of text has been undertaken, the final content rests solely with the authors.

We thank all of the delegates, including members of the Organising Committee, the Scientific Panel and the volunteers for contributing to the success of the conference. We also gratefully acknowledge the support provided by IUFRO, ACIAR and USC.

The Editorial Team – Dr John Meadows, Professor Steve Harrison and Professor John Herbohn.



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**Cover photograph: View from Mt Coolum to Mt Ninderry and Yandina Station.** (Photo: John Herbohn)

**Contents**

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# Removing Barriers to the Commercialisation of Agroforestry Trees in Nepal

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## Abstract

Agroforestry has evolved as a part of the traditional subsistence farming systems in the mid-hills of Nepal. These farming systems are undergoing major changes brought about by the outmigration of male labour and resulting feminisation of the rural labour force. There has been inadequate agronomic development and serious food insecurity is a problem in Nepal. Of 75 districts, 42 have a food deficit. Most of these districts are in the mid-hills and mountain region of Nepal. Fortunately, the productive functions of trees in these agroforestry systems perform important subsistence functions of supplying firewood and fodder, and also present a resource that can be utilised to redress the trade imbalance of Nepal's timber products. However, there are many barriers to getting these trees into the market. This paper presents two agroforestry case studies of differing situations with respect to market integration of agroforestry products. It then analyses the barriers for advancing agroforestry, and draws practical policy implications for promoting commercial agroforestry, in Nepal. The first case study describes subsistence-level agroforestry systems including: fuel and fodder trees on terrace risers sustaining a few livestock; agropastoral systems on fallow land; and silvo-fishery, apiculture and sericulture. In most areas of Nepal agroforestry has not made major advances and all these practices by and large provide productive services at subsistence level only. There are however instances where agroforestry trees are well linked into industrial wood flows. The Government of Nepal is promoting small-scale woodlots or private forests as part of an agroforestry system. Adoption of private forestry in Nepal remains very low with only about 2458 registered private forests covering an area of 2333 ha. Despite this low registration, volume of timber extracted from private land is twice that from other sources (community forest and government forest). The second case study describes a situation where trees from private land are well linked into commercial wood flows and highlights the specific institutional arrangements that have facilitated this development.

**Keywords:** Private forestry, Food security, Act and Policies, Innovative agroforestry practices.

## 1. Introduction

Agroforestry has been recognized as one of the important systems for supporting livelihoods in the middle hill population of Nepal. Agroforestry integrates existing farming systems along with innovations such as silvo-fishery and sericulture, and it is important for its productive, protective and regulatory functions. In Nepal, there has been inadequate agronomic development and serious food insecurity is a problem. The total number of food

insecure people across Nepal is estimated to be 3.7 million. Of 75 districts, 42 have a food deficit, and 40% of the families have started to skip or reduce their meals (FAO, 2010).

The food deficit situation is extremely alarming in the Far- and Mid-Western Mountains. Additionally, there is an increasing trend of people migrating temporarily and permanently outside of their home country in search of a better life (Bhadra, 2007). A report suggests that more than 50% of Nepalese households have at least one member outside of household living in another district or abroard for various purposes (CBS 2011). Male migration has resulted in a significant level of land abandonment. Consequently, there is decreased food production at a local level and massive import of food (Adhikari and Hobley, 2011; Paudel et al. 2014).

There is however ample scope for agroforestry systems to be practiced in the country which can address the problem of food security to some extent. In this context, the Government of Nepal has taken steps in developing forestry for economic prosperity. The development of agroforestry science in Nepal literally began with the Fifth Five-year Plan period (1975-1980). It has stressed the contribution of forests to the economic, social and industrial development of the country. The Three Year Approach Paper (2013/14 -2015/16) currently in operation has also aimed to identify high value medicinal and aromatic plants, sustainable harvest, technology development, commercialization and marketing for economic development, environment protection and enhancing rural livelihood among others (NPC, 2013). The interim constitution of Nepal (2007) and Forest Policy (2015) have acknowledged the role of private forests and emphasized the private public partnership in developing forest entrepreneurship.

For management purposes, the Government of Nepal has classified forests into two main categories: National Forests and Private Forests. The ownership and control of National Forests lies with the government and that of Private Forests with the individual private tree owner. National Forests include all non-private demarcated or non-demarcated forest lands, paths, ponds, lakes or streams and river-beds inside such forests, and waste or uncultivated or unregistered lands surrounded by forest or situated near adjoining forests. For the management purpose, the National Forest is further divided into five categories:

1. Government Managed Forests
2. Protected Forests
3. Community Forests
4. Leasehold Forests and
5. Religious Forests

Although the policy, rules and regulations are in place private individuals are reluctant to plant trees on farmland. This is mainly because of the lengthy and cumbersome bureaucratic process that needs to be followed up, right from planting of tree seedlings to their harvesting and transportation. Similar is the case with non-timber forest products. At times, the government does place bans on the collection and selling of tree and herb species. Currently the timber species, Sal (*Shorea robusta*), Satisaal (*Dalbergia latifolia*), Okhhar (*Juglans regia*) and Bijayasal (*Pterocarpus marsupium*) have been banned for collection and trading (Report of the District Forest Office (DFO's) workshop, Kathmandu, 2015). Therefore, despite the potential of earning high income for the farmers and improving their livelihoods, most of the high value timber species that could grow on private land are not planted because of the complexity in following the rules and regulations. Nonetheless, private forests are contributing significantly to timber production and its flow in the country is quite

substantial. Sawmills, plywood factories and other forest based enterprises are using timber obtained from private forests but no study has been undertaken in connection with the constraints of timber flow from private forests to sawmills and other wood-based enterprises. Hence, a case study has been undertaken to examine the contribution of private forests to timber flow in three districts of the country, and to explore the existing barriers that are hindering the commercialisation of agroforestry trees in Nepal.

## 2. The Study Site

This research was carried out in three middle hill districts (Kavre, Sindhupalchok and Lamjung) of Nepal. In Kavre and Lamjung districts, a joint project of Government of Nepal and Australia entitled "Enhancing Livelihoods and Food Security through Agroforestry and Community Forestry (EnLiFT) has been in operation since 2013 whereas Sindhupalchok is identified as satellite area for extension activities. Both Kavre and Sindhupalchok districts were the sites of the then Nepal Australia Community Forestry Project (Figure 1).


**Figure 1: Location of research sites.**

## 3. Research Method

Policy and regulatory documents including the periodic plans and recent forest policy of the government were reviewed. A total of 4 saw mills and 8 other wood-based entrepreneurs that are using logs from private and community forests including plywood, parquet and furniture were visited during the month of July 2015 (Table 1).

**Table 1: Types of wood based entrepreneurs visited in three districts.**

| TYPES OF WOOD BASED ENTERPRISES | DISTRICTS | | |
|---|---|---|---|
| | KAVRE | LAMJUNG | SINDHUPALCHOWK |

| | | | |
|---|---|---|---|
| • Sawmills | 3 | 1 | Not available |
| • Parquet/ Furniture | 1 | 2 | 4 |
| • Plywood | 1 | Not available | Not available |

Source: field visit, 2015

These saw mills and factories were selected based on the type and their operating capacities. Detailed interviews with the sawmill owners were carried out following a semi-structured checklist (provided in Appendix 1). The mechanism of timber flows in these saw mills and wood-based entrepreneurs and factories from various sources (government forest, community forests and private forests) were observed and recorded. Discussions with respective factory owners have been carried out. One sawmill and two privately owned forest-based enterprises (one each in three districts) did not provide any important information except that they would procure timber from private forests. The study was carried out just after the massive earthquake in the country. Therefore, the presence of labour in some of the wood-based entrepreneurs was very minimal (only two persons).

## 4. Results and Discussions

### 4.1 Major Timber Species

Pinus species especially Salla (*Pinus roxburghii*) and other hardwood species such as Katus (*Castonopsisb indica)*, Chilaune *(Schima wallichii*) and the softwood Uttis (*Alnus nepalensis)* are the major tree species that sawmills procure as raw materials. Bhuwan sawmill located in Lamjung also procure Sal (*Shorea robusta*) trees as major raw materials.

Normally sawmills pay cash to the contractors who bring logs to the mill gate. The price varies with the species. Sal (*Shorea robusta*) fetches the maximum price followed by Champ (*Michelia champaka*) in comparisons to the other species. Details of the prices that sawmills and other forest-based enterprises are paying for the different species are provided in Table 2.

**Table 2: Price of round logs varies with the type of timber species**

| | **KAVRE DISTRICT** | | **SINDHUPALCHOWK DISTRICT** | | | | **LAMJUNG DISTRICT** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Farm gate price for round logs (NRs)** | | **Farm gate price for round logs (NRs)** | | | | **Farm gate price for round logs (NRs)** | | | |
| **Name of forest based enterprise** | **Uttis** | **Salla** | **Name of forest based enterprise** | **Uttis** | **Salla** | **Chilaune** | **Name of forest based enterprise** | **Sal** | **Chilaune** | **Chap** |
| Anilsunil | 360-370 | 550-570 | Jugal furniture | - | 200-300 | 200-300 | Bhuwan sawmill | 2800 | 300-350 | 600-700 |
| Araniko | 350-410 | 550-600 | Gaurati Bhimsen | 500 | 500 | 400-500 | Ramasa | 2400-2500 | 1000 | - |
| Triupati | 300-400 | 500-600 | | | | | | | | |
| Shikar | 400 | 560-600 | | | | | | | | |

### 4.2 Timber Flow Mechanism

It has been found that almost all sawmills and forest-based entrepreneurs procure round logs from private forests (both registered and unregistered) (Figure 2). Only one factory located in Lamjung district procures round logs from Community Forests through a bidding process, but the volume is very small.

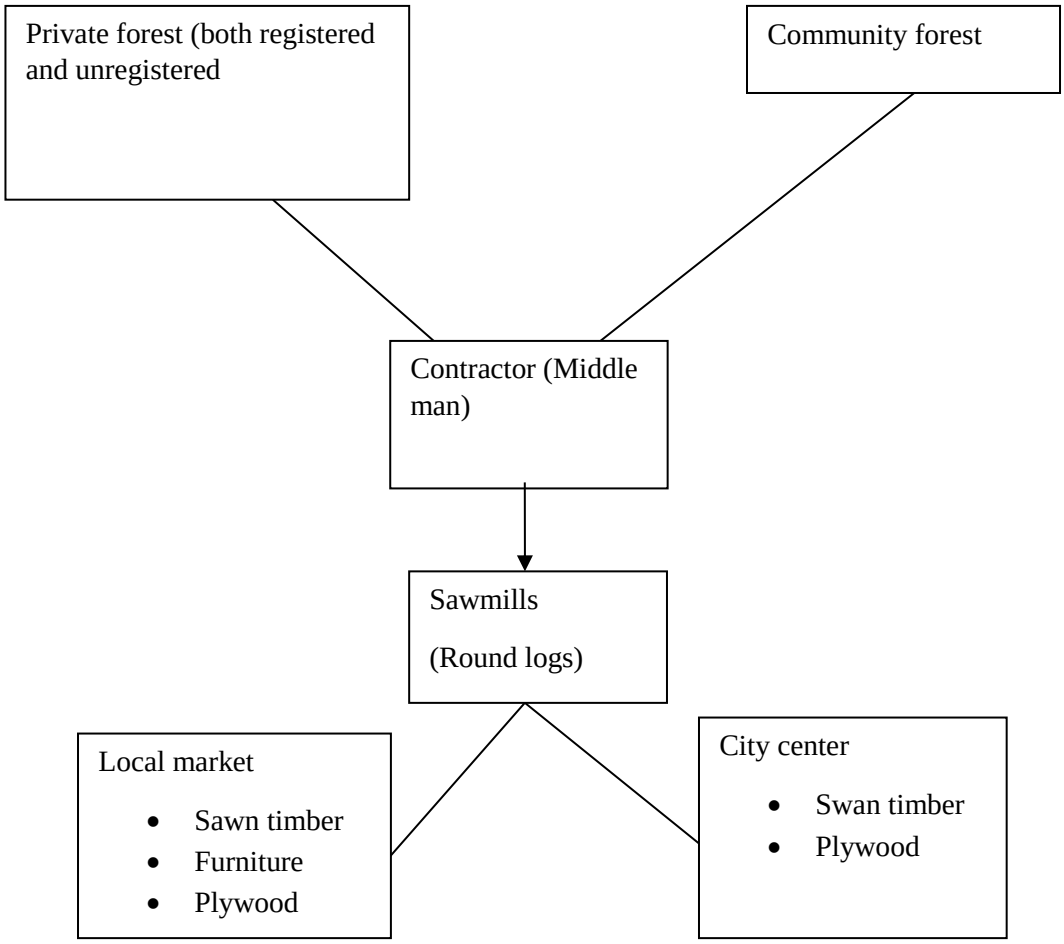


**Figure 2: Timber supply mechanism**

### 4.3 Use of Timber in Sawmills and Their Capacities

Most of the sawmills saw round logs in their mill using circular saws. The end product however varies. Some produce laminates and flitching for recutting, and others produce furniture as well (Figures 3-5). But Shikar plywood factory located in Kavre district uses timber exclusively for making plywood. The plywoods produced at this mill are distributed throughout the country under the brand name of 'Shikhar'.


**Figures 3-5: Various end products from sawmills (Lamjung, Kavre and Sindhupalchok).**

### 4.4 Capacity of Sawmills and Wood-based Enterprises

Most of the sawmills have records of log productions for the current year only. It is very interesting that they don't have the records of previous years. However, all of the sawmills reported they were currently running below their production capacity. They are obtaining less quantity of timber as against their annual requirement (Table 3). This is mainly because of an unavailability of raw materials (round wood), inadequate supply of electricity and a shortage of labour. The labour shortage was because of the earthquake as labourers have left for their homes in India. It was reported during the interview that it is very hard to find skilled Nepali labourer for this kind of job. It is mainly because of out-migration of youth, and youths are interested in this type of work. Market demand for timber is very high and mill capacity is also good but due to the unavailability of adequate timber logs there is a limit on the annual production.

**Table 3: Capacity of Sawmills and Wood-based enterprises**

| **Name of the Sawmills** | **Full capacity '000 cft.)** | **Current capacity ('000 cft.)** |
|---|---|---|
| 1 AnilSunil (Kavre) | 50-60 | 30-40 |
| 2 Araniko (Kavre) | 60-70 | 20-25 |
| 3 Tirupati (Kavre) | 50-55 | 15-20 |
| 4 Bhuwan (Lamjung) | 5 | 4-5 |
| **Name of the Parquet /Furniture Enterprises** | | |
| 1 Parquet production house (Kavre) | Not available | Not available |
| 2 Jugal furniture (Sindhupalchowk) | 10-15 | 10 |
| 3 Gaurti Bhimsen (Sindhupalchowk) | 0.2-0.3 | 0.2-0.3 |
| 4 New Jugal (Sindhupalchowk) | Not available | Not available |
| 5 Prabu (Sindhupalchowk) | 5-7 | 0.8-0.9 |
| 6 Ramasa (Lamjung) | 0.5 | 0.5 |
| 7 Basnet (Lamjung) | Not available | Not available |
| **Name of the Plywood Enterprises** | | |
| 1 Shikar (Kavre) | 300-400 | 50-60 |

Source: Field visit, 2015.

### 4.5 The Role of Middlemen (contractors)

A middleman or contractor plays the vital role in procuring timber from private forests and community forests. Normally contractors act as a local agent but without any institutional identity. Private individuals do not support each other while supplying the timber. It is the contractor who performs all of the jobs for them. Generally, mill owners contact the local contractor. It has been revealed that all the paperwork such as tax paid receipt, approval letter from DFOs etc. required to procure logs from private and community forests is done

by the contractor himself. The contractor has to satisfy the civil servant concerned and invest a large amount of money by themselves. The mill owner pays the price to the contractor and the contractor in turn pays the concerned farmer or private individuals according to the nature of the species and estimates of the timber volume.

The process of procuring timber from private individuals is through informal meetings and they estimate the volume of the tree by ocular estimation. The middleman, on an average, depending on the species and distance, pays the individuals. For example, they would pay NRs 1000 to 5000 per Utis tree (100-150 per cubic feet) whereas NRs 250-300 per cubic feet for Pine species. These middlemen receive almost double the price for timber from sawmill owners and capture 40-50 % of the timber market price.

**4.6 The Role of Private Individuals**

The role of private farmers has not been found very crucial in timber flow as private individuals are not involved directly in timber business. It is the middlemen or the contractors who deal with the sawmill owners and carry out all official formalities for them. However, individual farmers do call these middlemen if they think of harvesting some trees growing in and around their farm lands. There is no formal contract (on paper) between the contractors and, or, middlemen and an individual farmer. It is a verbal only agreement. The contractors pay the price to an individual farmer for his/her standing tree on an ad-hoc basis. The price varies with the type of species: pine species fetching about NRs 275-300 per cubic feet. *Alnus nepalensis* gets the lowest price (150-200) per cubic feet in comparisons to other species *Schima walichii* (200 NRs/ cubic feet). Individuals with trees on difficult terrain to work on would get less amount of money than at road heads. As farmers' estimation of timber volume varies it is likely that in most of the cases they did not get a 'good' price for their product.

Observation on farmers' field sites show that these trees are naturally grown. They don't seem planted and farmers also say that they haven't planted these trees but have come naturally on their own private but unregistered farmland. These farmers also do not know the age of the tree that they would harvest. They just estimate the girth that would give some economic return for them. It is the contractor that fells the tree and transports it to the mills. The cost of transporting timber to the mill gate depends on the distance of the farm to the mill gate and seasons of the year.

Farmers can cut their trees at any month of the year if they wish so but they are not supposed to sell the timber at sawmills or any other wood-based enterprise (even within the same district) during the four months of June 15 - October 16. Forest Regulations 1995 says that "*Timber and Firewood may be collected and taken out from the Forest area during the period between Kartik (October 17) to Jestha (June 14)"*. It does not however say from private forests, yet private individuals are not allowed to bring their logs/timber within this four months period as well. The cost of regulatory compliance is very high for the private individuals both in terms of their time and resources. They have to show various types of paperwork to the DFOs before they can get the permission of transporting the timber for sale.

A glimpse of the steps involved for selling and distribution process of private forest product is presented below (Figure 6). That being the case the private individual agrees to sell their timber produce at much lower rate to the middle man (the contractor) which could be more if they sell their products by themselves at the mill gate.

**4.7 Management of Sawmills and Use of Sawn Timber**

Most of the mills are managed by a single person and a few sawmills are partnership based. In most of the sawmills, local customers come to the mill to buy the sawn timber for their work. The parquet house located in Kavre district purchase timbers having very short length (less than 50 cm). They use these short sawn timbers for joinery purposes. Some sawmills have wholesale and retail shops. For most sawmills the final products are mainly furniture items (table, dining table, chair, bed, sofa sets) and other wooden structures. A very few sawn timber (logs) are sold within and outside the districts but most of the products go to city centres like Kathmandu, Dang, Butwal, Nepalgunj, Bhairawa, Biratnagar, Narayanghat and Jhapa.

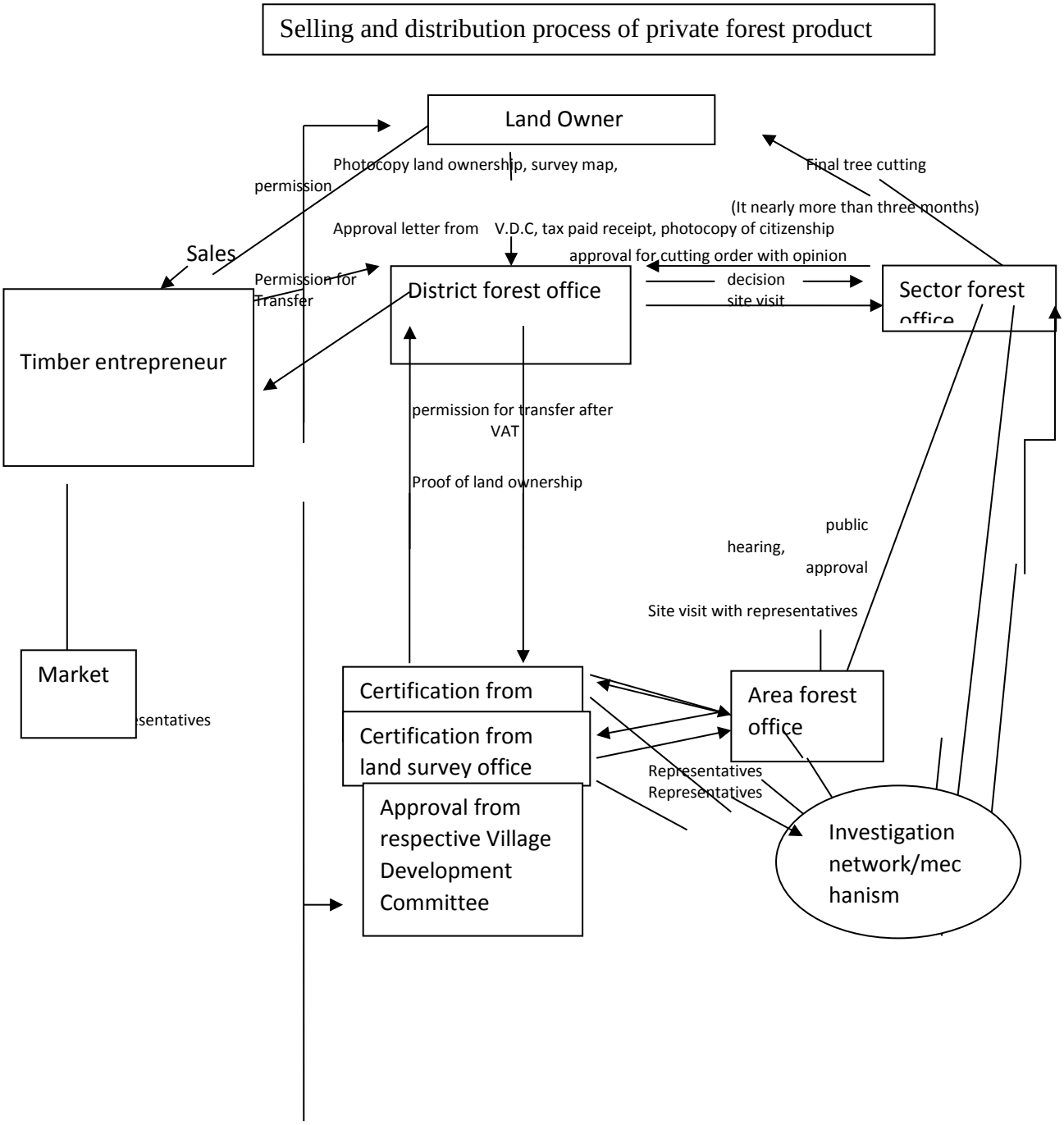

**Figure 6: Selling and distribution process of timber from private forest**

## 5. Conclusions and Policy Implications

The lengthy administration process of harvesting and transportation of timber to sawmills is the most hindering factors for timber flow in the study area. People are not interested in planting trees on their private farmlands but they don't mind raising trees naturally on their unregistered land. That is why the number of registered private forest in the country is low, at around 2333 hectares only (DFO Workshop, 2015), but the flow of timber in local markets from private land is large (93073.9 m3) in comparison to other categories.

It has been observed that Pine species (mainly *Pinus roxburghii*) and other trees such as *Alnus nepalensis* and *Schima wallichi* are the main species that contribute to the running of sawmills in three districts of Nepal. However, in Lamjung district *Shorea robusta* is one of the prime species that help run sawmills. Almost all sample sawmills in Kavre district procure timber from Kavre, Dholakha, Sindhupalchowk and Ramechhap districts of the country. Interestingly, in Lamjung district most sawmills procure timber from community forests through a bidding process. It was revealed that procuring *Shorea robusta* is not an easy job for contractors. They have to pay a great deal of money to the local youth engaged in these types of jobs.

In private forests tree selection and felling is done by contractors and farmers whereas in community forests the decision is made by a community forest member. Contractors (i.e. the middle man) transport round logs to the mills and these contractors are paid on a per cubic feet basis depending on the tree species. Some sawmills have advanced technology. They have their own saws (band and circular) and other machines for peeling and flitching. Most of the sawmills are managed by single person: the owner. They normally sell their finished product in the large cities within Nepal. The market demand for sawn timber is very high but sawmills are not running to their full capacity. It is mainly because the unavailability of round logs and labour, and frequent power cuts. The administrative process for procuring logs especially from private forests have been found to be one of the major causes of sawmills running below their full capacity.

The Forest Act 1993 and Regulations 1995 are the legal instruments to translate the policy vision into practice. Forest Act 1993 categorizes national and private forests on the basis of ownership. Private Forest represents the forests or trees planted, nurtured or conserved in any private land that belongs to an individual as defined by the prevailing law. Two types of private forest are in operation in Nepal. One is the registered and the other is unregistered. And the framework of private forests is very different. A total of 10 different private forests types have been identified based on timber utilization (DFO Workshop, 2014).

Private forests are actually contributing to the national economy providing employment opportunities and raw materials for various types of wood-based industries. Their contribution to the national economy in terms of Value Added Tax (VAT) only is also very large (Table 4). Private individuals have to pay 13% royalty to the government while selling their timber products. The quantity of timber sold from private forests and the collection of tax in different fiscal years is shown in Table 4.

**Table 4: Quantity of timber sold by private forest and collection of tax in different fiscal year**

| Fiscal Year | Timber sold ($m^{3)}$ | Revenue collected by the Gov. |
|---|---|---|

| | | through Value Added Tax (U.S $) |
|---|---|---|
| 2065/66 | 70126.17 | 752645.93 |
| 2066/67 | 76776. | 777159.25 |
| 2067/68 | 73004.8 | 527253.74 |
| 2068/69 | 88160.9 | 833435.22 |
| 2069/70 | 93073.9 | 1232136.22 |

Source: *Hamro Ban,* 2069/70, Department of Forests, Babar Mahal.

The quantity of timber sold from government forests, community forests and private forests, and the collection of revenue in the fiscal year 2069/70 is very high in comparisons to other type of forests (Table 5).

**Table 5: Glimpse of timber sold by forest management type**

| Types of forest | Quantity of Timber sold ($m^{3)}$ | Revenue obtained (U.S $) |
|---|---|---|
| Government forest | 22532.8 | 6988983.15 |
| Community forest | 10509.2 | 718168.94 |
| Private forest | 93073..9 | 1232136.21 |

Source: *Hamro Ban,* 2069/70, Department of Forests, Babar Mahal.

Private Forest Development Directives 2011 (the directives) published by the Department of Forests in the year 2013 (with amendment) has provisioned the private forest registration procedure. These procedures are lengthy and difficult to abide by in practice. Individuals wishing to register private forests have to abide by the following important steps.

**Step 1: Submission of application to the office of the District Forest Office, or Ilaka Forest Office or Range Post.**

Each application must include the following documents:

- Area covered by private forest,
- Type of tree species planted,
- Age of planted trees,
- Number of trees planted,
- For Non-Timber Forest Products and Medicinal and Aromatic Plants, the area covered by it,
- Land ownership certificate,
- Receipt of payment of previous year's land tax, and
- Photocopies showing the land registration number and land map.

**Step 2: Investigation procedure.**

- Intensive investigation process over the application by the office of the District Forest Office,
- Inviting individuals, institutions and local-level government agencies as appropriate to find out the fact,
- Investigation process could lead to field verification and inquiry with a representative of the Village Development Committee and Municipality as deemed necessary,
- For private forests adjoining national forests and government land, authorities will have to inspect the land and the cost involved for these activities has to be borne by the private individuals,
- For the entire investigation process 52 days have been allocated but in practice it may take longer than that.

The most hindering factors in private forestry are the provision of permission for tree harvesting and transportation. Some of them are:

- If an individual wishes to harvest trees planted on their own private land they must inform, at least one day before commencing, the concerned DFO office/ Illak Forest office or Range post with the recommendation from the concerned Village Development Committee and Municipality,
- In the case of trees felled for commercial purposes, the private individual must provide details of the number of felled trees, their type and volume to the concerned DFO office/ Illaka Forest office and or Range post,
- In the case of private unregistered forest and those adjoining the national forest, an investigation from Range post is necessary before felling and if deemed necessary land survey authorities must be invited and private individuals have to pay for the entire service charge incurred for those activities,
- If the private individuals wish to transport trees outside the district of the tree's origin, then permission has to be obtained from the District Forest Office,
- Individual has to give priority to 26 types of tree species to plant on their private land.

Farmers have limited access to improved tree seeds, new technologies and market opportunities. Hence these elements should be addressed. A DFO's workshop held in 2015 in Kathmandu also identified the following points as constraints to developing and commercialising agroforestry trees in the country:

- long process for private forest registration,
- irrelevance of whether the forest is registered or not,
- a lack of supportive technological and financial systems,
- due to government circular, cutting different species of trees and restriction on transporting,
- difficulties collecting, selling and transferring of forest product from private forest,
- difficulties in transferring the forest product due to the collection of illegal donations from local club, different group, jerks and government unit,
- expenses in gaining approvals from the village development committees for tree cutting,
- limitations of fragmented forest
- farmers receiving low returns due to the due presence of marketing middlemen,
- limited knowledge of suitable species
- unavailability of planting stock (to meet demands),
- no effective law and protection policy for private forests,
- no insurance and finance service,
- no union of owners of private forest,
- lack of suitable development program and support for private forest growers,
- some single industrialist and businessman have price monopoly, and
- lack of geographical and climatic investigations into species suitability.

Agroforestry practices can embrace a wide variety of plants. Pandit et al (2014) has recorded a total of 145 different species including 56 species of medicinal and non-timber plants in their study sites. There is much scope for increasing productivity of both agriculture and forestry for increased benefits to the farming communities. Hence, the government of Nepal should focus on growing of agroforestry species on private land and removing or minimizing the practical difficulties cited above.

Because of the barriers mentioned above farmers are reluctant to raise trees on their farmland and implement agroforestry systems. Hence, its potential contribution has not been

analysed in detail. There could be a great deal of contribution in terms of Gross Domestic Product from private forests. Planting trees on private land including fallow lands could be a turning point for generating employment opportunities, checking out-migration, enhancing food security and improving an ecological balance including minimizing the effect of climate change.

## 6. Acknowledgements

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**Appendix 1: Questionnaire check list**

1. **A typology of mill technology**: i.e. are they peeling for laminates, flitching for re-cutting to smaller sizes elsewhere, milling boards to specification sizes;

2. **Details on tree production.** Collect species data, and if possible good to whether trees are from naturally regenerated stands, intentionally planted in woodlots / private forests; from farmland (terrace risers).

3. **Details on mill production capacity.** How much does the annual production vary from year to year? How much does production vary across seasons of the year?

4. **Supply-demand dynamics.** Is the limit on the annual production caused by supply of timber from farms, or mills technical capacity or market demand?

5. **Contracts with farmers.** How is the relationship between farmer and mill established? Does grower approach mill or other way around? What formal contracts are made? How is price determined? How is farmer paid?

6. **Regulations.** What paperwork and payments does the farmer and the miller have to make to the DFO or other agencies? What is cost of regulatory compliance?

7. **Supply chain responsibilities.** Who selects trees for felling? Who fells the trees? Who transports trees to mill? Who transports mill products to customers? What is cost of transport relative to stump price of tree?

8. **Mill ownership.** Who are owners? Are they owner-operator companies, or are the owners wealthy investors in KTM or India or China etc. Do owners have more than one mill in other areas?

9. **Customers.** Who are the customers? What arrangements exist between mill and customer? Does the owner of the mill also own the wholesale & /or retail steps in the supply chain? What are the final end products and the destination of the timber from these mills?

10. **Formal and informal institutions.** Do farmers collaborate in helping each other supply timber? Are there formal cooperatives? What is relationship between this flow of timber from private land and that from community forests? E.g. Are CFUG member's also supplying private trees and using CFUG facilities, institutional connections etc?

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