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Ecosystem Goods and Services in Uttara Kannada

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Forests provide various services classified as supporting services, provisioning services, regulating services and cultural services Most of these services are underestimated or not estimated and are thus undervalued in policy decisions. This paper is based on the quantification of various provisioning services from forests such as timber, fuel wood, fodder, green leaf manure, medicinal plants and NTFP. The area under different types of forest is derived from remote sensing data. Quantification of forest goods has been done based on the data compiled from the division offices of the Forest Department and micro level studies (productivity, etc.). Market prices were used for valuing the goods. The valuation of forest goods and services at micro level is expected to explore the possibilities for more effective micro level planning. This helps in integrating the environmental services with the economic goals of the region while ensuring the sustenance of natural resources and maintaining intergeneration equity.

Keywords: Valuation, forests, Western Ghats, Provisioning services, Market price

Introduction:

Ecosystem functions are those processes which includes the exchange of energy between the plants and animals which are needed for the sustenance of life. These functions include nutrient cycling, oxygen regulation, water supply etc. The specific ecosystem functions which are beneficial to humans are termed as ecosystem services. Thus ecosystem goods and services are the conditions and the process through which natural ecosystems and the species that make them up sustain and fulfill the human needs (Daily, 1997). Forests are multifunctional ecosystems provide both ecological and economic security with provision of goods and services. Forest ecosystems account for over two-thirds of net primary production on land–the

conversion of solar energy into biomass through photosynthesis making them a key component of the global carbon cycle and climate (MEA, 2005). 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. The forest ecosystem provides a large number of valuable products such as timber, firewood, non-timber forest product, biodiversity, genetic resources, medicinal plants etc. There are two types of needs for timber-commercial and industrial. The commercial timber production is the local utilization of timber while the industrial timber is used by the industries. The second most important and dominant part of forest produce is fuel wood. According to International Energy Agency (1998) 11% of world energy consumption comes from biomass, mainly fuel wood (CBD, 2001). In addition to the timber and firewood, forest provides the non timber forest product (NTFP) like seegekai, honey, wax, etc. For the purpose of valuation it is important to take into account all resources including NTFP, etc. Most of NTFPs consumed by local populations, and some are marketed. These include plants and plant materials used for food, fuel, storage and fodder, medicine, cottage and wrapping materials, biochemical, as well as animals, birds, reptiles and fishes, for food and feather. Unlike timber-based products, these products come from variety of sources like: fruits and vegetables to eat, leaves and twigs for decoration, flowers for various purposes, herbal medicines from different plant parts, wood carvings and decorations, etc.

The survival, livelihood and human welfare depends upon the flow of array of goods and services obtained from ecosystem. Inventorying and valuation of the flow of goods and services is essential for appropriate ecosystem management decisions. Ecosystem goods and services represent the benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al, 1997) or the benefits people obtain from ecosystems as well as non-utilitarian sources of value (MEA 2003). Despite the essential functions of ecosystems and the consequences of their degradation, ecosystem services are undervalued by society, because of the lack of awareness of the link between natural ecosystems and the functioning of human support systems evident from most of the contemporary approaches based on utilitarian approaches (CGER, 1994). The ecosystem goods and services with the ecological perspective of valuation can be grouped into four different categories, which are:

i. Provisioning services – it includes products i.e., food (including roots, seeds, nuts, fruits, spices, fodder), fibre (including wood, textiles) and medicinal and cosmetic products.
ii. Regulating services – which are of immense importance to the human society such as (a) carbon sequestration, (b) climate and water regulation, (c) protection from natural hazards such as floods, avalanches or rock-fall, (d) water and air purification and (e) disease and pest regulation.
iii. Supporting services – such as primary and secondary production and biodiversity; a resource that is increasingly recognized to sustain many of the goods and services that humans enjoy from the ecosystem.
iv. Cultural services – which satisfy human spiritual and aesthetic appreciation of ecosystems and their components.

Figure 1 provides an integrated framework for assessing the ecosystem goods and services (De Groot *et al*, 2002). The total economic value (TEV) is the sum of all the benefits that are attributable to the specific resource or ecosystem being valued. The total economic value is composed of (i) use value (UV) and (ii) non-use value (NUV). Use value to humans consists of direct, indirect and option value. Direct-use values can be consumptive or non-consumptive and are commonly derived from goods and services by the inhabitants of the ecosystem whereas Indirect-use values are those that are

more functional, the benefits of which often extend away from the ecosystem itself and are not consumed. This communication is based on the valuation of provisioning services of forest ecosystem in Uttara Kannada district, Karnataka state, India.

This involved

- Quantification of various provisioning goods and services derived from forest;
- Total valuation of provisioning goods and services derived from forest.

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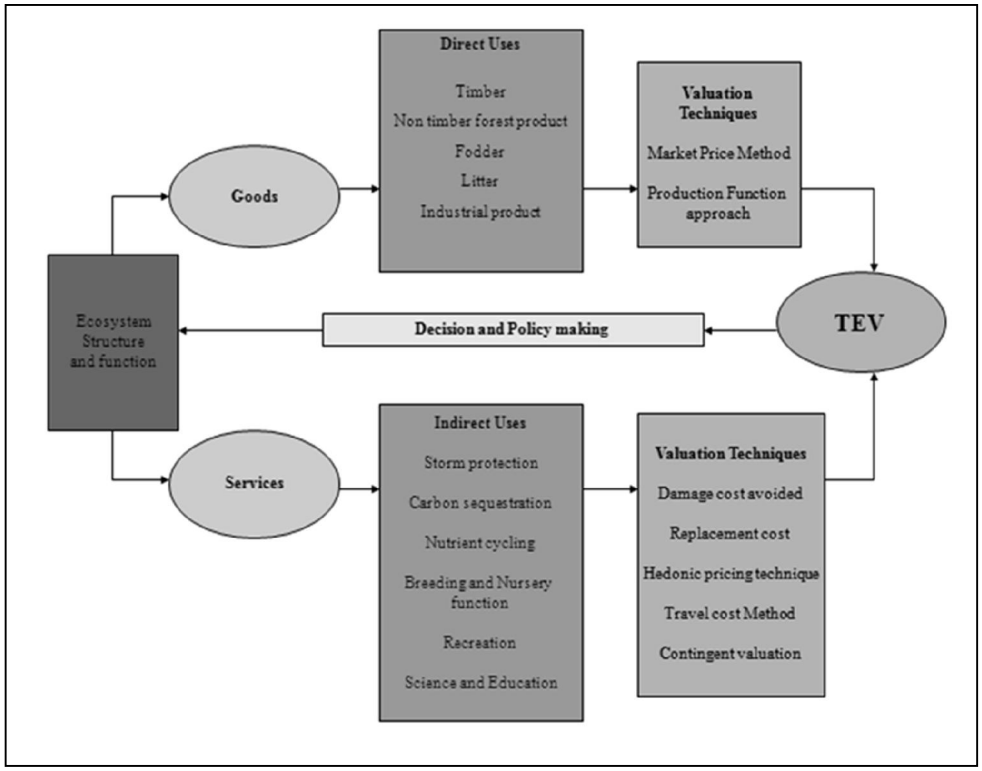


Figure 1: Integrated framework for assessing ecosystem goods and services

Methods

Goods and services quantified from forests of Uttara Kannada at taluk level include timber, NTFP, bamboo, canes, food, medicinal plants, honey from bee keeping, fodder, fuelwood for domestic and commercial usage, litter, mulching leaves, inland fishing, domestic water use, industrial water use, water for power generation, irrigation services, ecological water, oxygen provision and wild fruits. Data were compiled from Divisional Office of Karnataka Forest Department, literatures pertaining to ecological and socio-economic studies in the district and also through interview with the subject experts. Spatial extent of different types of forests was analysed using remote sensing data. Minimal forest gate price of the goods are used for valuation of goods and proxy prices are used for goods which do not pass through market transactions. Valuation: The quantified goods and services are valued by market value approach given by the equation 1.

$$V = \sum_{i=1}^{11} \sum_{j=1}^{n} Q_{i,j} \times P_{i,j} \quad \ldots\ldots. \ 1$$

Q: quantity of goods, P: price of goods, i: number of taluks, j: goods type

Example:

$$V_{Timber} = \sum_{i=1}^{11} \sum_{j=1}^{7} Q_{i,j} \times P_{i,j}$$

where, V_{Timber} = value of timber in the district; Q = quantity of timber; P = price of timber; i = no. of taluks, j = timber types (teak, rosewood, jungle wood, etc.).

Study Area

Uttara Kannada district is located in the north – western part of Karnataka state, in India. It lies between 13.9220° N to 15.5252° N latitude and 74.0852° E to 75.0999° E longitude. The district cover an area of 10, 291 km^2 which is sub-divided into 11 taluks. The district has the population of 13.53 lakh persons. The population density of the district is 132 persons per km^2, which is the lowest in the state. Figure 2 depicts the population density across taluks, the highest population density in Bhatkal taluk (420 persons per km^2) and the least in Supa taluk (26 persons per km^2). The district's diverse economy span across subsistence farming, modern agricultural practice, horticulture, forestry, fisheries, handicrafts, industries, power generation, mining, seaports, tourism and many other services. The district ranks at seventh place in the state of Karnataka in terms of Human Development with HDI value of 0.65 and the district is one among the five districts with highest education index value (KHDR, 2005).

Figure 1: Geographical Location of Uttara Kannada District

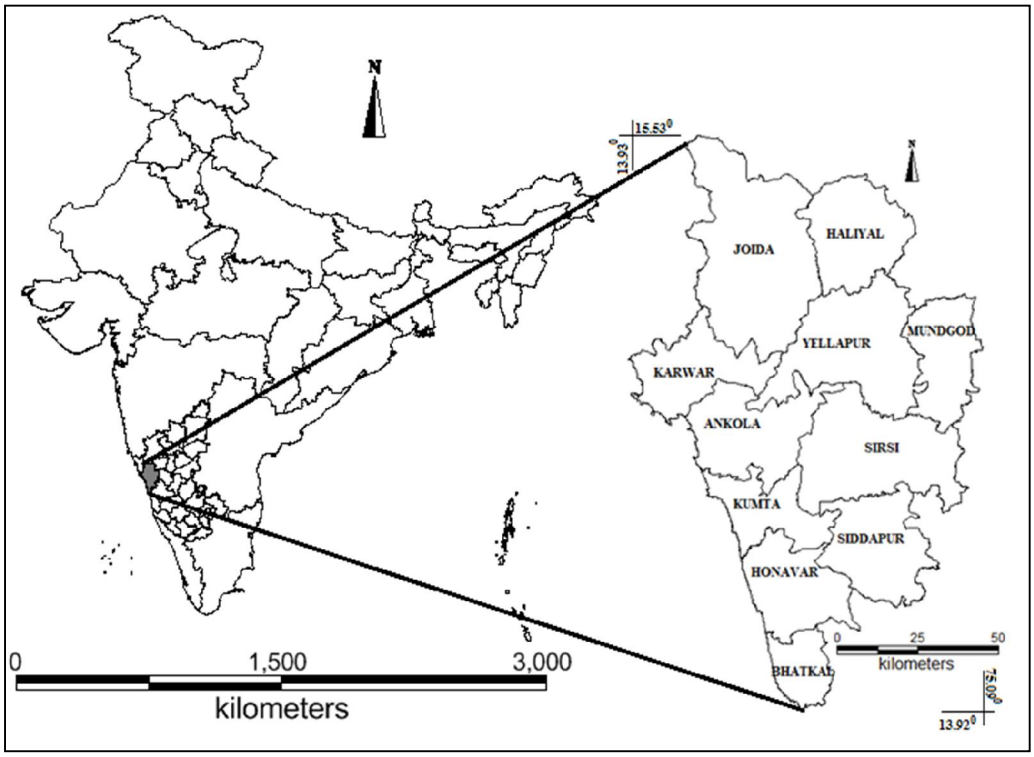


Figure 3 depicts the land use in the district based on the analysis of IRS P6 (Indian remote sensing) multi spectral data of spatial resolution 5.8 m. Area under forests covers 71.72% of the total geographic area of the district. The forest cover ranges from 47% (Mundgod) to 85% (Supa and Yellapur taluks). Figure 4 illustrates that about 49% of the total forest land in the district is of evergreen type followed by 22% of semi-evergreen to moist deciduous forests. Dry deciduous forests are very less and are found in the eastern part of Haliyal and Mundgod taluk.

There has been a significant amount of forest loss owing to various developmental activities across district and conversion of natural forests into plantations. Forest resources across taluks generate significant use and non – use values at local and regional levels. Income obtained from forest substantially supports the majority of the rural communities who are either agriculture or landless poor. A large portion of the income of the tribal and pastoral communities in the district is derived from gathering economy which they use for subsistence as well for marketing.

Figure 2: Talukwise Population Density in Uttara Kannada

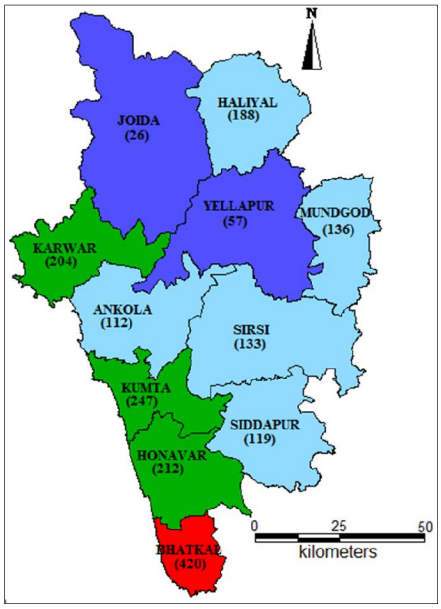


Figure 3: Land –use Map of Uttara Kannada District

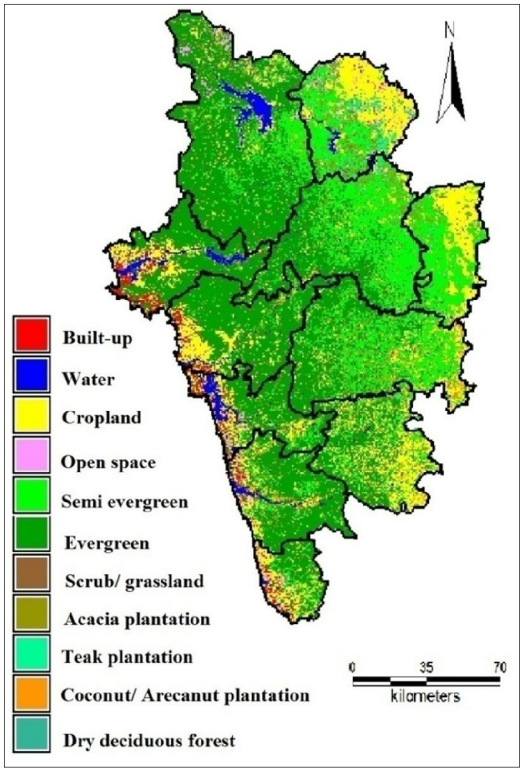
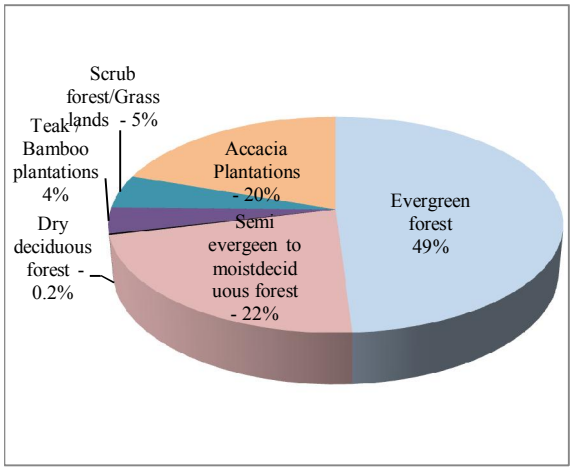


Figure 4: Vegetation Distribution in Uttara Kannada



Results and Discussion

Based on the consideration and inclusion of various components in ecological perspectives we present four scenarios of total value of provisioning goods and services as follows:

- Scenario-I: provisional services include timber, NTFP, litter and mulching leaves, fodder, medicinal plants, fuelwood, food, inland fishing and hydrological services;
- Scenario-II: components in Scenario-I and ecological water;
- Scenario-III: components in Scenario-II and oxygen services;
- Scenario-IV: components in Scenario-IV and wild fruits.

Table 1: Total Value of Provisioning Goods and Services in different scenario

Scenario	Total Value (in Rs. crore)
Scenario – I	8650.66
Scenario – II	9282.08
Scenario – III	12543.62
Scenario – IV	15159.43

Figure 5: Share of Total Value of Provisioning Goods and Services from Forest

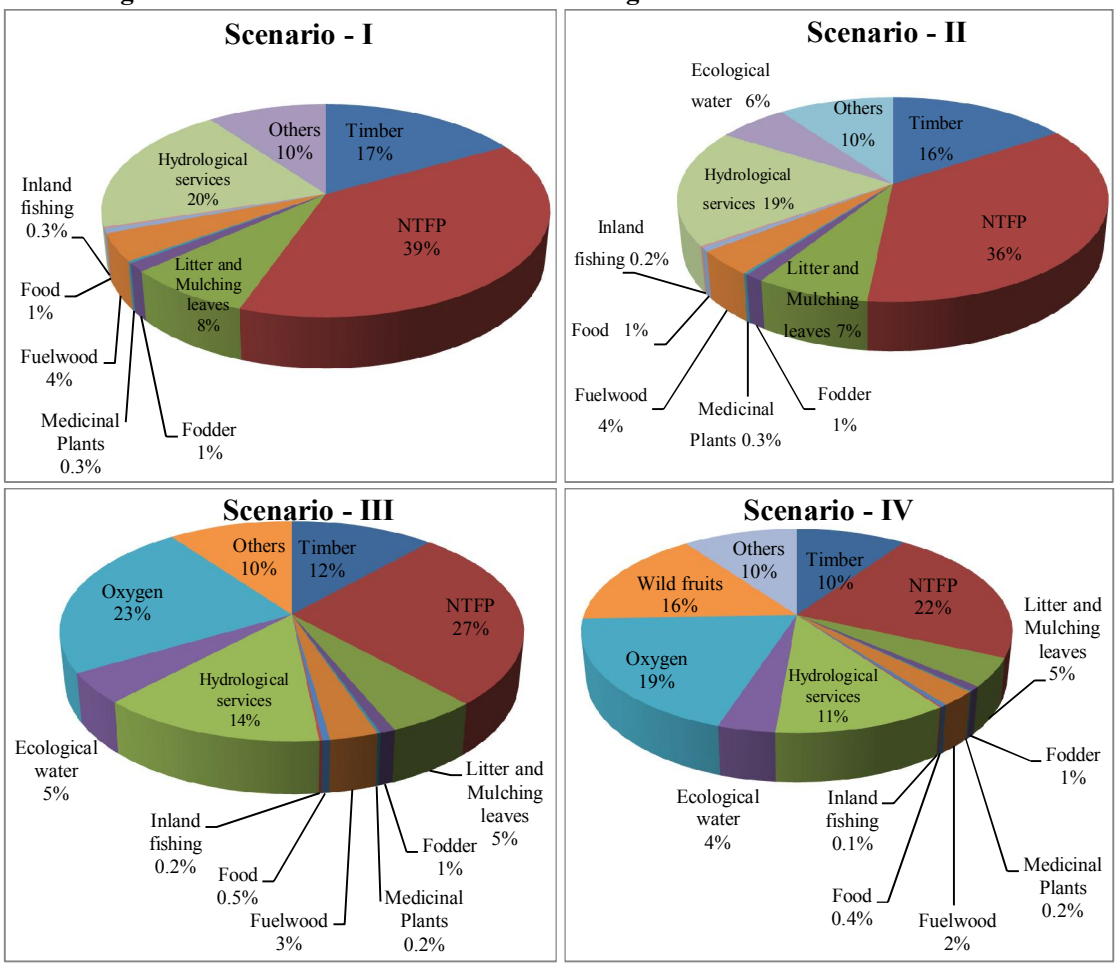


Figure 6: Talukwise Share of Total Provisioning Goods and Services from Forest

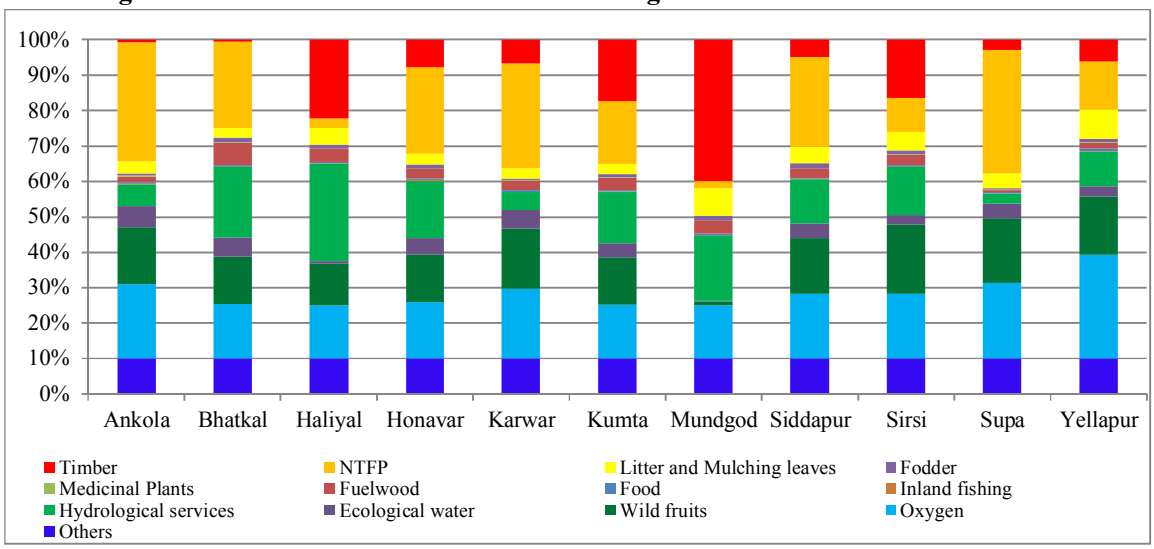
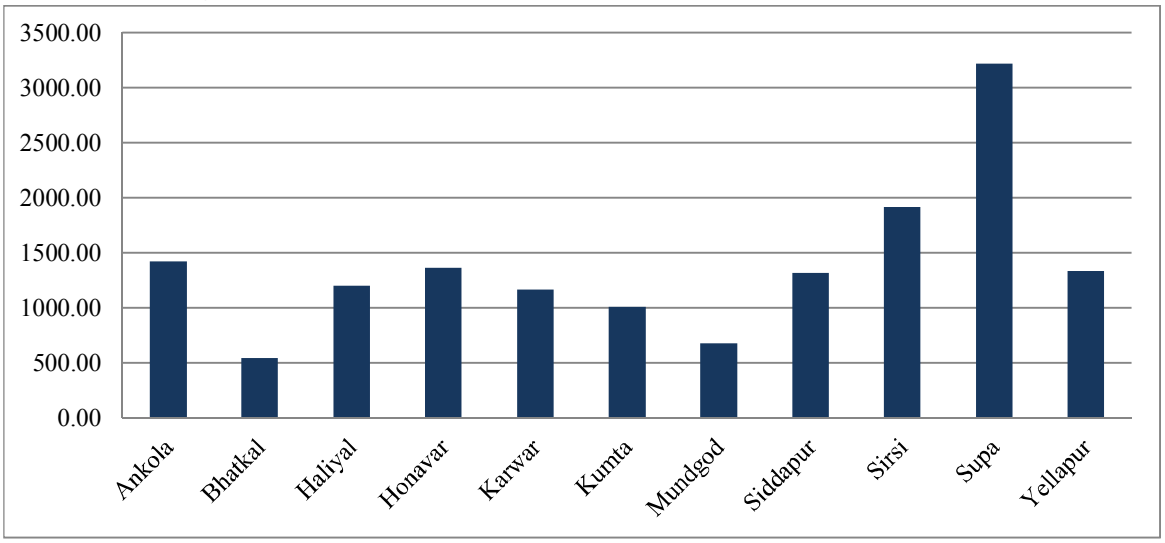


Figure 7: Talukwise Total Value of Provisional Goods and Services



The estimated total value of provisioning goods and services are presented in Table 1. Further, Figure 5 portrays the share of different components of total provisioning goods and services in four scenarios. In all four scenarios, NTFP is the major contributor to the total value. The share of the value of food, inland fishing, medicinal plants, fuel wood, fodder, litter and mulching leaves varies from 14% in Scenario-I to 8% in Scenario-IV. These goods have an important bearing on the livelihood of people and especially the livelihood of local people. The value of ecological water, oxygen provision and wild fruits comprises to about forty per cent share in the total value in Scenario – IV. These components are often neglected in valuation of forest and policy making but they play an important role in ecosystem sustenance, biodiversity and thus in human wellbeing in the long run. Talukwise share of provisioning goods and services is given in Figure 6 considering Scenario-IV. The share of value of food, inland fishing, medicinal plants, fuelwood, fodder, litter and mulching leaves in all taluks is around 10 percent of the total share. Figure 6 illustrates that the share of timber is higher in Haliyal and Mundgod taluks which are under deciduous forests. Considerable share of NTFP is evident in all taluks except Haliyal and Mundgod taluks.. The value of hydrological services varies across taluks depending upon the extent of water utilization for domestic purpose, irrigation, industrial use and power generation. The other major contributors to the total value of provisioning goods and services are the value of ecological water, oxygen and wild fruits across taluks. Figure 7 presents the talukwise breakup in the total provisioning goods and services of the district. This illustrates that Supa taluk contributes the highest amount of provisioning goods and services with Rs. 3,218 crores per year (21% of the district), while Mundgod taluk contributes the least of Rs. 540 crores per year (3.5% of the district).

Valuation of provisioning goods and services from forest ecosystems is about Rs. 2,05,388/hectare/year, which is implicit in the subsistence, income and local employment. Forestry sector contributes significantly to the district, state and national economy and also to the linked sectors industries, agriculture, fisheries, tourism, health, rural development, energy, etc. Sector-wise district's Gross District Domestic Product (GDDP) given in Table 2. GDDP of Uttara Kannada is about Rs 5998 crores and forests' goods is about 180 crores (3% of GDDP), in contrast to the valuation of ecological provisioning services from forest ecosystems of Uttara Kannada district is about Rs.15,159 crores.

Table 2: GDDP of Uttara Kannada with Sectors

Sector	Share in Rs. crore	Share %
Primary Sector (Agriculture, Forestry, Fishing, Mining)	1060	18
Forestry and Logging Sector	180	3
GDDP of Utttara Kannada	5978	100

Source: Directorate of Economics and Statistics, Government of Karnataka.

The forest products included in the national income account framework includes: (a) Industrial wood (timber, match and pulpwood) and fuelwood and (b) minor forest products (Haripriya, 2001). It includes only the recorded values by forest department and thus all other benefits from forests are unaccounted in the national income. This necessitates relook at the current approach of computations of Gross domestic district product (GDDP), State Domestic Product (SDP) and Gross Domestic Product (GDP). Gross underestimation and non-accounting of natural resources and forest resources in particular is responsible for unsustainable utilization of natural resources. Under valuation of ecosystem goods and services is evident from GDDP of Rs. 5978 crore in 2009-10 (at current prices), which accounts as the sectoral share of forests of Rs. 180 crores contrary to Rs. 15159 crores.

Conclusion

Land use analyses show that 49% of the total forest land in the district is of evergreen type followed by 22% of semi-evergreen to moist deciduous forests. Valuation of provisioning goods and services from forest ecosystems is about Rs. 2,05,388/hectare/year, which is implicit in the subsistence, income and local employment. Forestry sector contributes significantly to the district, state and national economy and also to the linked sectors industries, agriculture, fisheries, tourism, health, rural development, energy, etc. Talukwise valuation of goods and services from forest ecosystem show that Supa taluk contributes the highest amount of provisioning goods and services with Rs. 3,218 crores per year (21% of the district), while Mundgod taluk contributes the least of Rs. 540 crores per year (3.5% of the district). Goods and services that forest ecosystems provide are grossly undervalued evident from GDDP of Uttara Kannada is about Rs 5998 crores, which accounts goods of forests as 180 crores (3% of GDDP), in contrast to Rs.15,159 crores from the provisioning services from forest ecosystems of Uttara Kannada district. The valuation of goods and services of ecosystems are vital for framing sustainable development policies to curtail further erosion of natural resources.

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