

Incentive mechanism for preventing deforestation and promoting conservation of forest ecosystem

Indrani Chandrasekharan*, R. Sendhil Kumar, M. Ravindranath and D. J. Kushwah

Normal Central Assistance and Additional Central Assistance (ACA) are devolved by the Planning Commission to assist the State Governments in specific areas. The present paper details an incentive mechanism for preventing deforestation and promoting conservation of forest ecosystems. A number of options to provide support to the states with vast tracts of forest cover above national average (NA) are discussed. A recommendation to consider excess dense forest cover above NA and devolving funds (Rs 10,000/ha) for management is recommended after discussions with experts. The suggestion could form the basis for an ACA package to the states to enable protection of forests.

Keywords: Deforestation, forest cover, incentive, tree cover, wastelands.

FORESTS provide timber, fuel wood, fodder, and a wide range of non-timber products. They are a source of natural habitat for biodiversity and repository of genetic wealth and provide means for recreation and opportunity for ecotourism. In addition, forests help in watershed development, regulate water regime, conserve soil and control floods. They contribute to the process of carbon sequestration and act as carbon sink, by reducing greenhouse gases (GHGs) and in turn global warming. In ecologically sensitive areas like mountains as well as river catchments forests play an important role in prevention of floods, landslides, etc. Degradation of forest resources has a detrimental effect on soil, water and climate, which in turn affects human and animal life.

Indian forests account for 677,088 sq. km, i.e. nearly 20.6% of the total geographical area (GA) of the country. Of this 54,569 sq. km (1.66%) is very dense forest (canopy cover more than 70%), 332,647 sq. km (10.12%) is moderately dense forest (canopy cover between 40% and 70%), while 289,872 sq. km (8.82%) is open forest cover (FC) (canopy cover between 10% and 40%) and scrub (less than 10%) accounts for 38,475 sq. km (1.17%) (ref. 1).

Madhya Pradesh with 76,013 sq. km of forests accounts for the largest area under FC, constituting nearly 11.23% of the total forest in the country and 24.66% of the state's GA. Arunachal Pradesh, Chattisgarh and Kerala have 2.55%, 4.11% and 1.18% of the country's GA while accounting for 10.01%, 8.25% and 2.3% respectively of

the FC. On the other hand, states like Rajasthan, Punjab, Haryana, Bihar, Uttar Pradesh and Gujarat put together account for 7.8% of the country's forests while covering 29.4% of GA. Arunachal Pradesh, Madhya Pradesh, Maharashtra and Uttarakhand account for nearly 56.52% of the dense FC in the country (Table 1).

The Tenth Five Year Plan² proposed raising the forest and tree cover of the country to 25% in 2007 and 30% by 2012. The 33% forest and tree cover would require an additional area of over 23 MHa to be brought under FC.

Some of the states have raised the issue of compensation for maintaining FC at levels higher than national average (NA) (20.6%). It is alleged that this is adversely affecting the development activity of the states that have minimal FC.

It is recognized that there is a need for appropriate valuation of forests to account for the benefits and costs while considering the requests. However, the issue has wider implications than just the valuation of forests.

Globally, governments support conservation and maintenance of forests. Subsidy for forest maintenance in Switzerland and US, subsidy for forestry in Sweden and UK, subsidy/compensation for forest conservation in Finland and subsidies for forest development, forest based resource, reforestation, etc. in Canada, are some forms of government support rendered for maintaining and conserving FC. These to some extent are based on income foregone, cost incurred on maintenance and implementation of sustainable management practices for production of forest produce.

A paper entitled 'Compensation for forest ecological services in China' advocates incentives considering that the said state/area renders an ecological service to the nation³.

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Table 1. Status of forest, tree and mangrove cover

| State/Union Territories | Geographic area (sq. km) | Forest cover (sq. km) | | | | | | | TCFCM | % TCFCM state's geographic area |
|-------------------------|--------------------------|-----------------------|-------------------------|-------------|------------------|---------------|----------------|------------|---------|---------------------------------|
| | | Very dense forest | Moderately dense forest | Open forest | % TFC of country | % DFC (11.78) | Mangrove cover | Tree cover | | |
| Andhra Pradesh | 275,069 | 130 | 24,199 | 20,043 | 6.55 | 6.28 | 329 | 7,640 | 52,341 | 19.03 |
| Arunachal Pradesh | 83,743 | 14,411 | 37,977 | 15,389 | 10.01 | 13.53 | – | 446 | 68,223 | 81.47 |
| Assam | 78,438 | 1,444 | 11,387 | 14,814 | 4.08 | 3.31 | – | 1,484 | 29,129 | 37.14 |
| Bihar | 94,163 | 110 | 3,004 | 2,465 | 0.82 | 0.80 | – | 2,522 | 8,101 | 8.6 |
| Chhattisgarh | 135,191 | 2,256 | 36,472 | 17,135 | 8.25 | 10.00 | – | 4,492 | 60,355 | 44.64 |
| Delhi | 1,483 | 0 | 54 | 122 | 0.02 | 0.01 | – | 107 | 283 | 19.08 |
| Goa | 3,702 | 55 | 1,095 | 1,014 | 0.32 | 0.30 | 16 | 268 | 2,448 | 66.12 |
| Gujarat | 196,022 | 114 | 6,024 | 8,577 | 2.17 | 1.59 | 936 | 7,621 | 23,272 | 11.87 |
| Haryana | 44,212 | 3 | 523 | 1,061 | 0.23 | 0.14 | – | 1,565 | 3,152 | 7.13 |
| Himachal Pradesh | 55,673 | 1,097 | 7,831 | 5,441 | 2.12 | 2.31 | – | 709 | 15,078 | 27.08 |
| Jammu and Kashmir | 222,236 | 2,135 | 8,394 | 10,744 | 3.14 | 2.72 | – | 5,633 | 26,906 | 12.11 |
| Jharkhand | 79,714 | 2,544 | 9,078 | 10,969 | 3.34 | 3.00 | – | 3,080 | 25,671 | 32.2 |
| Karnataka | 191,791 | 464 | 21,634 | 13,153 | 5.21 | 5.71 | 3 | 5,467 | 40,721 | 21.23 |
| Kerala | 38,863 | 1,024 | 8,636 | 5,935 | 2.30 | 2.49 | 8 | 2,632 | 18,235 | 46.92 |
| Madhya Pradesh | 3,08,245 | 4,239 | 36,843 | 34,931 | 11.23 | 10.61 | – | 6,267 | 82,280 | 26.69 |
| Maharashtra | 3,07,713 | 8,191 | 20,193 | 19,092 | 7.01 | 7.33 | 158 | 8,978 | 56,612 | 18.4 |
| Manipur | 22,327 | 923 | 5,541 | 10,622 | 2.52 | 1.67 | – | 142 | 17,228 | 77.16 |
| Meghalaya | 22,429 | 338 | 6,808 | 9,842 | 2.51 | 1.85 | – | 405 | 17,393 | 77.55 |
| Mizoram | 21,081 | 133 | 6,173 | 12,378 | 2.76 | 1.63 | – | 122 | 18,806 | 89.2 |
| Nagaland | 16,579 | 236 | 5,602 | 7,881 | 2.03 | 1.56 | – | 238 | 13,957 | 84.18 |
| Orissa | 1,55,707 | 538 | 27,656 | 20,180 | 7.14 | 7.28 | 203 | 4,589 | 53,166 | 34.14 |
| Punjab | 50,362 | 0 | 723 | 835 | 0.23 | 0.19 | – | 1,823 | 3,381 | 6.71 |
| Rajasthan | 3,42,239 | 14 | 4,456 | 11,380 | 2.34 | 1.15 | – | 8,379 | 24,229 | 7.08 |
| Sikkim | 7,096 | 498 | 1,912 | 852 | 0.48 | 0.62 | – | 27 | 3,289 | 46.35 |
| Tamil Nadu | 1,30,058 | 2,650 | 9,790 | 10,604 | 3.40 | 3.21 | 35 | 5,621 | 28,700 | 22.07 |
| Tripura | 10,486 | 61 | 4,969 | 3,125 | 1.20 | 1.30 | – | 134 | 8,289 | 79.04 |
| Uttar Pradesh | 2,40,928 | 1,297 | 4,682 | 8,148 | 2.09 | 1.54 | – | 8,203 | 22,330 | 9.27 |
| Uttarakhand | 53,483 | 4,002 | 14,396 | 6,044 | 3.61 | 4.75 | – | 658 | 25,100 | 46.93 |
| West Bengal | 88,752 | 2,302 | 3,777 | 6,334 | 1.83 | 1.57 | 2118 | 2,269 | 16,800 | 18.93 |
| Andaman and Nicobar | 8,249 | 3,359 | 2,646 | 624 | 0.98 | 1.55 | 637 | 53 | 7,319 | 88.72 |
| Chandigarh | 114 | 1 | 8 | 6 | 0.00 | 0.00 | – | 9 | 24 | 21.05 |
| Dadra and Nagar Haveli | 491 | 0 | 130 | 91 | 0.03 | 0.03 | – | 28 | 249 | 50.71 |
| Daman and Diu | 112 | 0 | 2 | 6 | 0.00 | 0.00 | 1 | 9 | 18 | 16.07 |
| Lakshadweep | 32 | 0 | 15 | 10 | 0.00 | 0.00 | – | 4 | 29 | 90.62 |
| Puducherry | 480 | 0 | 17 | 25 | 0.01 | 0.00 | 1 | 42 | 85 | 17.71 |
| Total | 3,287,263 | 54,569 | 332,647 | 289,872 | – | – | 4445 | 91,663 | 773,196 | – |

The Supreme Court of India in a judgement dated 26 September 2005 in WP 202/1995 directed estimating net present value (NPV), for compensating states having FC above NA. It needs to be mentioned that several states like Madhya Pradesh, Chattisgarh, Bihar charge NPV from user groups which clear forests for alternate uses at of Rs 0.58–0.92 million/ha depending on the quantity and density of the forest land converted.

The President of India had also mooted the idea of ‘forest credit’⁴. According to the report of the working group⁵ on forests, 270 MT of fuel wood, 280 MT of fodder and over 12 million cubic metre of timber and countless non-timber forest produce are removed from forests

annually; the total revenue per annum is estimated at Rs 275,000 million.

A study in 2000 (ref. 6), which examined the contribution of forests of Himachal Pradesh in sustaining livelihood of rural population, suggested that the annual indirect benefits far exceed the direct benefits of forests.

According to the National Forest Commission Report⁷, forests are a national wealth and their protection and maintenance should be viewed in that light and therefore compensation for maintaining higher forests area cannot be justified. Further it is suggested that India could learn from Brazil and consider levying an ecological value added tax to compensate for the loss of revenue to those

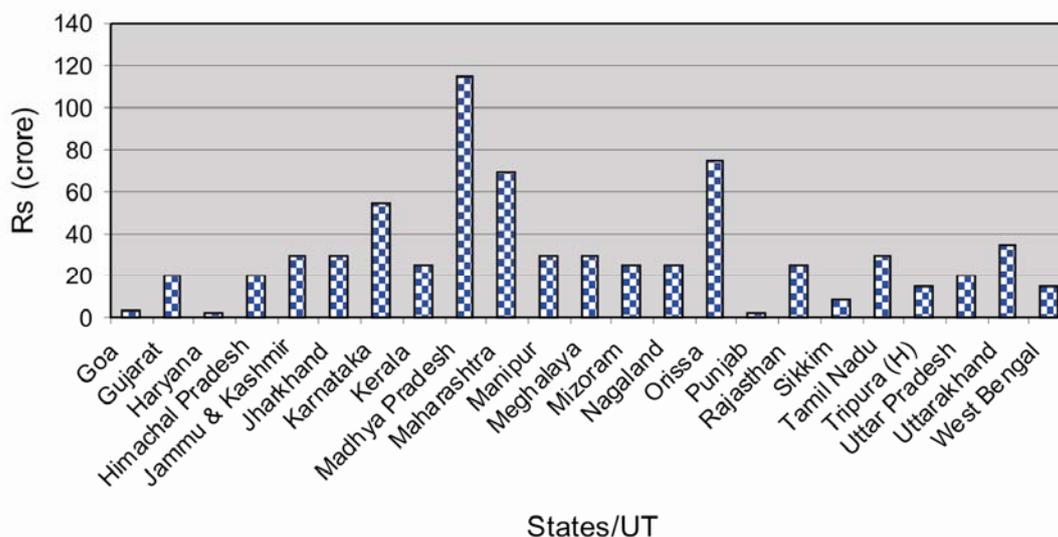


Figure 1. Grants-in-aid for maintenance of forests – 12th Finance Commission.

Indian states which have done a good job of protecting their forests.

In addition to support for afforestation under various centrally sponsored schemes, the 12th Finance Commission has also devolved Rs 10,000 million to states (Figure 1) based on percentage of FC held.

The 13th Finance Commission can also be requested to devolve Rs 30,000 million for this purpose which is of the order of Rs 4000 million every year to the states.

In order to address the concerns and possibly provide incentives to states to preserve and raise FC and tree cover, a simple criterion of distribution was proposed in the working paper of the Planning Commission (PC) on 'Towards economic approach to sustainable forest development'⁸. Essentially, the criterion is based on four parameters, viz. FC in 2001, the wastelands available, total GA and the population of the state in 2001. The paper has developed an index as follows:

$$I_i = \{(f/g) \times 0.5 + (w/g) \times 0.25 + (p) \times 0.25\}.$$

The index has been normalized to 100.

F_i is the FC and tree cover in state, i the total forest area in country; W_i the potentially convertible wasteland in state, i the total potentially convertible wasteland in country; G_i the geographical area in state, i the total geographical area in the country; P_i the population in state, i the total population in the country and taking; $f = F_i$, $w = W_i$, $g = G_i$ and $p = P_i$.

In this article, a methodology to provide incentives to states holding and maintaining large tracts of FC above the NA has been worked out. The FC in excess of the NA of 20.6% held by states and the area required to be afforested by states to achieve the NA is indicated in Table 2. States/union territories, viz. Madhya Pradesh,

Arunachal Pradesh, Andaman and Nicobar have 60.33%, 4.06% and 59.76% respectively of FC in excess of NA. As can be seen from Table 2, 19 states have FC in excess of the NA of which 9 are hill states and 10 belong to the plains. Arunachal Pradesh has the highest excess FC of 50,522 sq. km. While Lakshadweep has the lowest of 18 sq. km. The total excess FC works out to 21.27 Mha belonging to 19 states which qualify for incentives. The 16 states with below NA FC will have to afforest 21.80 Mha to achieve the NA; of which Rajasthan requires to afforest the highest of 0.55 Mha to achieve the NA.

The national dense forest coverage is 11.78% of the national GA. 13.59 Mha under dense forest cover (DFC) qualifies for incentive spread over 19 states. The largest tract of FC is in the states of Arunachal Pradesh and Chhattisgarh followed by Uttarakhand (Table 3).

The total tree, forest and mangrove (TCFCM) cover of the country is 77.32 Mha. In terms of percentage of TCFCM, Madhya Pradesh continues to have the largest tract, accounting for 10.64% of the TCFCM of the country followed by Arunachal Pradesh and Chhattisgarh. Tree cover and mangrove (TC&M) comprises 2.92% national GA. The excess TCFCM cover and area required to be afforested by states taking into account tree cover and mangroves, if any, is in Table 3.

NPV of the excess FC held has been worked out based on average monies currently collected by states, i.e. Rs 3 lakh/ha and the said amount is considered to be held under fixed deposit at the prevailing interest rates (8%) and the interest accruing calculated as available to be disbursed as incentive to the State Forest Department. Incentives to states have been calculated on the current excess FC (Table 3), excess DFC and excess TCFCM cover held (Table 4) by states. Based on accepted norms of

Table 2. Forest cover (FC), dense forest cover (DFC) and tree, forest and mangrove cover (TCFCM) qualifying for incentives

| State/UT | Geographic Area (GA) (sq. km) | Total FC | FC as % GA state | % Difference with NA FC (20.6) | Area FC qualified for incentive | DFC | % DFC | NDFC (11.78%) DFC % | Area incentive qualified for | TC + FC + mangrove | % TCFCM SGA | TCFCM (23.52%) TCFCM % | TCFCM (excess) eligible for incentive |
|------------------------|-------------------------------|----------|------------------|--------------------------------|---------------------------------|--------|-------|---------------------|------------------------------|--------------------|-------------|------------------------|---------------------------------------|
| Andhra Pradesh | 275,069 | 44,372 | 16.13 | -4.47 | - | 24,329 | 0.85 | -2.93 | 0 | 52,341 | 19.03 | -4.42 | 0 |
| Arunachal Pradesh | 83,743 | 67,777 | 80.93 | 60.33 | 50,522 | 52,388 | 62.56 | 50.78 | 42,525 | 68,223 | 81.47 | 57.95 | 48,529 |
| Assam | 78,438 | 27,645 | 35.24 | 14.64 | 11,483 | 12,831 | 16.36 | 4.58 | 3,593 | 29,129 | 37.14 | 13.62 | 10,683 |
| Bihar | 94,163 | 5,579 | 5.92 | -14.68 | - | 3,114 | 3.3 | -8.48 | 0 | 8,101 | 8.6 | -14.92 | 0 |
| Chhattisgarh | 135,191 | 55,863 | 41.32 | 20.72 | 28,012 | 38,728 | 28.65 | 16.87 | 22,807 | 60,355 | 44.64 | 21.12 | 28,552 |
| Delhi | 1,483 | 176 | 11.87 | -8.73 | - | 54 | 3.64 | -8.14 | 0 | 283 | 19.08 | -4.44 | 0 |
| Goa | 3,702 | 2,164 | 58.45 | 37.85 | 1,401 | 1,150 | 31.06 | 19.28 | 714 | 2,448 | 66.12 | 42.6 | 1,577 |
| Gujarat | 196,022 | 14,715 | 7.51 | -13.09 | - | 6,138 | 3.13 | -8.65 | 0 | 23,272 | 11.87 | -11.65 | 0 |
| Haryana | 44,212 | 1,587 | 3.59 | -17.01 | - | 526 | 1.19 | -10.59 | 0 | 3,152 | 7.13 | -16.39 | 0 |
| Himachal Pradesh | 55,673 | 14,369 | 25.81 | 5.21 | 2,901 | 8,928 | 16.04 | 4.26 | 2,372 | 15,078 | 27.08 | 3.56 | 1,982 |
| Jammu and Kashmir | 222,236 | 21,273 | 9.57 | -11.03 | - | 10,529 | 4.74 | -7.04 | 0 | 26,906 | 12.11 | -11.41 | 0 |
| Jharkhand | 79,714 | 22,591 | 28.34 | 7.74 | 6,170 | 11,622 | 14.58 | 2.8 | 2,232 | 25,671 | 32.2 | 8.68 | 6,919 |
| Karnataka | 191,791 | 35,251 | 18.38 | -2.22 | - | 22,098 | 11.52 | -0.26 | 0 | 40,721 | 21.23 | -2.29 | 0 |
| Kerala | 38,863 | 15,595 | 40.13 | 19.53 | 7,590 | 9,660 | 24.86 | 13.08 | 5,083 | 18,235 | 46.92 | 26.4 | 10,260 |
| Madhya Pradesh | 308,245 | 76,013 | 24.66 | 4.06 | 12,515 | 41,082 | 13.33 | 1.55 | 4,504 | 82,280 | 26.69 | 3.17 | 9,771 |
| Maharashtra | 307,713 | 47,476 | 15.43 | -5.17 | - | 28,384 | 9.22 | -2.56 | 0 | 56,612 | 18.4 | -5.12 | 0 |
| Manipur | 22,327 | 17,086 | 76.53 | 55.93 | 12,487 | 6,464 | 28.95 | 17.17 | 3,834 | 17,228 | 77.16 | 53.64 | 11,976 |
| Meghalaya | 22,429 | 16,988 | 75.74 | 55.14 | 12,367 | 7,146 | 31.86 | 20.08 | 4,504 | 17,393 | 77.55 | 54.03 | 12,118 |
| Mizoram | 21,081 | 18,684 | 88.63 | 68.03 | 14,341 | 6,306 | 29.91 | 18.13 | 3,822 | 18,806 | 89.2 | 65.68 | 13,845 |
| Nagaland | 16,579 | 13,719 | 82.75 | 62.15 | 10,304 | 5,838 | 55.21 | 43.43 | 7,200 | 13,957 | 84.18 | 60.66 | 10,057 |
| Orissa | 155,707 | 48,374 | 31.07 | 10.47 | 16,303 | 28,194 | 18.11 | 6.33 | 9,856 | 53,166 | 34.14 | 10.62 | 16,536 |
| Punjab | 50,362 | 1,558 | 3.09 | -17.51 | - | 723 | 1.43 | -10.35 | 0 | 3,381 | 6.71 | -16.81 | 0 |
| Rajasthan | 342,239 | 15,850 | 4.63 | -15.97 | - | 4,470 | 1.3 | -10.48 | 0 | 24,229 | 7.08 | -16.44 | 0 |
| Sikkim | 7,096 | 3,262 | 45.97 | 25.37 | 1,800 | 2,410 | 33.96 | 22.18 | 1,574 | 3,289 | 46.35 | 22.83 | 1,620 |
| Tamil Nadu | 130,058 | 23,044 | 17.72 | -2.88 | - | 12,440 | 9.57 | -2.21 | 0 | 28,700 | 22.07 | -1.45 | 0 |
| Tripura | 10,486 | 8,155 | 77.77 | 57.17 | 5,995 | 5,030 | 47.94 | 36.16 | 3,792 | 8,289 | 79.04 | 55.52 | 5,822 |
| Uttar Pradesh | 240,928 | 14,127 | 5.86 | -13.76 | - | 5,979 | 2.48 | -9.3 | 0 | 22,330 | 9.27 | -14.25 | 0 |
| Uttarakhand | 53,483 | 24,442 | 45.7 | 25.1 | 13,424 | 18,398 | 34.4 | 22.62 | 12,098 | 25,100 | 46.93 | 23.41 | 12,520 |
| West Bengal | 88,752 | 12,413 | 13.99 | -6.61 | - | 6,079 | 6.85 | -4.93 | 0 | 16,800 | 18.93 | -4.59 | 0 |
| Andaman and Nicobar | 8,249 | 6,629 | 80.36 | 59.76 | 4,930 | 6,005 | 72.8 | 61.02 | 5,034 | 7,319 | 88.72 | 65.2 | 5,378 |
| Chandigarh | 114 | 15 | 13.16 | -7.44 | - | 9 | 7.9 | -3.88 | 0 | 24 | 21.05 | -2.47 | 0 |
| Dadra and Nagar Haveli | 491 | 221 | 45.01 | 24.41 | 120 | 130 | 26.48 | 14.7 | 72 | 249 | 50.71 | 27.19 | 104 |
| Daman and Diu | 112 | 8 | 7.14 | -13.46 | - | 2 | 1.98 | -9.8 | 0 | 18 | 16.07 | -7.45 | 0 |
| Lakshadweep | 32 | 25 | 78.13 | 57.53 | 18 | 15 | 46.88 | 35.1 | 11 | 29 | 90.62 | 67.1 | 21 |
| Puducherry | 480 | 42 | 8.75 | -11.85 | - | 17 | 3.46 | -8.32 | 0 | 85 | 17.71 | -5.81 | 0 |
| Total | 3,287,263 | 677,088 | - | - | 212,683 | 54,569 | - | - | 135,901 | 773,196 | - | - | 208,270 |

Table 3. Incentive for excess forest cover – statewise (options – 1 and 2) (Area in sq. km) (Rs in million)

| State/UT | Geographic area (sq. km) | Total FC | FC % of state GA | % FC-NA FC (20.6) | FC (excess) eligible for incentive | | 8% NPV (Rs 0.3 million/ha) | Management including maintenance @ Rs 10,000/ha | FC (excess) eligible for incentive under option-2 | 8% NPV (Rs 0.3 million/ha) | Management including maintenance @ Rs 10,000/ha |
|------------------------|--------------------------|----------|------------------|-------------------|------------------------------------|----------------|----------------------------|---|---|----------------------------|---|
| | | | | | under option-1 | under option-2 | | | | | |
| Andhra Pradesh | 275,069 | 44,372 | 16.13 | -4.47 | - | - | - | - | - | - | - |
| Arunachal Pradesh | 83,743 | 67,777 | 80.93 | 60.33 | 50,522 | 26,928 | 64,630 | 50,520 | 26,928 | 64,630 | 26,930 |
| Assam | 78,438 | 27,645 | 35.24 | 14.64 | 11,483 | 11,483 | 27,560 | 11,480 | 11,483 | 27,560 | 11,480 |
| Bihar | 94,163 | 5,579 | 5.92 | -14.68 | - | - | - | - | - | - | - |
| Chhattisgarh | 135,191 | 55,863 | 41.32 | 20.72 | 28,012 | 28,012 | 67,230 | 28,010 | 28,012 | 67,230 | 28,010 |
| Delhi | 1,483 | 176 | 11.87 | -8.73 | - | - | - | - | - | - | - |
| Goa | 3,702 | 2,164 | 58.45 | 37.85 | 1,401 | 1,401 | 3,360 | 1,400 | 1,401 | 3,360 | 1,400 |
| Gujarat | 196,022 | 14,715 | 7.51 | -13.09 | - | - | - | - | - | - | - |
| Haryana | 44,212 | 1,587 | 3.59 | -17.01 | - | - | - | - | - | - | - |
| Himachal Pradesh | 55,673 | 14,369 | 25.81 | 5.21 | 2,901 | 2,901 | 6,960 | 2,900 | - | - | - |
| Jammu and Kashmir | 222,236 | 21,273 | 9.57 | -11.03 | - | - | - | - | - | - | - |
| Jharkhand | 79,714 | 22,591 | 28.34 | 7.74 | 6,170 | 6,170 | 14,810 | 6,170 | - | - | - |
| Karnataka | 191,791 | 35,251 | 18.38 | -2.22 | - | - | - | - | - | - | - |
| Kerala | 38,863 | 15,595 | 40.13 | 19.53 | 7,590 | 7,590 | 18,220 | 7,590 | 7,590 | 18,220 | 7,590 |
| Madhya Pradesh | 308,245 | 76,013 | 24.66 | 4.06 | 12,515 | 12,515 | 30,040 | 12,510 | 12,515 | 30,040 | 12,510 |
| Maharashtra | 307,713 | 47,476 | 15.43 | -5.17 | - | - | - | - | - | - | - |
| Manipur | 22,327 | 17,086 | 76.53 | 55.93 | 12,487 | 12,487 | 29,970 | 12,490 | 6,036 | 14,490 | 6,040 |
| Meghalaya | 22,429 | 16,988 | 75.74 | 55.14 | 12,367 | 12,367 | 29,680 | 12,370 | 5,868 | 14,080 | 1,410 |
| Mizoram | 21,081 | 18,684 | 88.63 | 68.03 | 14,341 | 14,341 | 34,420 | 14,340 | 8,862 | 21,270 | 2,130 |
| Nagaland | 16,579 | 13,719 | 82.75 | 62.15 | 10,304 | 10,304 | 24,730 | 10,300 | 5,700 | 13,680 | 1,370 |
| Orissa | 155,707 | 48,374 | 31.07 | 10.47 | 16,303 | 16,303 | 39,130 | 16,300 | 16,303 | 39,130 | 16,300 |
| Punjab | 50,362 | 1,558 | 3.09 | -17.51 | - | - | - | - | - | - | - |
| Rajasthan | 342,239 | 15,850 | 4.63 | -15.97 | - | - | - | - | - | - | - |
| Sikkim | 7,096 | 3,262 | 45.97 | 25.37 | 1,800 | 1,800 | 4,320 | 1,800 | 156 | 370 | 40 |
| Tamil Nadu | 130,058 | 23,044 | 17.72 | -2.88 | - | - | - | - | - | - | - |
| Tripura | 10,486 | 8,155 | 77.77 | 57.17 | 5,995 | 5,995 | 14,390 | 5,990 | 2,982 | 7,160 | 720 |
| Uttar Pradesh | 240,928 | 14,127 | 5.86 | -13.76 | - | - | - | - | - | - | - |
| Uttarakhand | 53,483 | 24,442 | 45.7 | 25.1 | 13,424 | 13,424 | 32,220 | 13,420 | 1,100 | 2,640 | 260 |
| West Bengal | 88,752 | 12,413 | 13.99 | -6.61 | - | - | - | - | - | - | - |
| Andaman and Nicobar | 8,249 | 6,629 | 80.36 | 59.76 | 4,930 | 4,930 | 11,830 | 4,930 | 2,592 | 6,220 | 620 |
| Chandigarh | 114 | 15 | 13.16 | -7.44 | - | - | - | - | - | - | - |
| Dadra and Nagar Haveli | 491 | 221 | 45.01 | 24.41 | 120 | 120 | 290 | 120 | 120 | 290 | 120 |
| Daman and Diu | 112 | 8 | 7.14 | -13.46 | - | - | - | - | - | - | - |
| Lakshadweep | 32 | 25 | 78.13 | 57.53 | 18 | 18 | 40 | 20 | 18 | 40 | 20 |
| Puducherry | 480 | 42 | 8.75 | -11.85 | - | - | - | - | - | - | - |
| Total | 3,287,263 | 677,088 | - | - | 212,683 | 212,683 | 510,450 | 212,660 | 112,456 | 330,410 | 116,950 |

Table 4. Incentive for excess dense forest cover – statewise (options 1 and 2) (Area in sq. km) (Rs in million)

| State/UT | Geographic area (sq. km) | Total DFC | % DFC SGA | % DFC-NA (11.78%) | DFC (excess) eligible for incentive | | Management including maintenance @ Rs 10,000/ha | % DFC-NA (11.78%) and 23.56% for hills | DFC (excess) eligible for incentive under option-2 | 8% NPV (Rs 0.3 million/ha) | Management including maintenance @ Rs 10,000/ha |
|------------------------|--------------------------|-----------|-----------|-------------------|-------------------------------------|----------------|---|--|--|----------------------------|---|
| | | | | | under option-1 | under option-2 | | | | | |
| Andhra Pradesh | 275,069 | 24,329 | 8.85 | -2.93 | 0 | 0 | 0 | -2.93 | 0 | 0 | 0 |
| Arunachal Pradesh | 83,743 | 52,388 | 62.56 | 50.78 | 42,525 | 102,060 | 42,520 | 39.00 | 20,431 | 49,030 | 20,430 |
| Assam | 78,438 | 12,831 | 16.36 | 4.58 | 3,592 | 8,620 | 3,590 | 4.58 | 3,592 | 8,620 | 3,590 |
| Bihar | 94,163 | 3,114 | 3.31 | -8.47 | 0 | 0 | 0 | -8.47 | 0 | 0 | 0 |
| Chhattisgarh | 135,191 | 38,728 | 28.65 | 16.87 | 22,807 | 54,740 | 22,800 | 16.87 | 22,807 | 54,740 | 22,800 |
| Delhi | 1,483 | 54 | 3.64 | -8.14 | 0 | 0 | 0 | -8.14 | 0 | 0 | 0 |
| Goa | 3,702 | 1,150 | 31.06 | 19.28 | 714 | 1,710 | 710 | 19.28 | 714 | 1,710 | 710 |
| Gujarat | 196,022 | 6,138 | 8.31 | -3.47 | 0 | 0 | 0 | -3.47 | 0 | 0 | 0 |
| Haryana | 44,212 | 526 | 1.19 | -10.59 | 0 | 0 | 0 | -10.59 | 0 | 0 | 0 |
| Himachal Pradesh | 55,673 | 8,928 | 16.03 | 4.25 | 2,409 | 5,780 | 2,400 | -7.53 | 0 | 0 | 0 |
| Jammu and Kashmir | 222,236 | 10,529 | 4.74 | -7.04 | 0 | 0 | 0 | -7.04 | 0 | 0 | 0 |
| Jharkhand | 79,714 | 11,622 | 14.58 | 2.8 | 2,232 | 5,360 | 2,230 | -8.98 | 0 | 0 | 0 |
| Karnataka | 191,791 | 22,098 | 11.52 | -0.26 | 0 | 0 | 0 | -0.26 | 0 | 0 | 0 |
| Kerala | 38,863 | 9,660 | 24.86 | 13.08 | 5,083 | 12,200 | 5,080 | 13.08 | 5,083 | 12,200 | 5,080 |
| Madhya Pradesh | 308,245 | 41,082 | 13.33 | 1.55 | 4,778 | 11,470 | 4,770 | 1.55 | 4,778 | 11,470 | 4,770 |
| Maharashtra | 307,713 | 28,384 | 9.22 | -2.56 | 0 | 0 | 0 | -2.56 | 0 | 0 | 0 |
| Manipur | 22,327 | 6,464 | 28.95 | 17.17 | 3,834 | 9,200 | 3,830 | 4.39 | 284 | 680 | 280 |
| Meghalaya | 22,429 | 7,146 | 31.86 | 20.08 | 4,504 | 10,810 | 4,500 | 8.30 | 593 | 1,420 | 590 |
| Mizoram | 21,081 | 6,306 | 29.91 | 18.13 | 3,822 | 9,170 | 3,820 | 6.35 | 400 | 960 | 400 |
| Nagaland | 16,579 | 5,838 | 35.21 | 23.43 | 3,885 | 9,320 | 3,880 | 11.65 | 680 | 1,630 | 680 |
| Orissa | 155,707 | 28,194 | 18.1 | 6.32 | 9,841 | 23,620 | 9,840 | 6.32 | 9,841 | 23,620 | 9,840 |
| Punjab | 50,362 | 723 | 1.44 | -10.34 | 0 | 0 | 0 | -10.34 | 0 | 0 | 0 |
| Rajasthan | 342,239 | 4,470 | 1.31 | -10.47 | 0 | 0 | 0 | -10.47 | 0 | 0 | 0 |
| Sikkim | 7,096 | 2,410 | 33.96 | 22.18 | 1,574 | 3,780 | 1,570 | 22.18 | 1,574 | 3,780 | 1,570 |
| Tamil Nadu | 130,058 | 12,440 | 9.56 | -2.22 | 0 | 0 | 0 | -2.22 | 0 | 0 | 0 |
| Tripura | 10,486 | 5,030 | 47.97 | 36.19 | 3,795 | 9,110 | 3,790 | 24.41 | 1,228 | 2,950 | 1,230 |
| Uttar Pradesh | 240,928 | 5,979 | 2.48 | -9.3 | 0 | 0 | 0 | -9.3 | 0 | 0 | 0 |
| Uttarakhand | 53,483 | 18,398 | 34.4 | 22.62 | 12,098 | 29,040 | 12,090 | 10.84 | 1,840 | 4,420 | 1,840 |
| West Bengal | 88,752 | 6,079 | 6.85 | -4.93 | 0 | 0 | 0 | -4.93 | 0 | 0 | 0 |
| Andaman and Nicobar | 8,249 | 6,005 | 72.8 | 61.02 | 5,034 | 12,080 | 5,030 | 61.02 | 5,034 | 12,080 | 5,030 |
| Chandigarh | 114 | 9 | 7.9 | -3.88 | 0 | 0 | 0 | -3.88 | 0 | 0 | 0 |
| Dadra and Nagar Haveli | 491 | 130 | 26.48 | 14.7 | 72 | 170 | 70 | 14.7 | 72 | 170 | 70 |
| Daman and Diu | 112 | 2 | 1.79 | -9.99 | 0 | 0 | 0 | -9.99 | 0 | 0 | 0 |
| Lakshadweep | 32 | 15 | 53.13 | 41.35 | 13 | 30 | 10 | 41.35 | 13 | 30 | 10 |
| Puducherry | 480 | 17 | 3.54 | -8.24 | 0 | 0 | 0 | -8.24 | 0 | 0 | 0 |
| Total | 3,287,263 | 387,216 | - | - | 132,612 | 318,270 | 132,550 | - | 78,964 | 189,510 | 78,960 |

Table 5. Incentive for excess tree, forest and mangrove (TCFCM) cover statewise

| State/UT | Geographic area (sq. km) | TC + FC + Management | % TCFCM SGA | TCFCM (23.52%) – TCFCM % | TCFCM (excess) eligible for incentive | Deficit TCFCM to be afforded | 8% NPV (Rs 0.3 million/ha) | Management including maintenance @ Rs 10,000/ha |
|------------------------|--------------------------|----------------------|-------------|--------------------------|---------------------------------------|------------------------------|----------------------------|---|
| Andhra Pradesh | 275,069 | 52,341 | 19.03 | -4.42 | 0 | 12,158 | 0 | 0 |
| Arunachal Pradesh | 83,743 | 68,223 | 81.47 | 57.95 | 48,529 | 0 | 11,647 | 4,852 |
| Assam | 78,438 | 29,129 | 37.14 | 13.62 | 10,683 | 0 | 2,564 | 1,068 |
| Bihar | 94,163 | 8,101 | 8.6 | -14.92 | 0 | 14,049 | - | - |
| Chhattisgarh | 135,191 | 60,355 | 44.64 | 21.12 | 28,552 | 0 | 6,852 | 2,855 |
| Delhi | 1,483 | 283 | 19.08 | -4.44 | 0 | 66 | 0 | 0 |
| Goa | 3,702 | 2,448 | 66.12 | 42.6 | 1,577 | 0 | 378 | 157 |
| Gujarat | 196,022 | 23,272 | 11.87 | -11.65 | 0 | 22,837 | 0 | 0 |
| Haryana | 44,212 | 3,152 | 7.13 | -16.39 | 0 | 7,246 | 0 | 0 |
| Himachal Pradesh | 55,673 | 15,078 | 27.08 | 3.56 | 1,982 | 0 | 476 | 198 |
| Jammu and Kashmir | 222,236 | 26,906 | 12.11 | -11.41 | 0 | 25,357 | 0 | 0 |
| Jharkhand | 79,714 | 25,671 | 32.2 | 8.68 | 6,919 | 0 | 1,661 | 691 |
| Karnataka | 191,791 | 40,721 | 21.23 | -2.29 | 0 | 4,392 | 0 | 0 |
| Kerala | 38,863 | 18,235 | 46.92 | 26.4 | 10,260 | 0 | 2,462 | 1,026 |
| Madhya Pradesh | 308,245 | 82,280 | 26.69 | 3.17 | 9,771 | 0 | 2,345 | 977 |
| Maharashtra | 307,713 | 56,612 | 18.4 | -5.12 | 0 | 15,755 | 0 | 0 |
| Manipur | 22,327 | 17,228 | 77.16 | 53.64 | 11,976 | 0 | 2,874 | 1,197 |
| Meghalaya | 22,429 | 17,393 | 77.55 | 54.03 | 12,118 | 0 | 2,908 | 1,211 |
| Mizoram | 21,081 | 18,806 | 89.2 | 65.68 | 13,845 | 0 | 3,323 | 1,384 |
| Nagaland | 16,579 | 13,957 | 84.18 | 60.66 | 10,057 | 0 | 2,414 | 1,005 |
| Orissa | 155,707 | 53,166 | 34.14 | 10.62 | 16,536 | 0 | 3,969 | 1,653 |
| Punjab | 50,362 | 3,381 | 6.71 | -16.81 | 0 | 8,466 | 0 | 0 |
| Rajasthan | 342,239 | 24,229 | 7.08 | -16.44 | 0 | 56,264 | 0 | 0 |
| Sikkim | 7,096 | 3,289 | 46.35 | 22.83 | 1,620 | 0 | 389 | 162 |
| Tamil Nadu | 130,058 | 28,700 | 22.07 | -1.45 | 0 | 1,886 | 0 | 0 |
| Tripura | 10,486 | 8,289 | 79.04 | 55.52 | 5,822 | 0 | 1,397 | 582 |
| Uttar Pradesh | 240,928 | 22,330 | 9.27 | -14.25 | 0 | 34,332 | 0 | 0 |
| Uttarakhand | 53,483 | 25,100 | 46.93 | 23.41 | 12,520 | 0 | 3,005 | 1,252 |
| West Bengal | 88,752 | 16,800 | 18.93 | -4.59 | 0 | 4,074 | 0 | 0 |
| Andaman and Nicobar | 8,249 | 7,319 | 88.72 | 65.2 | 5,378 | 0 | 1,291 | 537 |
| Chandigarh | 114 | 24 | 21.05 | -2.47 | 0 | 3 | 0 | 0 |
| Dadra and Nagar Haveli | 491 | 249 | 50.71 | 27.19 | 104 | 0 | 25 | 10 |
| Daman and Diu | 112 | 18 | 16.07 | -7.45 | 0 | 8 | 0 | 0 |
| Lakshadweep | 32 | 29 | 90.62 | 67.1 | 21 | 0 | 5 | 2 |
| Puducherry | 480 | 85 | 17.71 | -5.81 | 0 | 28 | 0 | 0 |
| Total | 3,287,263 | 773,196 | | | 208,270 | 206,921 | 49,985 | 20,819 |

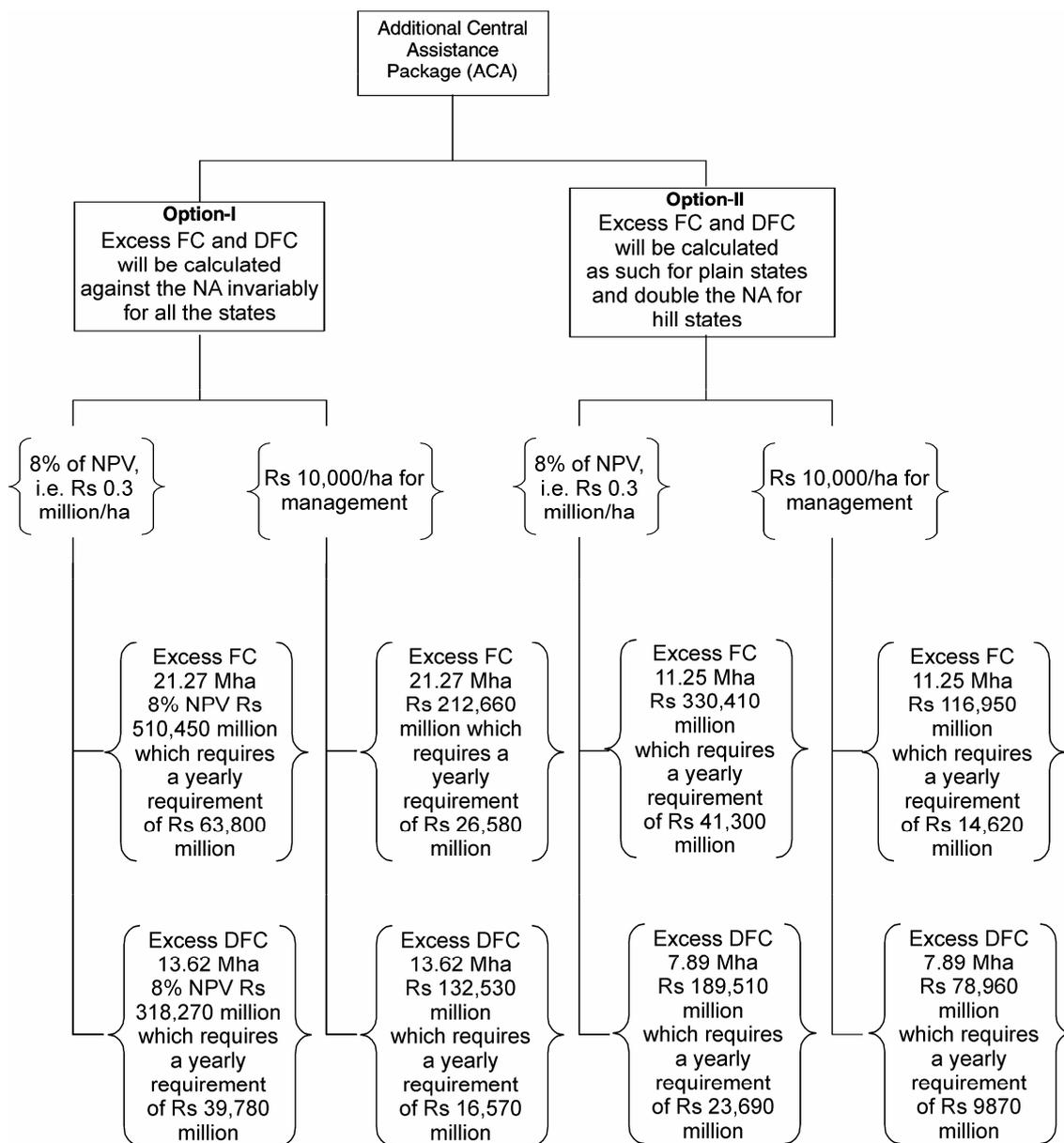


Figure 2. Additional central assistance package and options recommended.

afforestation, monies at Rs 10,000/ha for management including maintenance has also been worked out. Rs 510,440 million as interest on NPV and Rs 212,660 million for management including maintenance shall be required for providing incentive for excess FC. Rs 318,270 million and Rs 132,530 million are required respectively if DFC alone, i.e. 13.6 Mha is considered. Based on the incentive calculated for management of FC and DFC, Rs 26,580 million per year for FC and Rs 16,580 million for DFC will be required (Figure 2).

It is generally accepted that hilly states need to hold 60% FC to control soil erosion, landslide, etc. As a second option therefore, incentive for management alone was calculated by subtracting double the NA of FC and DFC held by hill states. Requirement of Rs 116,950

million for FC and Rs 78,960 million for DFC was thus arrived at. The yearly incentive package therefore works out to Rs 14,620 million for FC and Rs 9760 million for DFC (Table 4).

A sum of Rs 499,850 crore and 208,190 million respectively is required for increasing TCFM cover by 20.69 Mha and Rs 526,060 million is estimated for afforestation and maintenance for a period of four years to afforest 21.04 Mha to equalize the FC to GA of country, held by the states.

In order to achieve the targeted 30% FC, it is suggested that the same percentage of FC of the GA of the country held by the states should be brought under FC to begin with or all states achieve the NA. A total area of 21.8 Mha shall thus become available to be brought under

Table 6. Statewise forest cover target for afforestation and waste land availability

(area in sq. km)

| State/UT | Geographic area (sq. km) | Total FC | FC as % GA of state | Area to be afforested | To be afforested/ per year | Total WL | To be increased by the concerned states | Area lacking |
|------------------------|--------------------------|----------|---------------------|-----------------------|----------------------------|----------|---|--------------|
| Andhra Pradesh | 275,069 | 44,372 | 16.13 | 12,296 | 1,537 | 45,267 | 4,331 | |
| Arunachal Pradesh (H) | 83,743 | 67,777 | 80.93 | – | – | 18,176 | – | |
| Assam | 78,438 | 27,645 | 35.24 | – | – | 14,034 | – | |
| Bihar | 94,163 | 5,579 | 5.92 | 13,823 | 1,728 | 5,448 | 11,264 | –5,816 |
| Chhattisgarh | 135,191 | 55,863 | 41.32 | – | – | 7,584 | – | |
| Delhi | 1,483 | 176 | 11.87 | 129 | 16 | – | 56 | |
| Goa | 3,702 | 2,164 | 58.45 | – | – | 531 | – | |
| Gujarat | 196,022 | 14,715 | 7.51 | 25,659 | 3,207 | 20,378 | 17,082 | |
| Haryana | 44,212 | 1,587 | 3.59 | 7,520 | 940 | 3,266 | 5,989 | –2,723 |
| Himachal Pradesh (H) | 55,673 | 14,369 | 25.81 | – | – | 28,337 | – | |
| Jammu and Kashmir (H) | 222,236 | 21,273 | 9.57 | 24,513 | 3,064 | 70,202 | 18,865 | |
| Jharkhand (H) | 79,714 | 22,591 | 28.34 | – | – | 11,165 | – | |
| Karnataka | 191,791 | 35,251 | 18.38 | 4,258 | 532 | 13,537 | – | |
| Kerala | 38,863 | 15,595 | 40.13 | – | – | 1,789 | – | |
| Madhya Pradesh | 308,245 | 76,013 | 24.66 | – | – | 57,134 | – | |
| Maharashtra | 307,713 | 47,476 | 15.43 | 15,909 | 1,989 | 49,275 | 6,763 | |
| Manipur (H) | 22,327 | 17,086 | 76.53 | – | – | 13,175 | – | |
| Meghalaya (H) | 22,429 | 16,988 | 75.74 | – | – | 3,411 | – | |
| Mizoram (H) | 21,081 | 18,684 | 88.63 | – | – | 4,470 | – | |
| Nagaland (H) | 16,579 | 13,719 | 82.75 | – | – | 3,709 | – | |
| Orissa | 155,707 | 48,374 | 31.07 | – | – | 18,953 | – | |
| Punjab | 50,362 | 1,558 | 3.09 | 8,818 | 1,102 | 1,173 | 6,978 | –5,805 |
| Rajasthan | 342,239 | 15,850 | 4.63 | 54,656 | 6,832 | 101,454 | 46,256 | |
| Sikkim (H) | 7,096 | 3,262 | 45.97 | – | – | 3,808 | – | |
| Tamil Nadu | 130,058 | 23,044 | 17.72 | 3,746 | 468 | 17,303 | – | |
| Tripura (H) | 10,486 | 8,155 | 77.77 | – | – | 1,323 | – | |
| Uttar Pradesh | 240,928 | 14,127 | 5.86 | 33,152 | 4,144 | 16,984 | 27,301 | –10,317 |
| Uttarakhand (H) | 53,483 | 24,442 | 45.7 | – | – | 16,097 | – | |
| West Bengal | 88,752 | 12,413 | 13.99 | 5,867 | 734 | 4,398 | 1,481 | |
| Andaman and Nicobar | 8,249 | 6,629 | 80.36 | – | – | 314 | – | |
| Chandigarh | 114 | 15 | 13.16 | 8 | 1 | – | – | |
| Dadra and Nagar Haveli | 491 | 221 | 45.01 | – | – | – | – | |
| Daman and Diu | 112 | 8 | 7.14 | 15 | 2 | – | – | |
| Lakshadweep | 32 | 25 | 78.13 | – | – | – | – | |
| Puducherry | 480 | 42 | 8.75 | 57 | 7 | – | – | |
| Total | 3,287,263 | 677,088 | – | 210,426 | 26,303 | 552,692 | 145,026 | –24,661 |

H, Hill states.

FC in the first instance and 21.04 Mha in the second. If TCFCM is taken into account, then the required area shall be 20.69 Mha (Table 5). In order to achieve the 33% target (30% FC and 3% tree cover) by 2017, the area of land that needs to be brought under FC by every state and the area of land that has to be afforested every year for the eleventh and twelfth plans (next 8 years) are shown in Table 5.

The country has 55.27 Mha of waste land of which the largest tract is in Rajasthan with 10.14 Mha (Table 6). As per NRSA studies, waste land category 4, 5, 13 and 15 account for 10.14% of the total GA of the country which can be afforested, i.e. 33.4 Mha. The wasteland (cat. 4, 5, 13, 14 and 15 as per WALIS) available in the states for TCFCM cover far exceeds the land required of 20.69 Mha (Table 5). However the states of Uttar Pradesh, Punjab, Bihar and Haryana combined have a deficit of 24,661 sq. km or 2.4 Mha.

In order to achieve the 30% target of FC an additional sum of Rs 65,760 million every year over a period of 8 years (2009–17) will be required. According to the outlays for Eleventh Plan for wasteland development over Rs 170,000 million is earmarked for this purpose.

The central assistance being provided for afforestation currently by all departments of GOI is of the order of Rs 19,800 million and the percentage expenditure incurred by states on forests and wildlife, including plantation, wherever relevant during the Tenth Plan is Rs 81,713 million which is 1.38% of the state budget. Expenditure on forestry needs to be increased at least to 4% of the state budget.

An additional central assistance (ACA) package for FC either based on 8% interest on NPV or on the management cost of Rs 10,000/ha can be considered. This works out to over Rs 510,450 million and 212,660 million for management of FC, to be released over a period of

8 years, i.e. Rs 63,800 million/year for NPV and Rs 26,580 million for management. As regards the second option, Rs 330,410 million and Rs 116,950 million respectively shall be required for 8% NPV and management with yearly expenditure of Rs 41,300 million and 14,260 million.

The ACA package for DFC, of 8% of NPV or the management cost at Rs 10,000/ha of the excess DFC works out to Rs 318,270 million and 132,530 million and if released over a period of 8 years, than Rs 39,780 million and Rs 16,570 million every year. As regards the second option, it works out to Rs 189,510 million and Rs 78,960 million for 8% NPV and management and Rs 23,690 million and 98,700 million yearly.

Considering that the Rs 26,580 million for excess FC management required for the first option, every year may not be readily available, the planning commission may consider an ACA package of Rs 9870 million for management of DFC under the second option. Figure 2 indicates the various ACA packages discussed and highlights the options recommended.

Among the options discussed to enable providing support to the states, the suggestion to consider excess DFC above NA and providing Rs 10,000/ha as management charges is recommended. The suggestion could form the basis for the ACA of the states, to enable them to protect the state's FC.

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