

# **CENTRAL EMPOWERED COMMITTEE**

## **SUPPLEMENTARY REPORT IN IA NO. 826 IN IA NO. 566 REGARDING CALCULATION OF NET PRESENT VALUE (NPV) PAYABLE ON USE OF FOREST LAND OF DIFFERENT TYPES FOR NON-FOREST PURPOSES**

This Supplementary Report is being filed by the CEC pursuant to this Hon'ble Court's order dated 28.11.2006 in IA No. 826 in IA No. 566 after considering the technical inputs provided by the Forest Survey of India, Ministry of Environment & Forests and after discussing the matter with the Chairman and Members of the Kanchan Chopra Committee, the Director General of Forests, the Inspector General of Forests (FC) and other officials of the MoEF. A copy of the record of discussions held with the Kanchan Chopra Committee on 14.12.2006 is enclosed at **ANNEXURE-RS-I** to this report.

### **FOREST TYPE-WISE FOREST COVER OF INDIA'S FOREST**

2. The Forest Survey of India, has since last two decades, been undertaking forest cover mapping of the country biennially using satellite data obtained from the NRSA, Hyderabad. The methodology

of mapping involves the geo-rectification of the satellite imagery using the Survey of India toposheets followed by the digital interpretation of the same and extensive ground truthing. The forest cover maps depict three tree canopy density classes viz very dense (>70% crown density), moderately dense (40-70% crown density) and open (10-40% crown density). The last assessment of the forest cover in the various States / UT's of the country was done by the Forest Survey of India in the year 2003, in which IRS 1D LISS III satellite data with spatial resolution of 23.5 m was used. The details in this regard is enclosed at **ANNEXURE-RS-II** to this report. A copy of the Forest Cover Map of India prepared by the FSI is enclosed at **ANNEXURE-RS-M-I** to this report. As an illustration, the Forest Cover Map of the State of Karnataka is enclosed at **ANNEXURE-RS-M-II** to this report. These details can be used to ascertain the forest cover of an area anywhere in the country – one ha. and above, by using its co-ordinates obtained with the help of a Global Positioning System (GPS).

3. Champion & Seth have classified the forests of India into the following 16 major groups: -

- (i) (i) Tropical Wet Evergreen Forests
- (ii) (ii) Tropical Semi-Evergreen Forests

- (iii) (iii) Tropical Moist Deciduous Forests
- (iv) (iv) Littoral and Swamp Forests
- (v) (v) Tropical Dry Deciduous Forests
- (vi) (vi) Tropical Thorn Forests
- (vii) (vii) Tropical Dry Evergreen Forests
- (viii) (viii) Sub-tropical Broad Leaved Hill Forests
- (ix) (ix) Sub-Tropical Pine Forests
- (x) (x) Sub Tropical Dry Evergreen Forests
- (xi) (xi) Montane Wet Temperate Forests
- (xii) (xii) Himalayan Moist Temperate Forests
- (xiii) (xiii) Himalayan Dry Temperate Forests
- (xiv) (xiv) Sub Alpine Forest
- (xv) (xv) Moist Alpine Scrub
- (xvi) (xvi) Dry Alpine Scrub

This classification of forest types has wide acceptability throughout the world and matches well with the many ecological classifications followed by the international organizations as well as other countries.

4. The map showing forest type zones of major groups of the forest types as classified by Champion & Seth was geo referenced and digitized. A small inaccessible area of the country and the area of

the State of Sikkim, which was not classified by Champion & Seth, have been assigned the appropriate forest type based on its features. Using the mosaic of forest cover of the entire country, the geo-rectification of the digitized forest type map was further improved using the map-to map rectification method. A copy of the digitized map of the “Forest Type Zones of India” based on Champion & Seth Classification is enclosed at **ANNEXURE-RS-M-III** to this report.

5. The raster GIS analysis of the two layers i.e. the “Forest Cover Map” and the “Forest Type Zones Map” was done for generating a map showing the forest cover in different forest types. The corresponding area figures were also generated in the GIS analysis. A copy of the map showing forest type-wise details of the forest cover in the country is enclosed at **ANNEXURE-RS-M-IV** of this report. As an illustration two maps showing forest type-wise details of the forest cover one for the State of Karnataka and the other for one district of Karnataka namely Udipi district are enclosed at **ANNEXURE-RS-M-V** and **ANNEXURE-RS-M-VI** respectively. The data so generated can be used to ascertain for an area, with the help of its co-ordinates, its forest type as per the Champion & Seth classification as well as its forest density. These details can also be used to generate details of forest of different density falling in different types of forests of any

specific area. The details of very dense forest, dense forest, open forest and scrub land falling in 16 forest type (major groups as per the Champion & Seth Classification) generated by superimposing the forest type zones on the forest cover of the country is enclosed at **ANNEXURE-RS-III** to this report. As an illustration these details for the Udipi district, Karnataka are enclosed at **ANNEXURE-RS-IV** to this report.

### **ECO-VALUE CLASSES OF FORESTS**

6. It is submitted that the classification of Forest Types of India's forests by Champion and Seth was done for silvicultural works particularly applied for the management of forests under working plans. The major basis of classification included the climate, the soil and the past treatment as these factors determine the vegetation type of a given locality. Subsequently, the other ecological parameters, that is the physiognomy, the structure, function, floristics and dynamics of vegetation etc. were used for further classification of forests into types and sub-types. The 16 major Forest Types of India have been sub-divided into 221 types and sub-types.

7. Generally, the ecological classifications have broader range because climate is chosen as a primary factor of classification and

has a very wide canvas. The physiography (lowlands and mountains) and soil become subsidiary to the climate. Thus, from the point of view of the ecological role and value of the forests, which is different from the management perspectives and silvicultural requirements, the Forests Types of India can be grouped into broad ecological classes. For the purpose of this report, the 16 major Forest types have been grouped into the following 6 ecological classes depending upon their ecological functions. This classification is based on experience and judgment and therefore is not very rigid.

- Eco-class I** - Consisting of Tropical Wet Evergreen Forests, Tropical Semi Evergreen Forests and Tropical Moist Deciduous Forests
- Eco-class II** - Consisting of Littoral and Swamp Forests
- Eco-class III** - Consisting of Tropical Dry Deciduous Forests
- Eco-class IV** - Consisting of Tropical Thorn Forests and Tropical Dry Evergreen Forests
- Eco-class V** - Consisting of Sub-tropical Broad Leaved Hill Forests, Sub-Tropical Pine Forests and Sub Tropical Dry Evergreen Forests
- Eco-class VI** - Consisting of Montane Wet Temperate Forests, Himalayan Moist Temperate Forests, Himalayan Dry Temperate Forests, Sub Alpine Forest, Moist Alpine Scrub and Dry Alpine Scrub

8. The details of very dense forest, dense forest, open forest and scrub land falling in different Eco-Value Classes in the country are

enclosed at **ANNEXURE-RS-V** to this report. Similar details can be compiled for any specific area with the help of its co-ordinates. A note on “Eco-Classes composition and other relevant details” is enclosed at **ANNEXURE-RS-VI** to this report.

## **EQUALIZATION VALUE OF FORESTS**

9. Based on the ecological importance of forest falling in different eco-value and canopy density classes, relative weightage factors have been assigned to them (**ANNEXURE-RS-VII**). It may be clarified that these values have also been assigned on the basis of value judgement and experience. By using these relative weightage factors, the equalized forest area in eco-value Class I and very dense forest corresponding to forest falling in different eco-value and density classes have been compiled (**ANNEXURE-RS-VIII**). For example, 17,997 sq.km. of open forest of Eco-Class IV has been calculated to be equivalent to 7,558 sq.km. of very dense forest of Eco-Value Class I i.e. the ecological value of 17,997 sq.km. of this forest is taken to be same as that of 7,558 sq.km. of forest having highest ecological value i.e. very dense forest in Eco-Value Class I. Accordingly, the entire forest area of the country has been calculated and found to be equivalent to 5.2 lakh sq.km. forest area having highest ecological significance as that of forest falling in eco-value Class I with density

above 70%. The equalization factor, which is obtained by dividing the total forest area with the equalized forest area, comes to 1.3042. This factor, multiplied with the average NPV per ha. and with the relative weightage factor, provides the NPV of forest falling in a specific eco-value.

### **AVERAGE NET PRESENT VALUE PER HECTARE OF FOREST**

10. For calculating the average Net Present Value per ha. of forest in India the following monetary value of goods and services provided by the forest have been considered:-

- (i) (i) Value of timber and fuel wood
- (ii) (ii) Value of Non Timber Forest Products (NTFP)
- (iii) (iii) Value of fodder
- (iv) (iv) Value of Eco-tourism
- (v) (v) Value of bio-prospecting
- (vi) (vi) Value of Ecological services of forest
- (vii) (vii) Value of Flagship Species
- (viii) (viii) Carbon Sequestration Value

11. The value of the first six goods / services has been taken as provided in Annexure – RIII of CEC's report dated 16.10.2006. The carbon sequestration value has been assessed on the basis of the



state-wise details of carbon in bio-mass of forest as assessed in the Green Indian States Trust (GIST) report (refer Table – 8 of the Monograph – I enclosed at Annexure-RII of the CEC’s report dated 16.10.2006) and taking the monetary value of CO2 @ US \$ 20/tonne, which has been arrived at on the basis of the EUA future prices (**ANNEXURE-RS-IX**). The state-wise details of the carbon sequestration value are enclosed at **ANNEXURE-RS-X** to this report. The value of the flagship species in respect of forest area outside the National Park and Wildlife Sanctuary, done on the basis of the valuation done in the GIST report and by assuming that 30% of the Royal Bengal Tiger, 50% of the Asian Elephant, 10% of the one horned rhino and 0% of Asian Lion are found outside the National Park / Sanctuary and that the value of other flagships / charismatic species is at least equal to those of these four assessed species, is enclosed at **ANNEXURE-RS-XI** to this report.

12. Accordingly, the average Net Present Value per ha. of forest in India has been calculated as under:-

<b>Sl. No.</b>	<b>Particulars</b>	<b>Value (Rs. / ha.)</b>
1.	Value of timber and fuel wood	1,52,830
2.	Value of NTFPS	7,631
3.	Value of fodder	2,958
4.	Value of Eco-tourism	65,113
5.	Value of bio-prospecting	25,553

6.	Value of Eco-logical services of forest	1,44,332
7.	Value of flagship species	2,58,400
8.	Carbon sequestration value	1,20,780
	<b>Total value of forest</b>	<b>7,77,597</b>
		<b>Say Rs. 8.0 lakh / ha. of forest area in the country</b>

13. At estimated average NPV value of the country's forests as Rs. 8.0 lakh per ha., the NPV for forest falling in various eco-value class and density sub-classes has been found to be (rounded to nearest thousand rupees) as under: -

**Matrix showing NPV of the different eco-value / canopy density classes at estimated average NPV value of the country's forest as Rs. 800,000/- per ha.**

<b>Eco-Value class</b>	<b>Very Dense Forest</b>	<b>Dense Forest</b>	<b>Open Forest</b>
Class I	10,43,000	9,39,000	7,30,000
Class II	10,43,000	9,39,000	7,30,000
Class III	8,87,000	8,03,000	6,26,000
Class IV	6,26,000	5,63,000	4,38,000
Class V	9,39,000	8,45,000	6,57,000
Class VI	9,91,000	8,97,000	6,99,000

**JUSTIFICATION FOR SOCIAL DISCOUNT RATE OF 4% USED FOR CALCULATING THE NPV**

14. This matter was discussed by the CEC with Sh. Partha Sen, Professor, the Delhi School of Economics, Prof. TCA Anant, Member Secretary, Indian Council of Social Science Research, Sh. Pavan Sukhdev, Director, Green Indian States Trust (GIST) and Sh. Pushpam Kumar, Associate Professor, Institute of Economic Growth and Honorary lead author for the GIST. Sh. Pavan Sukhdev and Sh. Pushpam Kumar have justified the 4% social rate of discount used in the GIST report on the principles of inter-generational equity, past trend, rate of inflation and other relevant factors. Prof. Partha Sen was of the view that the social rate discount should ideally be zero so as to give equal weight to the consumption of all generations, including the unborn. For the purpose of present study, he has advocated that the social rate of discount should be taken as 2%. Prof. TCA Anant, giving reference to the "Report on the effect of the climate change and global warming on the world's economy" compiled by noted economist Sir Nicolas Stern for the Government of United Kingdom wherein a discount rate of 0.1% has been used, opined that the rate of discount should be kept as low as possible and that setting the discount rate at some arbitrary cost of capital linked value would be erroneous. Copies of observation made by them are enclosed at **ANNEXURE-RS-XII (COLLY,)**. From the above, it may be seen that the social discount rate of 4% used in valuation of NPV

of the forest used by the GIST and used in this report by the CEC is quite reasonable.

## **CONSERVATIVE VALUATION OF GOODS AND SERVICES PROVIDED BY FOREST**

15. As per the GIST, they have been conservative in estimating forest values in respect of timber, fuel-wood, NTFP, Eco-tourism, by perception, ecological services etc. The value of timber has been taken on the basis of the revenue generated by the Forest Department through auctions, which does not take into consideration the timber given at concessional rate or given free of cost under the Nistar Rights etc. For the purpose of valuation of fuel-wood, the value of the fire-wood used collected / pilfered by the local residents and headlands supplied free of charge has not been considered. The valuation of non-timber forest products such as bamboo etc. has been estimated based on the nominal royalty payable to the Forest Department. The bio-prospecting values are quite conservative as statistics on the exact number of medicinal plants etc. are not available. The ecological value of forest has been assessed by using the replacement cost method which is quite conservative. A note dated 20<sup>th</sup> December, 2006 received from the Green Indian States Trust in this regard is enclosed at **ANNEXURE-RS-XIII** to this report.

16. The annual value of timber and fuel-wood, carbon, NTFP, eco-tourism, fodder and watershed services of forest as assessed by the Kanchan Chopra Committee in respect of the State of Himachal Pradesh and the comparative figures of the average NPV used in this report using the study done by the GIST are given below: -

	<b>Timber &amp; fuel-wood</b>	<b>Carbon sequestration</b>	<b>NTFP</b>	<b>Eco-tourism</b>	<b>Ecological Services (watershed services)</b>	<b>Total</b>
As assessed by Kanchan Chopra Committee (weighted average for Himachal Pradesh)	2311/-	13384/-	2796/-	5414/-	23387/-	<b>47292/-</b>
As assessed in this report (using GIST study)	6113/-	4831/-	305/-	2605/-	5773/-	<b>19627/-</b>

## **CONCLUSIONS AND RECOMMENDATIONS**

17. In the present report, by using the forest cover of India assessed by the Forest Survey of India and superimposing on it the digitized map of Forest Types as per Champion & Seth classification, the forests of India have been classified into 18 eco-class / sub-class having broadly the similar ecological values. For each of the 18 sub-class, the NPV has been calculated on the basis of the studies done by the GIST using reliable National / State level published data.

18. In the absence of the availability of location specific values of goods and services provided by the forest with different species composition and density, altitude, management practice, soil type and depth, slope, aspect, productivity, dependence of local population etc., the CEC is of the view that the above methodology is reasonably reliable and presently the best available option. It is also not time consuming and subjective. It may be seen that the basic principles suggested by the Kanchan Chopra Committee have also been broadly used by the CEC for assessing the NPV.

19. It is understood that in an ongoing project, the FSI is carrying out state-level mapping of the Forest Types. The above exercise is expected to be completed within the next 12-18 months. Thereafter, the MoEF through the FSI, may consider carrying out district-wise mapping of Forest Types and its further classification into type / sub-type on the basis of species composition and density, climate, altitude, soil type etc. Once the above exercise, which may take about another three years, is completed in each district for various sub-type of forest, the NPV may be assessed after quantifying the value of goods and services provided by each sub-type of forest. Till then, the NPV may continue to be charged corresponding to the eco-value class / sub-class in which the forest land is located. The value

of the NPV may be revised periodically, say every five years, on the basis of forest cover assessment done by the FSI and the change in the wholesale price index.

20. The FSI may prepare and supply adequate number of district-wise maps showing very dense forest, dense forest, open forest and scrub land falling in different Forest Types to the respective States / UT's Forest Departments and the regional offices of the MoEF. The FSI may also procure adequate number of GPS equipments for supply to them. It is estimated that an amount of about Rs. 1.0 crore will be required by the FSI for the purchase of high quality plotters, colour xerox machines, GPS equipments, consumables, payment of honorarium, outsourcing of staff etc. This amount may be made available to the FSI by the Ad-hoc CAMPA out of the interest received by the latter. It is expected that the entire exercise will be completed within a period of three to five months.

21. Based on the co-ordinates of the forest area to be used for non-forest purposes / diverted and the ground truth verification, the corresponding eco-value class / sub-class can easily be ascertained by the State Forest Department for the purpose of determining the NPV payable. In respect of the projects involving use of forest land above 100 ha., the verification may be done at the time of the site

inspection by the regional office of the MoEF. The technical assistance wherever required, may be provided by the FSI.

22. In respect of forest area diverted for renewal of mining leases or where trees have already been felled, the NPV may be assessed on the basis of the forest density of the adjoining forest area. In respect of the scrub land, the NPV corresponding to the "open forest" may be charged. As recommended in the earlier report dated 16.10.2006, the use of land falling in National Parks and Wildlife Sanctuaries may continue to be permitted only in exceptional and totally unavoidable cases with the permission of this Hon'ble Court. Such permissions may be considered on payment of an amount equal to ten times in the case of National Parks and five times in the case of Sanctuaries respectively of the NPV payable for the corresponding eco-value class / sub-class. For use of non-forest land falling within the National Parks and Wildlife Sanctuaries an amount equal to the NPV of the corresponding eco-value class / sub-class may be charged except in respect of marine National Parks and Wildlife Sanctuaries. These are very sensitive eco-systems, exceptionally rich in bio-diversity and therefore have a very high ecological value. For these areas, the amount equal to five times the NPV for the adjoining forest may be charged.



23. In the above background, it is recommended that: -

- (i) (i) for non-forestry use / diversion of forest land, the NPV may be directed to be deposited in the Compensatory Afforestation Fund as per the rates given below:-

(in  
Rs.)

<b>Eco-Value class</b>	<b>Very Dense Forest</b>	<b>Dense Forest</b>	<b>Open Forest</b>
Class I	10,43,000	9,39,000	7,30,000
Class II	10,43,000	9,39,000	7,30,000
Class III	8,87,000	8,03,000	6,26,000
Class IV	6,26,000	5,63,000	4,38,000
Class V	9,39,000	8,45,000	6,57,000
Class VI	9,91,000	8,97,000	6,99,000

- (ii) (ii) the use of forest land falling in National Parks / Wildlife Sanctuaries will be permissible only in totally unavoidable circumstances for public interest projects and after obtaining permission from the Hon'ble Court. Such permissions may be considered on payment of an amount equal to ten times in the case of National Parks and five times in the case of Sanctuaries respectively of the NPV payable for such areas. The use of non-forest land falling within the National Parks and Wildlife

Sanctuaries may be permitted on payment of an amount equal to the NPV payable for the adjoining forest area. In respect of non-forest land falling within marine National Parks / Wildlife Sanctuaries, the amount may be fixed at five times the NPV payable for the adjoining forest area;

- (iii) (iii) these NPV rates may be made applicable with prospective effect except in specific cases such as Lower Subhanshri Project, mining leases of SECL, Field Firing Ranges, wherein pursuant to the orders passed by this Hon'ble Court, the approvals have been accorded on lump-sum payment / no payment towards the NPV; and
- (iv) (iv) for preparation and supply of district level maps and GPS equipments to the concerned State / UT Forest Departments and the regional offices of the MoEF, the Ad-hoc CAMPA may be asked to provide an amount of Rs. 1.0 crore to the Forest Survey of India out of the interest received by it.

24. The CEC in its earlier report dated 16.10.2006 has already given its observation / recommendation regarding projects for which full / part exemption from the payment of the NPV is justified.

The Hon'ble Court may please consider the above report and may please pass appropriate order in the matter.

**(M.K. Jiwrajka)**  
**Member Secretary**

**Dated: 2<sup>nd</sup> January, 2007**

Any additional information, if required may kindly be collected from Mr. Haris Beeran, Advocate of the Ministry of Environment & Forests.

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