



Forest Resource Accounting: An Overview and Indian Perspective

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Abstract:

Forest Resource accounting is a debated issue. With the fast-growing economy in India, the growing pressure and increasing awareness for environmental protection requires deep understanding of the interactions between forest and other sectors concerning economic development, forest resources consumption and forest environmental degradation. Classical Gross Domestic Product (GDP) measures under the System of National Accounts (SNA) do not take into account material externalities, instead they emphasize on GDP as a measure of economic growth. Accounting for forest wealth has a number of policy useful benefits that is why it is necessary to maintain such accounts which incorporate all those benefits. True contribution of forestry sector benefits to the national economy are at present grossly underestimated with the result that the actual benefits are several times higher than those reported and incorporated in the national income accounts. Recognizing the need for a realistic valuation of forest benefits and costs, an appropriate accounting framework for integrating Forest Resource Accounts (FRA) into the National Income Accounts (NIA), is needed. It will provide better understanding of the full range of goods and services supplied by the forests which is essential for the optimal utilization of forests, and may provide an economic rationale for sustainable forestry. Forest stakeholders the world over are considering the transition to sustainable forest management (SFM). This paper attempts to discuss the initiatives undertaken worldwide and by India in context of FRA including its evolution, development, data gaps and issues concerned and recommends the way forward.

Keywords: India, Forests, Forest Resource Accounting, Planning Commission, SEEA, SNA, Sustainable forest management.

1.0 Introduction:

Forests worldwide are known to be critically important habitats in terms of the biological diversity they contain and in terms of the ecological functions they serve (Pearce and Pearce, 2001). Rapid industrialization and accelerated economic growth in recent years has led to phenomenal environmental degradation and depletion of natural resources in many parts of the world (Verma and Kumar, 2006). The need to understand the values that reside in forests arises from the estimated rates of loss of forest area and, hence, in biological diversity (Pearce and Pearce, 2001). When we make decisions to alter natural forest ecosystems, we often give little thought to the consequences that change may have on forest ecosystem services or to the ultimate cost of losing those services. This oversight stems from our incomplete knowledge

about how changes in ecosystems affect the level of services that the system provides and our inadequate understanding of the roles played by seemingly trivial ecosystem components (Krieger, 2004). For many countries, forests are closely linked to economic growth and well-being. Although there is information about the economic value of commercial timber, many other contributions of forest accounts overlooked as they have no market price and could also be missing entirely from national accounts. Forests contribute to livelihood of rural populations; they are used for tourism and recreation; and they provide valuable services by protecting watersheds, and storing carbon (World Bank). India has a total land area of 329 million hectares (Gundimeda *et al.*, 2007) of which around 23.4%, that is, 76.87 million hectares (Mha), is classified as the forestland with tree cover (Sharma and Chaudhry, 2013).

System of Integrated Environmental and Economic Accounting (SEEA), as satellite accounts to Conventional System of National Accounts (SNA), suggests the development of physical and monetary accounts of environmental and exhaustible resource stocks. The conventional System of National Accounts (SNA), which measures economic performance and growth, neglects natural resources depletion and environmental degradation, is obviously incomplete (United Nations, 2000; Ying *et al.*, 2011). Classical GDP measures under the SNA do not take into account material externalities, instead they emphasize on GDP as a measure of economic growth (Gundimeda *et al.*). They are not designed to capture significant gains or losses to human and natural capital that happen year after year and affect the true or holistic wealth of the nation and its citizens (MoSPI, 2013). To respond to this problem, various national and international organizations concerned with environmental planning and management have been striving to develop an appropriate system for environment statistics (Verma and Kumar, 2006).

Natural Capital comprises of water, forests, land, air etc., but primary focus in this paper will remain Indian forestry sector which is one of the primary sector contributing significantly to Indian economy. Thus there is a need to evaluate the real contribution of the forestry sector to national economy. Conventionally, this was done under Forest Resource Accounting (FRA) which links various functions of forests as ecosystems with the actual and potential income producing capacity of forests as capital. Forest Accounts tends to provide a framework to capture the value of all the economic contributions of forests and how they are linked to the economy (World Bank). However, this system suffered from a number of drawbacks such as un-accounting of positive externalities generated by this sector. Therefore National Forest Commission recommended that an appropriate system of FRA should be developed and implemented in India. This is how FRA system has developed over decades due to efforts of several individual researchers, academic institutions, development organizations etc. This paper attempts to discuss the initiatives undertaken worldwide and by India in context of forest resource accounting including its evolution, development, data gaps and issues concerned and recommends the way forward.

2.0 Evolution and Development of Environmental Accounting System:

Forests interact with the economy in more ways than any other resource. Accounting for forest wealth has a number of policy useful benefits, that is why it is necessary to maintain such accounts which incorporate all those benefits. One such approach is SNA which is a powerful tool to calculate major economic indicators like GDP, GNP etc. After identifying various economic activities taking place in the economic space of each country and on the basis of theories and models of economic growth, the United Nations (UN), in 1968, presented the System of National Accounting (SNA) that was later on revised in 1993, which elaborated its coverage to include inflation, recognition of economic contribution of the service sectors, financial institutions and the role of governments with respect to policy formulation in the economic growth of the country. The revised SNA-2008 reflects the evolving needs of its users, new developments in the economic environment and advances in methodological research. The SNA 2008 is a statistical framework that provides a comprehensive, consistent and flexible set of macroeconomic accounts for policymaking, analysis and research purposes (UN, 2008). There are two methods mainly considered in the literature for accounting of environmental externalities in national income accounting, one suggesting extension of conventional national income accounts by developing satellite accounts of environment and natural resources (SEEA) and another suggesting extension of input-output table of the economy (Murty, 2011). The SEEA is a system for organizing statistical data for the derivation of coherent indicators and descriptive statistics to monitor the interactions between the economy and the environment and the state of the environment to better inform decision-making.

In 1992, the UN Conference on Environment and Development "Earth Summit", as per Agenda 21 recommended that countries should implement environmental-economic accounts. In response, the United Nations Statistics Division (UNSD) published the Handbook of National Accounting–Integrated Environmental and Economic Accounting (UN, 1993), commonly referred to as the SEEA (MoSPI, 2013). The United Nations Statistical Commission (UNSC) adopted a system of Environmental Economic Accounting Central Framework formulated by

European Commission, Food and Agriculture Organisation, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank at its 43rd session in 2012 (Balasubramaniam, 2013).

The Central Framework, under SEEA, applies the accounting concepts and rules of the SNA to ecosystem goods and services and allows for the integration of environmental information (often measured in physical terms) with economic information (often measured in monetary terms) in a single framework. In physical terms, the changes between the beginning and end of the accounting period are recorded as either additions to the stock or reductions in the stock and whether possible the nature of the addition or reduction is recorded. In monetary terms, the same entries are made but an additional term is included to record the revaluation of the stock of environmental assets (Balasubramaniam, 2013). The emphasis of SNA on "GDP" as the key measure of growth will probably be studied by future generations as the single most significant design defect in the economic history of mankind as it does not account for the externalities generated by natural capital as well as do not reflect the depletion and degradation of the environment and hence may lead to incorrect development decisions.

(i) Forest-Related Aspects of the SNA:

Apparently, there is a greater flexibility for making forest-related adjustments in asset accounts than in current accounts as produced & non-produced assets under economic assets include natural assets (e.g. livestock & timber plantations) & land and natural forests, respectively. Then, depending upon the type of asset, asset accounts (as prescribed by SNA framework) include the information on Opening stocks; Capital formation; Other changes in volume like economic appearance and disappearance of produced and non-produced assets, natural growth of non-cultivated biological resources, catastrophic losses, uncompensated seizures (by the government), other volume changes in non-financial assets etc.; Revaluation (nominal holding gains & losses); and Closing stocks (which are Opening stocks plus the sum of the preceding adjustments). The data about the opening stocks and closing stocks of forests for many Indian states could be obtained from the publications of Ministry of Environment and Forests (MoEF) and State Forest Departments. The opening stocks represent the area categorized

as forested land present at the beginning of the accounting period (Murty, 2011).

(ii) Forest Related Aspects of SEEA:

Accounting and valuation of changes in forest resources stocks as per SEEA requires the data of the opening and closing stocks of the resources during an accounting period (Murty, 2011). SEEA provides a measure of forest values that is more comprehensive than SNA in two respects. First, SEEA forest accounts include both cultivated and natural forests in the asset accounts. Second, SEEA forest accounts attempt to include all forest goods and services, both market and non-market, in the flow accounts, which is essential for representing cross-sectoral linkages Forestry Department of FAO (2004).

(iii) Forest Resource Accounting (FRA):

Forests are one of the most important components of the terrestrial environmental system and a complete resource base. They form an ecological system consisting of tree dominated vegetative cover (Verma and Kumar, 2006). The following Figure 1 shows various components of FRA.

Forest resource accounting (FRA) comprises of management tools which integrate forest information from various sources thereby making it useful for policy-making and planning and contribute to the development of natural resource accounts (IIED and WCMC, 1994; IIED and WCMC, 1996). The calculation of natural growth should be based on the forest resources available at the beginning of the accounting period (Balasubramaniam, 2013). Environmental accounts have been constructed for forest resources more often than for most other resources. The earliest set of forest accounts was constructed by Norway in the late 1970s. At that time only physical asset accounts for standing timber were constructed. Fuelwood was included in the supply and use table for energy, which is widely used in Norway's multi-sector macroeconomic planning model. Norway also constructed land accounts, which include information about forested land and land use by different sectors. Since that time, many other countries have constructed forest accounts and these have expanded to include monetary asset accounts for standing timber as well as non-timber goods and services (Forestry Department of FAO, 2004). This shows how forest resource accounting has evolved over time.

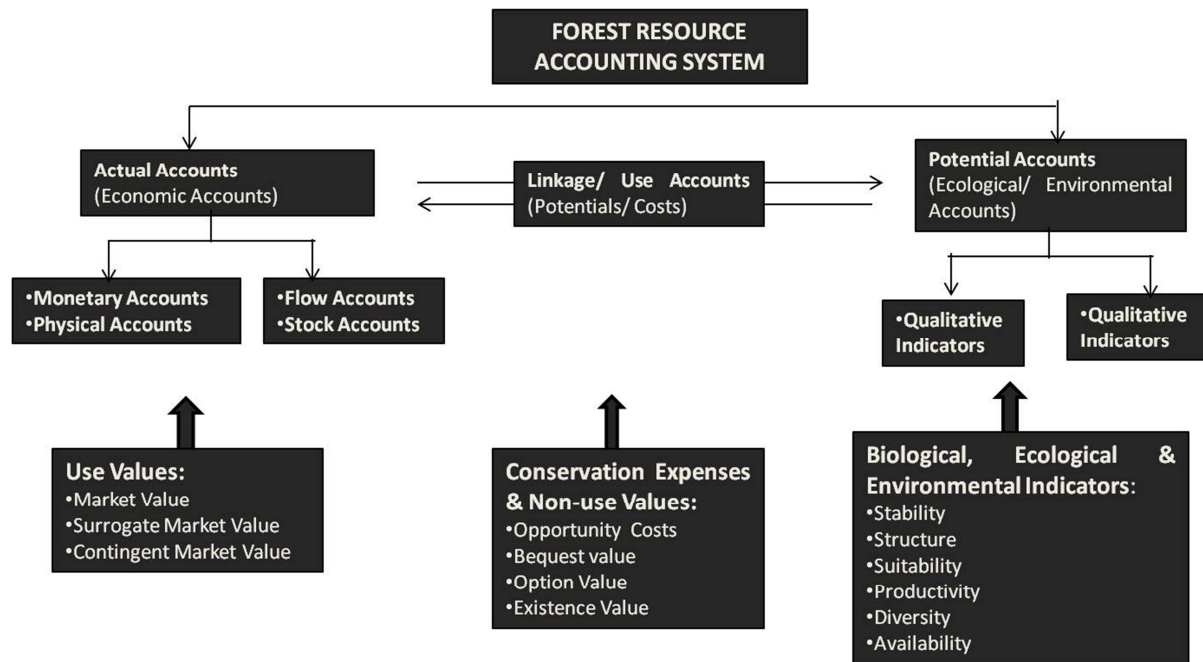


Figure 1: Three components of forest resource accounting (Modified from Xu et al., 1995)

(iv) Conventional System of Forest Resource Accounting:

The income from forest resources is aggregated at the national and state levels under the head "Income from Agriculture, Forestry and Fisheries" and the sub-head of "Forestry and Logging" which includes income accruing from industrial wood, fire wood and Minor Forest Produce (MFP) (CSO, 2002). At the State level, the State Directorate of Economics and Statistics (DES) prepares estimates of State Domestic Product (SDP) and Net State Domestic Product (NSDP). The estimates are prepared at the state level first, which are then consolidated to obtain estimates at the national level (CSO 2007). Gross Domestic Product (GDP) and Net Domestic Product (NDP) from the forestry sector are computed as follows:

GDP = Value of Output- Repairs, Maintenance and other Operational Costs

NDP = GDP - Consumption of Fixed Capital (whereby Consumption of Fixed Capital is Depreciation of Fixed Assets)

The GDP from forestry sector can be estimated by following either the production approach through Gross Value Added (GVA) like timber or the consumption approach (e.g. Fuelwood). It aims at

estimating the value of output at factor cost in the first instance and then deducting the value of various inputs at purchasers' prices (Mali et al., 2011).

3.0 Green Facts of India: A Mega-diverse Country:

The forests of India have long been an important part of its culture and a defining feature of its landscape (MoEF). India with a wide range of climate, geography, and culture is unique among biodiversity-rich nations and is known for its diverse forest ecosystems and mega-biodiversity. It ranks as the 10th most forested nation in the world (Global Forest Resources Assessment, 2005), with 23.4% (76.87Mha) of its geographical area under forest and tree cover (Kishwan et al., 2012; SFR, 2009). Out of 34 global biodiversity "hot spots," four are located in India, i.e., Eastern Himalayas, North-east, Sundarbans, and Western Ghats (Pisupati, 2011). India is one of the 17 megadiverse countries (MoEF). Fifteen biodiversity-rich areas of country covering an area of approximately 74000 km² have been designated as biosphere reserve and four of them, namely Nilgiri, Nanda Devi, Sundarbans, and Gulf of Mannar, have been recognised by UNESCO under world network of biospheres (ICFRE, 2011). With only 2.4% of the land area, India accounts for 7 to 8

percent of the recorded species of the world (Gokhale, 2010). This biodiversity is of immense economic, ecological, social, and cultural value. Approximately 275 million people in India (27% of the total population) are known to live in the forest fringes and earn bulk of their livelihood from forests (World Bank, 2001; 2006; Poffenberger, 2000, Sinha *et al.*, 2010). FSI defines forests as “all the lands, more than one hectare in area, with a tree canopy density of more than 10%.” Champion and Seth (1968), classified India’s forests into four major ecosystems groups, namely, tropical, subtropical, temperate, and alpine. These major groups are further divided into 16 types. Of the 16 forests types, tropical dry deciduous forests form the major percentage that is 38% of the forest cover in India (Sharma and Chaudhry, 2013). With the fast-growing economy in India, the growing pressure for environmental protection and increasing environmental awareness require deep understanding of the interactions between forest and other sectors concerning economic development, forest resources consumption and forest environmental degradation (MoSPI, 2013) Forests contribute directly to welfare through the provision of amenity values, which may not satisfy the SNA's definition of “production.” They also provide other industries with services, such as watershed protection, whose value the SNA records as part of the operating surplus of recipient industries instead of as services furnished by forests. For these reasons, the SNA likely understates the economic contribution of forests (Vincent and Hartwick, 1997).

4.0 Methods for Valuing Forest Benefits:

A number of studies have been undertaken in recent years to develop methods for valuing non-market benefits of forests in monetary terms (Mathur and Sachdeva, 2003). The physical and monetary accounting for forests includes the following four elements (Ying *et al.*, 2011):

1) Forestland; 2) Forest standing timber; 3) Forest products, and 4) Forest ecological services.

The different techniques can be divided into five broad groups (Mathur and Sachdeva, 2003):

1) **Market price valuation**, including methods to estimate the benefits of subsistence production and consumption;
2) **Surrogate market approaches**, including travel cost method, hedonic pricing and the substitute

goods approach;

3) **Production function approaches**, which focus on biophysical relationships between forest functions and market activities;

4) **Stated preference approaches**, mainly the contingent valuation method and variants; and

5) **Cost-based approaches**, including replacement cost and defensive expenditure.

5.0 Challenges to Accounting of Forestry Resources in Indian Context:

The limitations of present methods of forest resource accounting are often quoted in literature (Verma and Kumar (2006); MOSPI (2013); Gundimeda (2001); Balasubramaniam (2013); Murty (2011)), which can be summarized as follows:

1) True contribution of forestry sector benefits to the national economy are at present grossly underestimated with the result that the actual benefits are several times higher than those reported and incorporated in the national income accounts. The difference (between the estimated and recorded contributions) will increase further if an imputed value is assigned for the environmental contribution of the forests to the society, mostly in terms of ecological services provided.

2) Notwithstanding the advantages of satellite accounts, there are serious drawbacks in the sense that they do not change GDP or GNP & as such, do not correct the inherent distortions in those indicators

3) Forests services provide intermediate inputs to other sectors such as livestock grazing, agriculture and tourism, but the value of these services is not recognized and hence, is attributed to the using sector, not to forestry. Ecosystem services such as watershed protection and carbon storage may not be represented at all.

4) The System of National Accounts (SNA), which India also follows currently, has treated cultivated forests and natural forests quite differently. For cultivated forests, the SNA records both production and changes in the forest stock so that consequences of depletion or re- afforestation are accounted for. For natural forests, however, the SNA records only the income from logging, but not changes in natural forest stocks, meaning thereby, income from over exploitation would be recorded as part of GDP, but the corresponding depletion of the forests stocks (the economic equivalent of depreciation) would not be recorded. Similarly the benefits from afforestation would not be recorded

as capital formation.

5) The widely used net-benefit method for calculating depletion is much simpler than the ser-cost method, however, economists consider it technically incorrect.

6) Economic valuations of forest goods and services are based on the notion of willingness to pay which, in turn, is based on the measurement of individuals' preferences, which may or may not maximize social welfare.

7) The forests also provide fodder for the livestock. The fodder has market value but it is considered to be largely undervalued. The central statistical organization includes the value of fodder in their national account estimates based on the information provided by the Ministry of Environment and Forests but it is considered to be grossly underestimated.

world over are considering the transition to sustainable forest management (SFM) (Verma and Kumar, 2006). Two related constraints on moving towards SFM are the high cost of information production and usage, and the gap between current practices and SFM. Forest resource accounting helps to keep down the costs of information usage by focusing on what is essential only-i.e. the information which is required to set, achieve and review forest policy and management goals. This helps bridge the gap between current and improved practices in a step- by step manner, practical manner. The following figure 2 provides key information areas of FRA approach (Verma and Kumar, 2006).

6.0 Review of Literature:

A number of empirical case studies in forest resource accounting are available in the literature (Hamilton and Lutz, 1996; Vincent and Hartwick, 1997; Repetto *et al.*, 1989; Hecht, 2000; Kasulo and Luhanga, 2005) which have focused on accounting for the net accumulation of timber that arises when forest is cleared or harvested (e.g. Van Tongeren *et al.*, 1993; Vincent, 1999a; Seroa da Motta and Ferraz, 2000; Hassan, 2000; Haripriya, 2000, 2001; Balasubramanium, 2013). These studies provided practical guidelines in the construction of forest accounts and their incorporation into national income accounts (Kasulo and Luhanga, 2005). Hultkrantz (1992) proposes an estimate, for Sweden, based on the opportunity costs of conserving land. A particularly novel treatment is Vincent *et al.* (1993) for Malaysia, which seeks to account for the value of species extinction. More recently, Haripriya (2000a) accounted for the pharmaceutical benefits of forests in India based on an estimate of option value (Atkinson and Gundimeda, 2006). Hamilton and Lutz (1996) examined the production relationship between the forest sector and other related sectors (agroforestry, hydropower, fisheries and manufacturing) (Balasubramanium, 2013). Following Vincent and Hartwick (1997), Seroa da Motta and Ferraz (2000) estimated timber depreciation in the Brazilian amazon. The results show substantially low depreciation estimates due to higher timber stocks and scarcity perception (Verma and Kumar, 2006).

Chopra & Kadekodi (1997) has done Forest Resource Accounting for the Yamuna Basin using CVM, Direct Market Valuation Multi-criteria Analysis and Travel Cost Method and concluded that the use value of

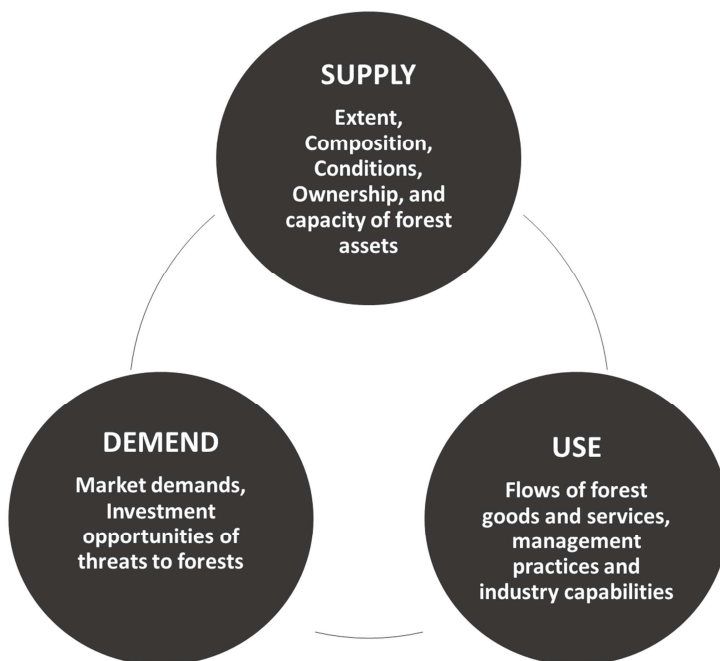


Figure 2: The FRA Approach showing key information areas (adapted and modified from Verma and Kumar, 2006)

Recognizing the need for a realistic valuation of forest benefits and costs, an appropriate accounting framework for integrating Forest Resource Accounts (FRA) into the National Income Accounts (NIA), is needed. It will provide better understanding of the full range of goods and services supplied by the forests which is essential for the optimal utilization of forests, and may provide an economic rationale for sustainable forestry. Forest stakeholders the

timber is Rs.1,879 to Rs. 18,540 per cubic meter with annual value of NTFPs Rs- 558 to Rs. 7509 and Ecological Functions worth Rs. 624 per hectare (Verma and Kumar, 2006). Verma (2000) assessed for the forest sector's contribution to the state economy of Himachal Pradesh, a mountain state. The total economic value of multiple contributions of forest to the economy of Himachal Pradesh was arrived at INR 1066,640 million. Thus, the forest contribution was assessed to be 92.40% of the total gross state domestic products (Balasubramaniam, 2013). Hari Priya (2000) developed forest resource accounts for Maharashtra state in India for the incorporation into the system of national accounts. The study used the system of integrated environmental and economic accounts framework to compile physical and monetary accounts for natural forests. Monetary accounts were valued by using the net price method. The accounts developed only incorporated monetary benefits such as timber, fuelwood and non-timber forest products like fodder. The results showed that the value added by forests is 3.56 percent of the net state domestic product, and that the value of depletion is 19.8 percent of the estimated value added. The environmentally adjusted state domestic product of Maharashtra was found to be 99.3 percent of the estimated net state domestic product (Kasulo and Luhanga, 2005). The unrecorded value of NTFPs constituted about 1.45% of GDP of the state in 2002–2003 through SEEA analysis in Karnataka forest (Panchamukhi *et al.*, 2008; (Balasubramaniam, 2013). A study done by Kanchan Chopra, Pushpam Kumar and B.B. Bhattacharya, Institute of Economic growth, New Delhi, India in 2002 estimated the value of goods and services provided by the forestry sector in India to be in the tune of Rs. 25984.53 Crores. Net of repairs, maintenance and other operational cost, the gross domestic product from the forestry sector came to Rs. 23003.43 Crores of the gross value. This increase in domestic product from forestry is 93.87% of the CSO reported product of Rs. 11,856 Crores for 1996-97. As a percentage of GDP at market prices, the forestry sector contributed 2.37% (1996-97 GDP at 1993-C prices) instead of 1.2 as earlier for the same year reference (Verma and Kumar, 2006). Mali *et al.* (2011) estimate the value of both recorded and unrecorded forest benefits so as to realistically reflect the real contribution of the forest sector to the economy of Gujarat state in India. The study revealed that in Gujarat state, for the period of 1999–2000 to 2006–

2007, the average recorded contribution of 'forestry and logging' sector to the GSDP at current prices was INR 582.57 crore which was, on average, about 0.34% of GSDP (DES, 2008). This study was estimated by 0.49% if the value of unrecorded forest benefits amounting to INR 852.15 crore was also taken into account (Balasubramaniam, 2013).

7.0 Way Forward for Green Accounting in India:

SNA aggregates as measure of welfare could be misleading. There is a need for transition from the existing SNA to a comprehensive set of national accounts in a step-by-step manner. 'Green Accounting' is a methodology for capturing the so-called 'externalities' of 'mainstream' economics (which include most material and unaccounted changes in natural capital, human capital, and social capital) by estimating their stock or net asset values, and thus bringing them within a common framework of value accounting for the nation (Gundimeda *et al.*).

7.1 Recommendations:

A holistic approach for valuation of forests is essential while examining the issue of compensation for expansion and maintenance of forest cover. Forestry sector is subject to inconsistent data from different sources. These data gaps need to be bridged. There are now a good number isolated studies done for specific sectors supported by Ministry of Environment and Forests (MOEF) and Central Statistical Organization (CSO), Government of India and International agencies like World Bank, South Asian Network for Development Economics and Environment (SANDEE) and South Asian Network of Economic Institutions (SANEI). Some of these studies even though incomplete in providing sector and region specific information to feed in to SEEA matrix for estimating green GDP for India, provide some insights in to methodological and empirical insights in to developing sector specific satellite accounts of changes in environmental and natural resource stocks. For effective implementation of SEEA, capacity building in terms of training and sharing of various countries' experience is a must. To overcome impediments in the system of economic valuation of forests of the country for estimating their true contribution, the following recommendations are made:

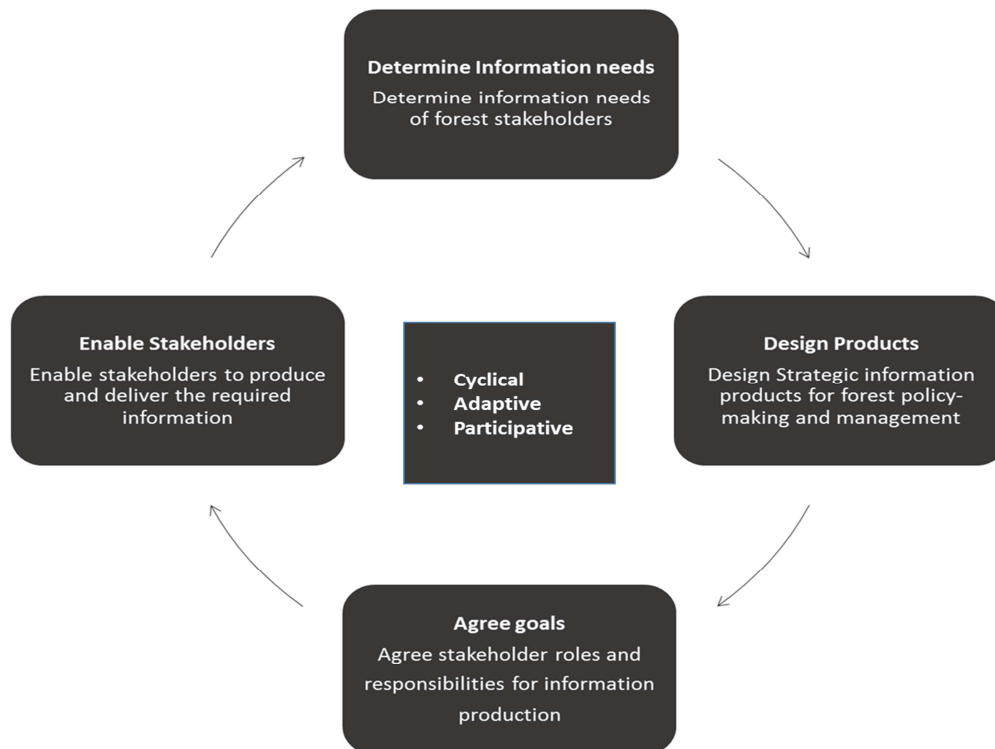


Figure 3: FRA Cycle: Linking information usage to refinement of policy and management objectives (Modified from Verma and Kumar, 2006).

1) A national level effort needs to be initiated to estimate economic value of various forest types, species and densities. This would require a great deal of coordination & correct estimation techniques.

2) India is not yet having a comprehensive data and information base for developing satellite physical and monetary accounts of changes in natural and environmental resource stocks as per the requirement of SEEA. Data limitations in the areas of environmental taxes, pollution, ecosystem services etc. also need to be addressed

3) As per the analysis done by the MoSPI (2013), ecotourism value can be captured through estimating the consumer surplus per hectare per tourist either through contingent valuation method or travel cost method which involve collecting information from different sites and tourists.

4) There is a need for developing sector and region specific physical and monetary accounts of environmental changes on a continuous basis in India.

5) As the forestry sector has multistakeholder and multisectoral linkages, the knowledge about FRA should be disseminated in the form of working or

policy papers on developing framework for valuing forests to guide the policy to them for inculcating appreciation of the concept and need for such a system.

6) There is need to identify the set of people and institutions that bear the cost vis-à-vis the beneficiaries in order to develop an appropriate incentive mechanism (Mathur and Sachdeva, 2003).

7) Haripriya (2001) reported that by having some green indicator in place like environment-adjusted domestic product (EDP) or genuine savings, the policies can be designed to enhance economic growth without extensive natural resource depletion, thereby, achieving more sustainable income.

8) National Level Stakeholder Workshop may be conducted inviting parties which lay a claim on forest land mainly for developmental purposes like Ministries of Rural Development, Irrigation, Power, Infrastructure, Mining, Railways and Surface Transportation and also NGOs (MoSPI, 2013).

9) As India faces many trade-offs in its attempt to reduce poverty and improve the living standard of its people, there is a need for an empirical basis on which to base policy decisions on trade-offs between

the many competing priorities of a developing nation, including intergenerational claims.

Thus, Green Accounting would better enable governments to evaluate choices without a bias against future generations, or a bias in favor of man-made assets as against natural assets. It would present in a different & holistic economic light choices such as conserving precious ecosystems rather than surrendering them at throwaway prices to logging interests for a relatively minor economic gain (Gundimeda *et al*). The Figure 3 that follows illustrates a FRA Cycle which links information usage to the refinement of policy and management objectives (Verma and Kumar, 2006).

Forestry is an example of an activity whose contribution to the economy in a welfare sense is unlikely to be measured well by value added in the production account. Forests contribute directly to welfare through the provision of amenity values, which may not satisfy the SNA's definition of "production." (Vincent and Hartwick, 1997). Green accounting for India is desirable, feasible, realistic and practicable and that a start can be made with available primary data already being collected by various official sources of the Government of India (Gundimeda *et al*). In sum, a holistic approach for forest valuation is crucial while examining the issue of compensation for maintenance and expansion of forest cover along with sensitization of public stakeholders.

8.0 Conclusion:

Accounting for the resources within forest ecosystems and changes in these resulting from human activities is a necessary first step towards the better representation of forests in climate change policy at regional, national and global scales. The economic policies are not geared to encourage forestry activity as say, in the case of agriculture sector, thereby increasing the opportunity cost of sustainable forestry management. Accounting for forest wealth has a number of policy useful benefits including the provision of a framework for analysing detailed and diverse data. The wealth account that we have presented for India's forests has described forestry-related stocks and flows in terms of land area (under forest), physical volume (of timber and carbon) and, finally, monetary values. All of these accounts are useful extensions of standard approaches. Techniques for calculating and capturing a wider range of forest values are however

increasingly employed. Undervaluation of forests in India is causing immense losses to the forestry sector and to the overall economic system. Forest resource accounting is urgently needed to achieve the sustainability goals of ecosystem management.

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