Sampling design and sources of information for estimation of forestry sector contribution in Nepal

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Abstract: This paper examined the sampling desing and different sources of information required for assessing the forestry sector contribution in national economy. National Population Census (2011), Living Standard Survey Report (2011), National Sample Census of Agriculture (2012), National Population and Housing Census (NPHC, 2011) and Annual Household Survey (AHS, 2012, 2013) were primarily important sources of information for this sudy. The Annual Report of the Department of Forests, Timber Corporation of Nepal, Herbs Production and Processing Company and Forest Products Development Board were useful documents to extract the production information of forestry sector. The household survey, focus group discussion, workshops, expert consultation provided reliable information to generate forest products statistics while assessing the gross value added in the sector. Regarding sampling design, Power allocation of 0.5 and proportional random sampling method was adopted for selection of CFUGs to ensure high precisions in population estimation, This approach was also adopted in another community based forest management system namely the leasehold forests whereas, complete enumeration was designed for religious forests and protected areas such as Nationa parks, Wildlife Reserves, Hunting Reserves, Conservation areas and Buffer Zone forests. A large amount of forest products from outside forests including private forests are being consumed informally by the majority of the rural households that don't come under the National Accounting system of the country.

Key words: Gross Domestic Product, System of National Accounts 1993,

1. Introduction

System of National Accounts (SNA) in many cases assures natural processes that may or may not be treated as productive activities depending on the context in which they appear. An activitiy becomes productive one once it goes through motivation, control and responsibility by a certain institutional unit creating ownership over the products produced". Thus, the growth of crops under management, organization and control by institutional units stimulates production process in economic sense. Such a growth is not pure-natural process which falls outside production boundary.

Forest output gets complicated when production goes beyond more than one fiscal year or more than one quarter. Living standing trees is considered as work-in-progress. The work in progress will be completed when the standing tree fells down and it changes the forest stocks or sale or other process. Thus, trees and forest goes long gestation period of production activities. There are two types of assets defined by SNA, i.e. produced assets and non-produced assets. Non-produced assets come into existences which are produced from other than process of production. Licences, lease, contracts and natural resources are non-produced assets. The land is non-produced assets. System of National Accounts takes accounts of produced assets as a result of human intervention. Hence, this paper does not include the indirect contribution of ecosystem services provided by forest in national ecosystem accounting.

2. Total Economic Value of Forest Services

Four types of ecosystem services are generally considered for economic assessment purpose. They are natural ecosystem, semi-natural ecosystem, agricultural ecosystem and other type ecosystem. The forests come under the category of natural ecosystem irrespective of their use. . Carbon stocks in the natural forest with different biodiversity and large carbon stocks in soil and plants lies relatively in the large and old trees. They may be in conservation or logged for wood production. Plantation forests in the agricultural land meet the definition of agricultural ecosystem. They are used primarily for wood production.

Valuation of forest ecosystem is difficult. Previously, the total economic value of forest was defined in a very narrow sense. Economists defined the total economic value of forest in terms of human consumption deriving from the tangible forest goods and services officially traded in the market. By the time being, the definition of total economic value has been changed and it tried to include all benefits produced from forests including ecosystem benefit, environmental benefits and other tangible benefits. The principle of environmental economics consider basic value of the resources as the total economic value i.e. use value and non use value.

Use Values include benefits from the use of forest resources. This concept can sometimes be understood as the values that individuals attach to the direct or indirect consumption of services provided by natural resources. For example, people can build houses by using the wood harvested from a national park or a forest. Other benefits include herbal medicine, leisure walk in the forest or the aesthetic landscapes.

3. Forest classification system in Nepal

National forest and private forest are broad categories for forest on the basis of land ownership. On the basis of management objectives and management rights, National Forest have been categorized further into Government managed forest, community forest, leasehold forest, religious forest, protection forest and forest under the protected area system (FAO, 2009). The NPWC Act, 1972 categorized the protected area into two major types: Core area and Buffer zone. The forest under the Buffer Zone are further categorized into BZ community forests, BZ leasehold forests, BZ religious forests and BZ private forests.

Forest classification based on management right/regimes as per Forest Regulation 1995 includes:
1. Government managed forests
2. Community forests
3. Leasehold forests (pro-poored based and industry based)
4. Religious forests
5. Protection forests
6. Collaborative forests (as per directives)
7. Private forests

Area and production information of such management regime are available in forestry sector database system.

Forest categories as per National Park and Wildlife Conservation Regulation are:
1. Core area forests
2. Buffer zone (BZ) forests (includes BZ community forests, BZ leasehold forests, BZ religious forests, BZ private forests)

Area of core forests and buffer zone forests are available but production information are not available because of different management objectives)

4. Sampling design for data collection

4.1 Community forests

The area was considered as an auxiliary variable for the stratification in each eco-development region. Thus, sampling frame of CFUGs provided by Department of Forest had been categorized according to three areas; 1. CFUGs area with missing or not defined; 2. area with more than 999 hectare; 3. area less than or equal to 999 hectare.

For each eco-development, histograms were plotted against frequency of community forest user group in the assigned area interval to view either the block in histogram covered smaller or larger.

Histogram of frequency of population and frequency of sampling frame was made similar as far as possible to arrive the final selection of number of forests from each area group from districts. A three stage stratified sampling was adopted to select the required CFUGs where

- ➤ **First stage is the selection of all eco-economic regions:** The sampling design adopted in the survey is a stratified systematic random sampling with representation of 3 Ecological belts and 5 Development Regions by selecting 15 sample districts in respective ecological development region.
- ➤ **Second stage is selection of district frrom each eco-economic region**: The districts were selected on the basis of population distribution of each stratum where frequency distribution of sample district closely matched with 15 ecological development regions.
- ➤ **Third stage is selection of FUGs from the sample districts:** Compromise power allocation at 0.5 was adopted in order to make equal priority to lower and upper extreme number of frequencies in stratum.

$$n_h \propto X_h^{\gamma} \, with \, \gamma = 0.5$$

- ➤ **Census:** Missing areas and 1000 or more than one thousand Hectares areas of community forest was completely enumerated to get more reliable estimates.

From above assumptions, the minimum sample size (n) was $670 \approx$ **700 Community forests**.
Missing areas and 1000ha or more areas of forests was completely enumerated. Thus all total 784 Community forests was survey in this study.

4.2 Leasehold forests

There are altogether 40 districts with leasehold forests and it was found that 43,011 hacter of land covered in total districts. Sampling frame with name of leasehold forest in the district was collected from official statistics. Same sampling methodology was adopted for leasehold forests with three stage stratified sampling plan for selecting the required CFUGs where

- First stage was the selection of all eco-economic regions
- Second stage was selection of at least one district frrom each eco-economic region
- Third stage was selection of leasehold forests from the sample districts

4.3 Collaborative Forest:

National Statistical institute (service provider agency) had obtained total number of colloborative forests from Department of Forest. There have been 22 collaborative forests in 10 districts covering in total area 57,497.57 sq. hectares. Census was conducted for all these collaborative forests.

4.5 Religious forest:

Since number of religious forest was small in number, the census was conducted for all regious forest units.

4.6 Protected area system

Name and number of buffer zone (12 in number) was obtained from Department of National Park and Wild Life. There are **TWENTY protected areas** in Nepal consisting of 10 National Parks, 3 wild life reserves and 6 conservation areas and one hunting reserve. Since sample size was small for the estimation of goods and services produced from protected area, criteria of sample design suggests us that it is better to conduct the censuses than sample survey.

4.7 Data collection from forest based manufacturing industries (herbal processing plants)

The Government of Nepal had established Herbal Collection and Processing co. Ltd. (An under taking of Government of Nepal) in 1981 December. The website of Ministry of Forest and Soil conservation

mentions that the company has its own land of 350 hectares to cultivate essential oil necessary for producing herbal medicine in its factory.

The balance sheet, profit and loss accounts, annexes about the expenditure items and other necessary financial statements required for estimating Gross Domestic Product and other macroeconomic indicators was obtained from its office.

The Dabar Nepal Pvt. Ltd. is second largest manufacturing of herbal medicine in Nepal. This industry has been cultivating herbs in different parts of country.

4.8 Sampling desing for Government managed forest

Community, leasehold and religious forests are managed by local communities or user groups, while government-managed and protected forests are directly administered and protected by government agencies. Forest products are supplied by Timber Corporation Nepal without competition. The government of Nepal has given the mandate this corporation to collect and to sell forest products to meet demand of urban population. Since it is semi-government agency, it keeps it's account. So, the quantity and price of timber sold in any accounting period was obtained after analysing its profit and loss accounts.

4.9 Data collection from Private Forest

Besides Community Forest User Group, one of the big forest categories is private forest in Nepal. The Private forest refers to trees on private agricultural or forest land used to supplement animal fodder, fuel wood and other basic resources or simply to provide saleable produce.

In our economy, there is significant level of household consumption of non-timber products. Similarly, gathering of fuelwood consumption is one of the best examples of informal economy in our economy. Fuelwood is the most important source of domestic energy. Fuelwood production and consumption activities by own households are non-market transactions and actual levels of fuelwood production are often unknown.

5. Secondary Sources of Infomation

5.1 Estimation of Household consumption of firewood, logs and other products

A household in SNA is an unincorporated establishment which does not record its accounts. Transaction made by this type of entities can be recorded through the household survey. We cannot apply the establishment type of survey design. Household consumption by use side is best tools to measure the fuelwood and logs and other products consumption. The household consumption of fuelwood, logs and other goods and services is measured from Living Standard Measurement Survey worldwide. Nepal Living Standard Survey (NLSS) is one of the multi topic survey conducted by Central Bureau of Statistics. The survey was conducted three times by bureau in duration of one and half decade but it was continued in annual basis (AHS) keeping in view of its importance.

5.2 National Population and Housing Census, 2011

The number of households used fuel wood to cook by districts and eco-development regions and nation was obtained from National Population and Housing Census (NPHC, 2011). This information was vital to find quantity and price information if it is related to the Nepal Living Standard Survey (NLSS, 2011) and Annual Household Survey (AHS, 2012, 2013). The proportion of household using firewood as main source of cooking fuel was found to be 64% for the census year 2011. Other sources of information for fuelwood production are annual household survey, consumer survey, annual forestry statistics, and import and export statistics.

5.3 Estimation of Household Timber Consumption in Nepal (Indirect estimation)

Large amount of timber, fuelwood and accessible forest products are consumed by the rural as well as urban households in construction activities. Nepal Population and Housing Census 2011 provides information of number of house construction at census year. Moreover, information of number of house was available from the same census. Again, each type of house were obtained from same census, 2011.

This household survey finds the quantity of consumption of timbers for construction and imputed price for each cubic feet. Similarly if household obtained the furniture from forest informally, it was counted and valuated. Thus, timber consumption by each type of house was obtained,

> **Quantity of Timber used by household for construction of house x Price of each cubic feet x number of that type of house constructed in the year 2014/15 = Value of Timber Consumption.**

If any househod obtained timber from saw mills, it was assumed that production of timber from Nepal Timber Corporation captured this value. So, this figure was not considered for informal production of timber.

The rates and ratio of how many household received timber from which sources (either from CFUGs, private Forest, religious forest etc.) were obtained from this survey. The survey was conducted from one district for each eco-development region to derive the information of output, intermediate consumption and value added by eco-development region.

From household survey, amount of timber used for the construction of each type of household and the number for households contructed at fiscal year 2013/14 was able to derive from the house growth from population census.

5.4 National Sample Census of Agriculture 2012

Area of private forest as well as the number of trees was obtained from the National Agriculture Sample Censuses. The number of fodder trees and trees standing can be obtained from the same census. National Statistical Institute conducted the study on these matter and estimate indirectly through the small number of sample household to estimate the rate and ratio.

Similarly, National Sample Census of Agriculture provides the information of no. of holding possessing the forest trees and area they covered in each district in the country. Moreover, census provides figure of number of scattered trees in each district. These figures were immense helpful to understanding informal supply of timber and fuelwood resources to households for subsistence of their liverhood.

5.6 Estimation of Herbal Consumption by Household (Indirect Estimate)

Herbal Production and Consumption by Household: National Statistical Institute had conducted a study on herbal consumption by household informally. Herbal consumption related questionnaires was added along with the timber consumption questionnaire in household survey.

Estimation of Intermediate Consumption: Household Survey for timber, herbal gives the intermediation consumption to collect and use these products. Similarly, establishment survey gives the production and intermediate consumption of community forest. Administrative records gives the estimate of IC for government forest.

Revenue statistics of herbs production and processing activities were taken from administrative record whereas informal production data were derived from the household survey. Processing industries were completely enumerated. Besides, some of the experts on the herb cultivation, production and processing were consulted.

5.7 Livestock Census in National Population and Housing Census (NPHC, 2011)

Fodder Consumption

Before conducting census and sample questionnaire, NPHC, 2011 prepared complete list of households during May and June 2011, a month before the main census. Listing schedule contains questions on number of house, households, household members by sex, agricultural land operated and **livestock** owned by households and operation of small scale non-agricultural activities. The number of livestock owned by the household gives some indicators of consumption of fodder. The National Sample Census of Agriculture, 2012 gave the information of age of livestock by type by districts. This information was crucial to determine the consumption of fodders and grass by type of livestock and by day and month.

6. Conclusion

Final OUTPUT of the forest research will be obtained from this research in the following format. ISIC rev. 4 clearly identifies the goods and services provided by the forest sector in national economy. There are three main subdivisions under the forestry ISIC division, i.e. a) silviculture and other forestry activities; b) logging; c) gathering of non-wood forest products; e) support services to forestry. These proposed categories refer to the compilation of forest products guided by the System of National Accounts 2008.

Table 16: Abbreviate form of the Cross-classification of forest types and International Standard Industrial Classification (ISIC Rev. 4) compilation

Categories	Items	Silviculture and other forestry activities	Logging	Gathering of non-wood forest products	Support services to forestry
Community Forest	Output				
	IC				
	Value Added				
And all types of forests	Output				
	IC				
	Value Added				

The detailed compilation of all types of forests would require full or almost full data on the all aspects of production, intermediate consumption and value added. The above ISIC subdivision will be completed after the studies of disaggregated types of forests, forest based industries, timber consumption, processing plants.

The comprehensive data obtained after surveys and censuses as well as studies will be enough for the national accounts purposes. Every item will be captured in our study which is clearly mentioned in the System of National Accounts (2008SNA), International Standard Industrial Classification (ISIC Rev. 4) and Central Product Classification CPC 2.1.

7. References
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