

A REVIEW OF EFFORTS DIRECTED TOWARDS AN INCLUSIVE AND EQUITABLE GREEN GRANT

Working Paper 1

Abstract

The present study is aimed at presenting an overview of the collection of efforts directed towards the formulation of a green grant. The green grant has hitherto addressed only a part of the larger ecosystem that needs to be conserved. Summarizing the existing work in the area, the paper goes on to address the limitations of the existing work in context of the updates to the discourse on climate change. Every new initiative benefits significantly from the initiatives and work which precedes it. To the same tune, this working paper tries to lay a foundation for optimizing public investments for climate action via the Finance Commissions. The paper sets a precedent by acknowledging the colonial roots of modern forest policies followed by the treatment of environment across Finance Commissions. Seminal studies submitted to the Commissions with varied formulaic propositions are critiqued.

11th August 2021

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Introduction

Beginning with the Eleventh Finance Commission, the sustainability discourse has been gaining importance in the fiscal-federal framework in the country. From a modest mention, heralding the consideration of environment and natural resource constraints to human livelihoods, the framework stands at 10% untied grants as of the Fifteenth Finance Commission. The singular aim has been to conserve the rich biodiversity inhabited in the subcontinent and attaining a 33% forest cover, nationally, as envisaged in the India Forest Act, 1927. With each Finance Commission, new ideas have been brought forth and debated. While their final inclusion in the disbursement process is of consequence, the progress in discourse towards a measure which rewards and compensates conservative efforts forms the ethos of this paper.

A crucial step towards ecologically conscientious fiscal frameworks, green grants are a steppingstone. That among the varied ecosystems in nature, one is picked is the first caveat. Terrestrial ecosystems are one of the many which supplement quality life on earth and in the country. That within the 'green', the grant is focused on dense canopy forests- ignoring the other 'greens' such as the grasslands and meadows- forms the second caveat. However, it is pertinent to acknowledge, analyse and applaud the increment in the thought so far. For this reason, the critique begins with a discussion centred around forests and endeavours to present the varied prospects for a holistic standpoint- fiscally and thoughtfully.

Path Dependency of Forest Governance in India:

The institutions established during colonial India continue to direct administration in independent India in modest and bold ways. The extant forest laws and institutions are no exception and a brief overview of this history is therefore critical. These institutions create the first division among the 'greens' based on a short run revenue maximisation mindset, common amongst all colonisers- foreign and native. The native (used only as a contrast) allude to the agri-pastorals which had long begun the conversion of forests to cultivable lands, taking away from the hunter-gatherer communities.

Pre-colonial history of forests and land use depicts changes in relationships among cultivators and hunter-gatherers. The broad theme of the time is centred around forests and land as a source of livelihood, often communal at that. This sense of community and having duties tied to resources mandated sustainable usage of resources which, however, may not be an absolute truth of the time. As Guha and Gadgil voice- the colonial period was a watershed in India's ecological history.

The British brought with them the ideals of western industrialization which championed private property and flourished on resource-extraction. The same seeds were sown in their newest colony to birth generations of environmental degradation. The theme changed from subsistence to extraction for State interests. A shortage of timber led to exploitation of a wide variety of wood in

Indian forests. The extractive process, eventually, illuminated the finitude of resources motivating the creation of a 'forest department' to ensure a perennial supply. The annexationist attitude towards forests was garbed under the need for 'conservation' and formally formulated in the Baden-Powell Act of 1878. The Act is in a way the basis for extant division of forests based on descending order of State Control into- reserved, protected and village forests. Subsequent Acts revised and strengthened State Control over forest resources, excluding the forest-reliant populace from deriving their subsistence. This monopoly simply exchanged hands at the dawn of Indian independence, transferred to the Indian State which retained and upheld the colonial extractive approach in its first National Forest Policy of 1952. Later, when the insatiable industrial demand re-highlighted limitations of resource supply, a similar 'conservation' approach regained attention well until 1980.

The Forest Conservation Act of 1980 restricted the unregulated deforestation and mandated Central approval for diversion of forests for developmental purposes. In the National Forest Policy of 1988, a more distinct shift in attitude, from conservation for 'national needs' to 'environmental stability' is observed. Moreover, there was emphasis laid on the subsistence needs of forest-reliant communities. Later, Joint Forest Management was proposed as a decentralized measure to conserve degraded common pool resources by fostering coordination among local and State communities.

The change in perspective is slow and many institutions remain imbued with a colonial perspective like the Forest Development Corporations (FDC). An institutional analysis conducted by Bhatkande et al brought to fore the inherent inefficiencies of FDC to promote agro-forestry. The extractive narrative defines forest development in terms of the revenue it can generate- showing a blatant disregard for the multitude of ecosystem benefits accruing from forests. Moreover, the perpetuation of Central control is emboldened in the land leasing arrangement by the FDC which facilitated the creation of its natural monopoly over timber.

Devolution of grants and State performance across Finance Commissions:

The fiscal federal institutionalisation of conservation efforts begins with the 11th Finance Commission. Every commission thereafter with its mandate for forests will be scrutinised to judge the impact and performance of States. One will be able to observe the changes, formulaic and worded, in the devolution frameworks up to the 15th Finance Commission. The changes in quantum of devolution, sanctions, and final utilisation (or not) of funds for conservation are important parameters for analysis.

The 14th Finance Commission commissioned a seminal study by Madhu Verma which augmented the formulaic calculations, incorporating the forests as an ecosystem. This augmentation is central to the vision of the present study- the embodiment of an ecosystem as opposed to its attributes.

Therefore, emphasis will be laid on the report and its propositions while scrutinising the final fiscal efforts.

The Finance Commission is an institution devised under Articles 275 and 280 of the Indian Constitution to in a way govern the fiscal-federal framework. Federalism is embedded within the division of governance into three levels- Centre, State and Local Governments; the prefix of fiscal specifies a budgetary arrangement between the national and sub-national governments. The Finance Commission, therefore, facilitates the inter-governmental transfer arrangements, given the existing assignment of revenue handles at each level.

This assignment of revenue handles birthed the first of the two fiscal imbalances the Finance Commission is institutionalized to resolve- vertical imbalance. The revenue streams flowing into the Centre's budget exceed its expenditure while the opposite is true at the State level. In a positional sense, this represents the vertical imbalance wherein there exists a disproportionate allocation of resources. The other imbalance is horizontal or *among* States. Given the diversity in India, each State's revenue generating, and infrastructure provisioning capacity is subject to its populace, culture, and geography to name a few factors.

Each Finance Commission is presented with a 'Terms of Reference' or ToR which detail the purview of said commission. India has had 15 Finance Commissions preside over its fiscal arrangements till now. The devolution of funds has been largely dependent on the following criteria: population, area, income distance, infrastructure, tax effort and fiscal discipline. Each of these is assigned different weights in the devolution formula, based on the underlying principles of equity and efficiency. As mentioned earlier, the Commissions devise not just sharing arrangements but also allow for and promote grants. While numerous centrally sponsored schemes exist, targeted towards different aspects of the environment for different states, no centralised fund has existed solely for the purpose of conservation. The lack of such a fund also owes itself to the domestic recognition of the need to conserve forests for their ecological benefits, as documented in the section above.

The existence of such a federal fund flow or criterion for devolution is of paramount importance to facilitate and support States in their conservation activities. A key motivation for centralised monetary support is that the country commits to global obligations. However, the fulfilment of pacts and agreements mandates coordination at the decentralized level of governance which are often devoid of any incentives to do so. A classic case of externalities wherein worsening environment has global impact is further exacerbated by the lack of consolidated political will to address it. Studies have found that sub-national governments are likely to spend less on natural resources should they command a large geographical area. This owes itself to an inherent opportunity cost of using the same land for developmental purposes, which is a priority across governments. Similarly, activities which reduced the negative externalities for residents of another State dissuade the origin State to curb its activities. Ecological conservation has wide spill-over

effects spatially which need not be internalised at individual state-level unless the resource itself is central to the incumbent's economy. (Kumar and Managi 2009) This underscores the need for the Finance Commission to dedicate a quantum specifically for conservation.

Forests are the natural resource accounted for in the Finance Commission as a substitute for the larger environment. The resource is discussed under the Own Non-Tax Revenue section of the States' budget assessments in the Finance Commission reports. Up until the Eleventh Finance Commission, the revenue from the forests was assumed to be low and consistently so given the colonial treatment of forests as an economic good. Missing the forest for the trees, the laws were based on either the preservation or consumption of the trees. By appealing to preserve limits the viewing of forests as a positive resource. Preservation underscores the States' claim to fiscal disability as induced by forests. Viewing forests as a positive economic resource contributing to human welfare in a measurable way and generating positive externalities is a missing perspective which is central to incentivizing conservation. Varied methodologies of ecosystem valuation have now made it possible to map various ecosystem services in a spatially explicit way. Linking inter-governmental transfers to ecosystem services provision will internalise the positive externalities that these ecosystems generate. This will create economic contracts for the conservation of ecosystems. A glance through the state forest reports for a couple of years preceding the introduction of the 12th Finance Commission illuminates a decline in total forest cover thus reinforcing the need to economize the legislations to conserve.

States well-endowed with forests faced fiscal disability or the inability to generate revenues using their natural resources owing to maintenance of national forestry targets. The Eleventh Finance Commission acknowledged this disability and the need for preservation, prescribing the creation of scientific working plans for management of forests to strike a balance between the two. While some States readily produced and received approval for their working plans, many flagged the financial constraints in fulfilment of the devised endeavours. This formed the reason for the Twelfth Finance Commission grant of 1000 crore rupees, devolved based on the total forest acreage in every State, over and above their respective expenditure on maintenance of forests.

As a result, well-endowed States with greater forest area, like- Madhya Pradesh, Chhattisgarh, and Arunachal Pradesh- received higher shares of the total grant. This mechanism disregarded the natural endowment of every State, penalizing the ones with less forested area owing to natural forces.

Despite this caveat, the measure was an important first in terms of actively addressing the monetary needs in maintenance of forests. The grant was directly tied to said maintenance of forests, specifically designated for it. The commission expected an additional and increased expenditure on forests equivalent to the grant received by every State. This implied guaranteed compensation for forest departments for their activities.

The 13th Finance Commission dedicated five times the sum of the preceding Finance Commission, 5000 crores for the preservation and maintenance of forests. Of the total grants-in-aid to States, preservation of forests cornered 1.5%. A key highlight of the green endeavour in that report was a formulaic devolution of funds. The formula, as presented under, rewarded- in addition to the previous forest acreage in each State- the quality of forests: very dense and moderately dense, and the effort of having conserved more than the national average of forests.

The Commission prefaced this formula with the disclaimer and acknowledgement that forest ecosystems have many beneficial attributes, beyond their density and the biodiversity they inhabit. An ideal formula would significantly benefit from the presence of unique data for said ecosystem for every State, instead of the quality data as reported under Forest Survey of India and State Forest Report. Flagging the standardization issue associated with better variables in both the surveys, the Commission resorted to using the quality and density paradigm given its elaborate measurement under forest cover.

Unlike the 12th Finance Commission grant, this grant was not entirely tied to maintenance of forests. To balance the fiscal disability of States and the need for conservation, this Finance Commission proposed a mixed approach- a tied grant for the first two years to facilitate creation of working plans by increasing State capacity and untied for the last three, with a 25% reservation for expenditure on forests alone. The full devolution of calibrated grants was conditional upon the approval of at least 80% of the scientific working plans prepared by the States. With a time horizon of a decade, the emphasis on working plans was laid considering the inevitable forces of climate change and to monitor upkeep of forests.

The issues flagged with respect to 12th Finance Commission were retained with the subsequent formulation. The denominator to assess proportion of forest acreage continued to be the States' geographical area, penalizing their physiographic zones. Apart from the limitation mentioned by the Commission itself, the incentive for conservation is too small to generate desirable results.

The 13th Finance Commission devolution of funds may be viewed as a transition from a conditional transfer framework to an unconditional transfer framework. The following Finance Commissions, 14th and 15th did not provide a grants-in-aid for forests and neither did the devolved funds mandate targeted action. The 14th Finance Commission observed 'the need to balance management of ecology, environment and climate change consistent with sustainable economic development' as a ToR, for the first time. This reflected the clarion call for sustainable development and national recognition of the monetary needs for ecological preservation.

With this inclusion, a concept or framework titled 'Ecological Fiscal Transfers' assumes prominence. Prior to the 14th Finance Commission, ecology or forests were addressed and made room for, additionally. The Finance Commissions did not include forests as a criterion for devolution of funds- it was not one among those which determined the States' share in Central taxes. Beginning with a 7.5% weightage in 14th Finance Commission and a 10% weightage with

15th Finance Commission is an EFT- the States' share of funds now includes an ecological component. The need and rewards for conservation have been internalized so far as the limited treatment of forests and ecology is concerned.

A study conducted by Busch et al. enumerates the impact of EFTs pre- and post the 14th Finance Commission devolution. While the forestry budgets saw a 19% absolute increase across states (25 out of 29, at the time), the budgets recorded a 16% decline when compared against the overall increase in devolution shares. The paper highlights another key facet which is the unavailability of cogent state-level forestry budget data. Reasons cited for the lackadaisical approach among states is their lack of confidence in continuation of EFTs and its solemn weightage in the criteria. (Busch, Kapur and Mukherji 2020)

Lastly, as a perennial thought underscoring all Finance Commissions has been equating ecology with forests. The 13th Finance Commission referred to forests as the first line of defence and hence the emphasis laid on the ecosystem. In fact, like the report mentions, the calibration could not cover the entirety of forests alone as an ecosystem, either. However, an important takeaway is that ecology extends beyond just forests.

Critique of Madhu Verma Report:

The High Conservation Value Forests report is an important step in the conceptualization of an equitable green grant. Previous Finance Commission reports and studies have single-mindedly focused on forest cover- starting with forest acreage culminating in an inclusion of moderately and very dense forests as part of forest cover. These measures, as they still thrive in formulaic devolutions, are adorned with an ease in calculation with the inherent trade-off of being exclusionary in nature. To focus merely on canopy cover is a folly for this jeopardizes the unique biogeographic and climatic composition of every State. A Rajasthan then, receives less funding as opposed to an Arunachal Pradesh, the difference attributed solely to natural factors and land area.

With this backdrop, the report attempts and proposes an inclusive measure which views forests as the ecosystem they are- a habitat of biodiversity which enriches its overall conservation value. This effort addresses the complexities in defining a forest and the measurement of its different contributions across States. Drawing upon the High Conservation Value toolkit published by Forest Stewardship Council, UK, the report enlists numerous criteria crucial in determining the HCV of forests across the country. They divide these criteria into three broad titles- Natural Endowment, Action Factors and Cross-cutting factors as depicted below:

| Factor | Indicators | Code |
|--------|---|--------|
| E | Proportion of geographical area under recorded forests | FAGA |
| | Canopy Density of Forest Areas | FCD |
| | Area under High Altitude Forests (Altitude >= 2000mtr) | HAF |
| | Number of endemic floral species | EMICFL |
| | Number of endemic faunal species | EMICFA |
| | Area under wetlands inside forests | WET |
| A | Proportion of recorded forest areas designated as protected areas | PARF |
| | Proportion of recorded forest areas which are natural forests | NFRF |
| | Diversion of recorded forest area between 1980-2012 | DIV |
| | Average patch size of forests | PATCH |
| C | Growing stock (in forests) per unit area | GS |
| | Intensity of regeneration | REG |
| | Area under wildlife corridor | CORR |

Scenario 1 All indicators of HCVF carry equal weights

$$HCVF_i = \sum_{i=1}^3 EF_i + \sum_{i=1}^4 AF_i + \sum_{i=1}^3 CF_i$$

Scenario 2 Indicators with differential weights i.e. Action Factors (0.5), Cross-cutting Factors (0.3) and Natural Endowment Factors (0.2)

$$HCVF_i = \left(0.2 \sum_{i=1}^3 EF_i\right) + \left(0.5 \sum_{i=1}^4 AF_i\right) + \left(0.3 \sum_{i=1}^3 CF_i\right)$$

EF_i Natural endowment factor indicators of state i
 AF_i Action factor indicators of state i
 CF_i Cross-cutting factor indicators of state i

Suggested formula for the XIV Finance Commission by incorporating the HCVF Index Score

$$G_i = \frac{\left(\left\{\frac{F_i}{\sum F_i} + R_i\right\} \times \left\{1 + \frac{M_i + 2H_i}{C_i}\right\}\right) + \frac{HCVF_i}{\sum HCVF_i}}{\sum_{i=1}^n \left(\left\{\frac{F_i}{\sum F_i} + R_i\right\} \times \left\{1 + \frac{M_i + 2H_i}{C_i}\right\}\right) + \frac{HCVF_i}{\sum HCVF_i}}$$

G_i Share for state i

A_i Geographical area of state i

F_i Total recorded forest area of state i

M_i Moderately dense forest area of state i

H_i Highly dense forest area of state i

$R_i = \max\left[0, \left\{\frac{F_i}{A_i} - \frac{\sum F_i}{\sum A_i}\right\} / 10\right]$

C_i Forest cover of state i

$HCVF_i$ High conservation value forest index of state i

n Number of States i.e. 28

Figure 1 The HCVF formula as proposed in the Madhu Verma Report.

The proposed addition of HCV Index in the 14th Finance Commission formula captured some of the inherent differences across States owing to their biogeographic placement and the biodiversity spawned therein. A comparison of funds devolved under the new formula as opposed to the old 13th Finance Commission formula, recalibrated the devolution for Arunachal Pradesh, resulting in a predicted decrease by ~47%. Likewise, the funds for Rajasthan were predicted to increase by ~40%. To this end, the report is an important improvement in accounting for biological heterogeneity in the country.

Other than the novel HCV component, the report improved upon the previous formula by:

1. Reducing the denominator of the reward (R_i) for conserving more than the national average variable- a more pronounced incentive. Currently, the variable is either zero or the difference between the State's Forest area in proportion to geographical area and the national forested area as proportion of national geographic area. The higher the preceding value, the bigger the reward. States are not penalized for having conserved less than the national ratio, explaining the 0 in the max function.
2. Replacing the geographical area of state by the Forest cover of the State to value unique proportions. The singular focus on forests in disbursement of the green grant by the Finance Commissions benefits from this change. The grant is optimized to the extent that each State's area

under moderately dense and dense forests is compared to its total forest cover. This acknowledges that larger geographical areas need not be dominated by forests and may support other ecosystems but falls short in their inclusion. The report is limited by its ToR in this regard.

The report also made important contributions by presenting conservative estimates of opportunity costs based on the next best biological use of land. Furthermore, calculations and suggestions have been provided for maintenance and restoration costs of forests. All three of these have been considered and reinforced centrally during devolution, devoid of any robust calculations.

The final selection of criteria for the HCV index for the report was constrained by the availability of data. This caused certain factors like Endemic Species to be strictly floral, given faunal datasets were unavailable. Likewise, socio-cultural value of forests such as pilgrimage spots or sacred groves could not be included in the study. The toolkit, however, prescribes for these to be included under the six categories of HCV forests it lists.

The grant for 'green' is inherently narrow, and ignorant of other ecosystems. Thus, whilst the new formula increases the efficiency of the green grant, the focus on forest-related metrics dismisses the varied ecosystems large landmasses can support. Gujarat, for instance, with 196024 sq.km. of land, supports deciduous forests (5%), rann (10%), agricultural land (54%), scrubland (10%) and wetlands (2-3%). Arunachal Pradesh with 43% of Gujarat's land, has 70% of its land covered by evergreen/semi evergreen forests. The hilly states are also mandated to keep two-thirds of their lands under forest cover. Therefore, the mere dominance of forest areas is not the best indicator.

The current calculator framework suffers under the garb of complexity, discouraging policymakers from engaging in its application in their budgetary processes. The HCV formula is visibly more complex owing to its consideration of more variables as opposed to the previous Finance Commission formula.

Moreover, an increase in the number of variables under consideration in any formulation leads to lowered weightage for included components. If said components include two or more counterparts, the resultant formula will entail a discord between reward and performance, a critical equation for incentive compatibility.

Two parameters- Patch and Corridors have overlapping definitions and boundaries costing the index its robustness. The former has been defined as the average size of large contiguous forests as tabulated by Forest Survey of India while the latter is defined in itself, as a patch connecting two wildlife populations separated by human structures. In essence, both the parameters symbolise large continuous forest areas unperturbed by anthropogenic activities.

Likewise, plantations have a thick canopy but take away from the natural forests. The issues that they cause are well documented. The inclusion of plantations in the extant forest cover metric excludes their impact on the biological cycles. The popularity of plantations owes itself to their

commercial profitability whilst capturing carbon- a key goal as climate change concerns gain traction across the globe. Research conducted to validate these aspects highlights that plantations sequester more carbon than natural forests, albeit the difference is slight and only in the short term. The rotational cycle of plantations, about 10-20 years, guarantees an equivalent release of carbon reversing a key purpose. The authors elucidate the superior carbon sequestration capacity of natural forests in the longer run, with reference to the Bonn Challenge pledge which aims to regenerate 350 million hectares(ha) of degraded land globally.

India has committed to regenerating 26 million hectares as part of this international commitment. The authors draw parallels between the complete conversion of 350 million hectares of degraded land to natural forests and plantations, and the impact on carbon storage in both scenarios by 2100. They conclude that natural forests store 40 times more carbon than plantations and 6 times more than agroforestry techniques. (Lewis and Wheeler 2019) Moreover, a study in the Annamalai Tiger Reserve of the Western Ghats in India, attested to the argument above while commenting on the stability of carbon sequestration across both- plantations and natural forests. Researchers found that natural forests, being inhabited by multiple species, may be more resilient to natural calamities like droughts as opposed to monodominant plantations. (Osuri et al 2020)

Some additional points:

The report acknowledges its exclusion of other ecosystems like grasslands, meadows, sholas, and mangroves. This list is primarily terrestrial and ignores water-based systems such as riverine, ocean and coastal. The interdependence of ecosystems has been left out of purview- for instance, the presence of mountains attracts precipitation which nourishes the forests around or the relation between forests and grasslands. Moreover, the open forests have been disregarded and given the synonym of degraded land in the report.

Over time, there has been limited to no recognition of the difference in urban and rural ecology. This difference captures best the development-conservation dilemma, and the measures so far seem to associate conservation with rural which is problematic. It implicitly allows for extractive use in urban centres and hinders opportunities at the rural, perpetuating the already visible dichotomy. The report, too, does not acknowledge this factor.

Extraction and unimpeded consumption of resources is at the heart of burgeoning metropolises across the world. Also termed parasitic as a structure, cities drain the natural resources of rural hinterlands contributing to mounds of waste, ensconced deep within the high GDP contributions they make. William Rees and his students propounded the framework of “ecological footprints” to ascertain the ecological needs of cities. (Rees 1997) The authors define said concept as ‘...the total area of productive land and water required to produce on a continuous basis all the resources consumed and to assimilate all the wastes produced by that population, wherever on Earth the land may be located.’

Their calculations cover select categories of consumption and ecosystems supporting the production of assessed goods. The study finds that Vancouver’s per capita ecological footprint is 4.3ha which translates into 2.36 million hectares of land on Earth, 200 times the city’s size. Studies built on this model for cities like London and those in the Baltic have calculated an ecological need between 120-200 times the size of their respective cities. This framework is critical as it champions the spatial component of ecological duress created by cities- it emboldens the facts that urban centers are dependent on ecosystems across geographies, far from their immediate proximities.

The final and this proposed formula do not reward incremental changes and are not dynamic in nature. Incentive compatibility demands that the performance of States be linked to the formula metrics with higher grants in the future linked improved performance in conservation of biodiversity and climate change.

Alternate Formulae proposed:

The Fifteenth Finance Commission commissioned TERI for a study to adjudge the role of intergovernmental transfers in promoting sustainable forest management. While this shows a persistence in the focus on the select ecosystem, the study itself is an effort to improve the existing formula. The formula proposed by Madhu Verma had a visual and computational complexity wrapped around it. The formula proposed in the TERI report is simpler, on that account. The formula as under:

The share of State (i) is given by S_i where

$$S_i = 0.5 \frac{\left(\frac{RFA}{GA}\right)_i}{\sum_i \left(\frac{RFA}{GA}\right)_i} + 0.5 \frac{(2DF + OF)_i}{\sum_i (2DF + OF)_i}$$

(a)
(b)
 Fiscal disability Ecological services

Figure 2 Formula as proposed in the TERI report.

In comparison to the earlier compensation formula, this proposal includes ‘moderately dense’ and ‘very dense’ forests under the heading of DF=dense forests. Additionally, this formula accounts for Open Forests, with a lower weightage than the dense. Given that maintenance of Reserved Forests is monetarily demanding, the fiscal disability component calculates the proportion of RFA in every State to the national proportion.

Another formula proposed attempts to account for the proportion of forest-dependent populations across States which demand greater compensation.

$$\text{Share } A1_i = \left[\left(0.5 \times \left\{ \left(0.8 \times \frac{RFA_i}{\sum RFA_i} \right) + \left(0.2 \times \frac{PA_i}{\sum PA_i} \right) \right\} \right) + \left(0.5 \times \frac{AdjFC_i}{\sum AdjFC_i} \right) \right] \times 100$$

where,

Share $A1_i$ is the share of state

RFA_i is recorded forest area in the state

$\sum RFA_i$ is total recorded forest area^a

PA_i is protected area in the state

$\sum PA_i$ is total protected area^a

$AdjFC_i$ is adjusted forest cover in the state

$AdjFC_i = (2 \cdot VDF_i) + (1 \cdot MDF_i) + (0.5 \cdot OF_i) + (0.5 \cdot TC_i)$

where,

VDF_i is very dense forest cover in the state

MDF_i is moderately dense forest cover in the state

OF_i is open forest cover in the state

TC_i is tree cover in the state

$$\text{Share } A3_i = \left[\left(0.5 \times \frac{X_i}{\sum X_i} \right) + \left(0.5 \times \frac{AdjFC_i}{\sum AdjFC_i} \right) \right] \times 100$$

$$X_i = \left[\left(0.8 \times \frac{AdjRFA_i}{\sum AdjRFA_i} \right) + \left(0.2 \times \frac{AdjPA_i}{\sum AdjPA_i} \right) \right] \times \left(\frac{FDPop_i}{\sum FDPop_i} \right)$$

where,

$FDPop_i$ is forest-dependent population in the state

Figure 3 Formula as proposed in an individual report titled, "Strengthening India's Forest Sector".

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