Encouraging State Governments to Protect and Restore Forests Using Ecological Fiscal Transfers: India’s Tax Revenue Distribution Reform

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Keywords
Climate; conservation finance; ecological fiscal transfers; forests; incentives; PES; REDD+

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Received 24 May 2017
Accepted 29 September 2017

Introduction

The benefits of converting natural ecosystems to agriculture are concentrated locally while the costs of environmental degradation are distributed across a geographically broader public. This motivates the concept of conditional payments for environmental conservation, in which the beneficiaries of ecosystems’ services encourage land-use decision makers to protect or restore ecosystems by making payments available conditional on them doing so. Two classes of conditional payments for environmental conservation both involve forests: payments for ecosystem services (PES) and reducing emissions from deforestation and forest degradation plus conservation, sustainable management of forests, and enhancing forest carbon stocks (REDD+). A third class of conditional environmental payments, ecological fiscal transfers (EFTs), involves conditional payments from higher levels of a country’s government (e.g., national) to lower levels (e.g., state or local; Table 1).

EFTs have several potential advantages over REDD+ and PES. Payers can take advantage of already-established structures for fiscal transfers between levels of government, avoiding the need to design new institutions or assign new property rights. Because the inclusion of recipients in fiscal transfer systems is commonly universal and automatic rather than voluntary, incentives can be two-sided rather than one-sided; that is, payers can penalize environmental degradation with reduced transfers as well as reward environmental improvement with increased transfers. EFTs can potentially mobilize larger volumes of finance than PES, raising the possibility of achieving both broad coverage and substantial dollar-per-hectare incentives. And EFTs could solve, in part, the challenge faced in REDD+ of translating incentives from national governments to more local levels (Loft et al. 2016). EFTs could potentially operate in tandem with international REDD+ payments, with payments from external funders to national governments for reducing emissions, and EFTs from national to state- and...
| Program          | Scale        | Coverage/enrolled area (ha) | Annual payment ($/ha/year) | Total payments during period ($) | Period       | Source                                |
|------------------|--------------|----------------------------|-----------------------------|----------------------------------|--------------|---------------------------------------|
| PES              | National→Household | Forest protection; reforestation; regeneration; forest management; agroforestry | 961,000                      | $41–$294 (2012)                  | $342 million | 1997–2012 Porras et al. (2013)        |
| Costa Rica       | National→Household | Forest conservation         | 528,000                      | $0.50–$30                        | $8.5 million | 2008–2010 de Koning et al. (2011)    |
| Ecuador (SocioBosque) | National→Household | Forest conservation         | 4,270,000                    | 280–1100 MXN                     | 8,586 million MXN | 2003–2013 Alatorre-Troncoso (2014) |
| Mexico           | National→Household | Watersheds; forests; grasslands; wetlands; marine areas; minerals | $6.70–$223                   | $37.1 billion                    | 2001–2012 ADB (2016)            |
| China (eco-compensation) | National→Household | Watersheds; forests; grasslands; wetlands; marine areas; minerals | $6.70–$223                   | $37.1 billion                    | 2001–2012 ADB (2016)            |
| REDD+            | International→National | Reduced deforestation       | 520,000,000 (Legal Amazon)   | $1.037 billion                   | 2008–2015 Amazon Fund (2016)     |
| Brazil           | International→National | Maintaining low deforestation | 15,100,000                  | $190 million                     | 2009–2015 Government of Norway (2015) |
| Guyana           | International→National | Forest conservation         | 15,100,000                  | $1,835                           | $61 million | Norman & Nakhooda (2014)             |
| REDD Early Movers| International→State | Forest conservation         | 314,000                      | 25–50€                          | 13 million € | Santos et al. (2012)                 |
| Voluntary carbon market | International→Local | Reduced deforestation and forest degradation, SFM, A/R | >$216 million >$403 million     | 2002–2008 $2.7 million € | 2011 May et al. (2012)             |
| EFTs             | State→Local     | Protected areas             | 39,470,000 (very dense or moderately dense forest) | $174–$303                      | $5.7 billion | 2016 Reserve Bank of India (2016)     |
local-level governments for protecting and restoring forest cover (Ring et al. 2010; Irawan et al. 2014).

However, EFTs also have limitations as an incentive mechanism. First and foremost, the primary purpose of intergovernmental fiscal transfers (of which EFTs are a subset) is to provide lower levels of government with the predictable financial resources they need to provide public services to their citizens (Bird & Smart 2002; Ring et al. 2011). Secondly they may be designed to equalize budgets across local governments (Bird & Smart 2002) or to compensate local governments for forgone resource use (Ring et al. 2011). Thus there may be only limited freedom to design EFTs as incentive mechanisms for the increased provision of ecosystem services. Furthermore, EFTs are limited to public sector recipients and don’t directly transfer incentives to individual households as PES can.

Until 2014 the few examples of EFTs mostly involved protected areas. EFTs for protected areas have been enacted in Portugal (Santos et al. 2012), France (Borie et al. 2014), and in 16 Brazilian states (Droste et al. 2017). EFTs are at earlier policy stages in Germany and Poland (Schröter-Schlaack et al. 2014), and have been proposed for the European Union (Droste et al. 2016), Indonesia (Mumbunan et al. 2012; Irawan et al. 2014), and India (Kumar & Managi 2009).

In 2014, the world’s first EFTs for forests were enacted in India when the 14th Finance Commission added forest cover to the formula used to determine the amount of annual tax revenue distributed by India’s central government to each of its 29 states. In this article, we describe the origins of the reform and discuss its potential effects within India. We conduct a preliminary exploration of the effect of the tax revenue transfers on state-level forest cover using 1 to 2 years of postreform data.

India’s Ecological Fiscal Transfers

Indian states are dependent on the central government for nearly half their revenue. Twenty-four percent of states’ revenue comes from taxes collected by the central government that are distributed to states’ general budgets via a multielement formula. An additional 20% of states’ revenue comes from the central government in the form of grants earmarked for specific purposes (“grants-in-aid”). States’ own taxes generate 46% of their revenue, while other non-tax revenue generates 9% (estimates for 2015–2016; Reserve Bank of India 2016).

The portion of centrally collected revenue that is distributed to states (“vertical devolution”) and the formula that determines how much revenue each state receives (“horizontal devolution”) are set every 5 years by the India Finance Commission, which is composed of academics, former bureaucrats, and other fiscal experts, and is regarded as apolitical. The report of the Finance Commission is submitted to the President and as per a longstanding convention its recommendations are accepted without changes by the Indian cabinet.

The horizontal devolution formula has undergone periodic changes from 1949 to present (Figure 1). Population was the only element of the formula from 1950 to 1954. It remained more than 75% of the formula until 1980 when it was reduced to around 20%, where it has roughly remained ever since. Measures of poverty and fiscal situation comprised a growing share of the formula, from around 20% from 1960 to 1979 to between 45% and 75% since. Tax effort and fiscal discipline comprised between 10% and 17.5% from 1995 to 2014; infrastructure comprised between 5% and 7.5% from 1995 to 2004; area has comprised 5–15% of the formula since 1995.

In February, 2014, the 14th Finance Commission introduced states’ forest cover circa 2013 as an element of the horizontal devolution formula, comprising 7.5% of the tax revenue to be transferred to states from 2015 to 2019. Forest cover has been monitored every 2 years by the Indian Forest Service at 23.5-meter resolution using satellite-based methods that have been operating since 1987. The measurement of forest cover does not

Conservation Letters, March/April 2018, 11(2), 1–10 Copyright and Photocopying: © 2017 The Authors. Conservation Letters published by Wiley Periodicals, Inc.
distinguish plantations, tree crops, or gardens from natural forests. Nor does the indicator differentiate forests based on their conservation value, as proposed by Verma et al. (2014), nor on forests’ ownership, land use, or legal status. It does, however, pay only for very dense and moderately dense forest cover (tree canopy density above 40% covering an area larger than one hectare) but not for open forest cover (tree canopy density between 10% and 40%).

The primary motivation of the 14th Finance Commission in adding forest cover to the formula was to compensate states for the “fiscal disability” caused by forgone opportunities to convert forests to other uses resulting from implementation of the 1988 National Forest Policy—an issue consistently raised in the Commission’s consultations by states with high forest cover concentrated in the Northeast. However, in its authorizing document the 14th Finance Commission justified the inclusion of forest cover on environmental grounds as well, declaring that “we believe that a large forest cover provides huge ecological benefits” (Government of India 2014).

The Government of India estimated in its 2015 national climate pledge (Intended Nationally Determined Contribution) that between $6.9 and $12 billion per year will be transferred to states proportional to their forest cover (Government of India 2015). In the first postreform budget in 2015–2016, an estimated 364 billion rupees (around 5.7 billion U.S. Dollars) were transferred to states on the basis of their forest cover (Reserve Bank of India 2016). This scale of finance dwarfs most previous conditional environmental payment programs for tropical forests in terms of total finance and dollars per hectare (Table 1). By comparison, Costa Rica’s flagship payments for environmental services program totaled $342 million from 1997 to 2012 (Porras et al. 2013), and all pledged international REDD+ finance for the decade 2006–2015 totaled less than $10 billion (Norman & Nakhooda 2015). Only China operates at a similar scale, having disbursed $37.1 billion in eco-compensation payments from 2001 to 2012 (ADB 2016). Forest-cover-proportional funds had previously been made available to states by the 12th and 13th Finance Commissions (Verma et al. 2014), but the recommendations of the 14th Finance Commission differed from those of its predecessors in three important respects. First, the 14th Finance Commission recommended a quantum of finance some 30 to 250 times larger: around $6–$12 billion annually, compared to only around $227 million and around $1 billion over 5-year periods recommended by the 12th and 13th Finance Commissions respectively. Second, the release of three-quarters of the funds granted by the 13th Finance Commissions was contingent on the preparation of workplans and other preconditions (Government of India 2009); in contrast the release of the EFTs was automatic with no preconditions. And third, grants from the 12th and 13th Finance Commissions had to be spent by states on forest-related budget items, whereas the EFTs operate as a pure transfer into states’ general budgets—part of a broader pattern by the 14th Finance Commission of shifting center-to-state payments from earmarked grants to general-purpose transfers.2

In order for the EFTs to operate as an incentive mechanism (i.e., to encourage states to increase their forest cover, in addition to merely compensating states for the “fiscal disability” of forgone revenue from converting forests to other land uses), state governments need to expect with some positive probability that future finance commissions will retain contemporary forest cover as a sizeable element of the tax revenue distribution formula. The persistence of many previous elements of the formula through time provides some level of confidence that forest cover may persist as well. Furthermore, though no official statement can prejudge the decisions of future finance commissions, India’s 2015 national climate pledge mentioned India’s long-term goal of increasing forest cover from 24% in 2013 to 33%, and referred to the 14th Finance Commission’s decision as a fiscal incentive that “has effectively given afforestation a massive boost” (Government of India 2015), perhaps suggesting that forest cover may remain a long-term component of the formula.

Assuming that the 15th Finance Commission retains contemporary forest cover as 7.5% of the formula for distributing post-2020 tax revenue, then states that increase forest cover will stand to gain tax revenue of roughly U.S.$174–$303 per hectare per year in post-2020 tax revenue, while states that lose forest cover before 2020 will stand to lose the same amount (Table 2). Note that the EFTs pay across all forested hectares; not just contracted hectares as in PES, or reductions in forest loss as in REDD+. Note also that because the total amount of tax revenue transferred is not affected by total forest cover, every additional hectare of forest in another state also results in a loss of around U.S.$6–$11 per hectare per year. This amount is probably too small to encourage “beggar-thy-neighbor” forest-destruction actions across state lines.

**Potential effects**

India reported 695,000 km² of forest cover circa 2015 (Ministry of Environment, Forest, and Climate Change; 2015), down from 869,000 km² in 1930 (Reddy et al. 2016) and up from 663,000 km² in 1989. Of this forest, 401,000 km² were classified as very dense or moderately dense, down from 417,000 km² in 2001. India’s
| State               | Very dense or moderately dense forest cover, 2013 (km²) | Percentage of total forest cover | Size of annual transfer | Increase from additional hectare of in-state forest | Decrease from additional hectare of out-of-state forest | Size of annual transfer | Increase from additional hectare of in-state forest | Decrease from additional hectare of out-of-state forest |
|---------------------|---------------------------------------------------------|---------------------------------|-------------------------|--------------------------------------------------|--------------------------------------------------------|-------------------------|--------------------------------------------------|--------------------------------------------------------|
| Andhra Pradesh/Telangana | 26,929                                                | 6.8%                             | $469,401,154            | $174                                             | $12                                                    | $816,349,834           | $303                                             | $21                                                    |
| Arunachal Pradesh   | 52,242                                                 | 13.2%                            | $910,633,708            | $174                                             | $23                                                    | $1,583,710,796         | $303                                             | $40                                                    |
| Assam               | 12,789                                                 | 3.2%                             | $222,925,893            | $174                                             | $6                                                     | $387,697,205           | $303                                             | $10                                                    |
| Bihar               | 3,627                                                  | 0.9%                             | $63,222,473             | $174                                             | $2                                                     | $109,952,128           | $303                                             | $3                                                     |
| Chhattisgarh        | 39,018                                                 | 9.9%                             | $680,125,302            | $174                                             | $17                                                   | $1,182,826,611         | $303                                             | $30                                                   |
| Goa                 | 1,128                                                  | 0.3%                             | $19,662,224             | $174                                             | $0                                                     | $34,195,203            | $303                                             | $1                                                     |
| Gujarat             | 5,596                                                  | 1.4%                             | $97,544,241             | $174                                             | $2                                                     | $169,642,158           | $303                                             | $4                                                     |
| Haryana             | 480                                                    | 0.1%                             | $8,366,911              | $174                                             | $0                                                     | $14,551,150            | $303                                             | $0                                                     |
| Himachal Pradesh    | 9,605                                                  | 2.4%                             | $167,425,381            | $174                                             | $4                                                     | $291,174,576           | $303                                             | $7                                                     |
| Jammu and Kashmir   | 12,900                                                 | 3.3%                             | $224,860,741            | $174                                             | $6                                                     | $391,062,158           | $303                                             | $10                                                    |
| Jharkhand           | 12,254                                                 | 3.1%                             | $213,600,273            | $174                                             | $5                                                     | $371,478,735           | $303                                             | $9                                                     |
| Karnataka           | 21,956                                                 | 5.5%                             | $382,716,467            | $174                                             | $10                                                    | $665,593,856           | $303                                             | $17                                                    |
| Kerala              | 10,930                                                 | 2.8%                             | $190,521,543            | $174                                             | $5                                                     | $331,341,813           | $303                                             | $8                                                     |
| Madhya Pradesh      | 41,553                                                 | 10.5%                            | $724,313,052            | $174                                             | $18                                                    | $1,259,674,873         | $303                                             | $32                                                    |
| Maharashtra         | 29,490                                                 | 7.4%                             | $514,042,112            | $174                                             | $13                                                    | $893,986,283           | $303                                             | $23                                                    |
| Manipur             | 6,822                                                  | 1.7%                             | $118,914,727            | $174                                             | $3                                                     | $206,808,220           | $303                                             | $5                                                     |
| Meghalaya           | 10,138                                                 | 2.6%                             | $176,716,139            | $174                                             | $4                                                     | $307,332,415           | $303                                             | $8                                                     |
| Mizoram             | 6,038                                                  | 1.5%                             | $105,248,772            | $174                                             | $3                                                     | $183,041,342           | $303                                             | $5                                                     |
| Nagaland            | 6,034                                                  | 1.5%                             | $105,179,047            | $174                                             | $3                                                     | $182,920,082           | $303                                             | $5                                                     |
| Odisha              | 28,340                                                 | 7.2%                             | $493,996,387            | $174                                             | $12                                                    | $859,124,152           | $303                                             | $22                                                    |
| Punjab              | 736                                                    | 0.2%                             | $1,282,926,264          | $174                                             | $0                                                     | $2,211,763             | $303                                             | $1                                                     |
| Rajasthan           | 4,496                                                  | 1.1%                             | $78,370,069             | $174                                             | $2                                                     | $136,295,722           | $303                                             | $3                                                     |
| Sikkim              | 6,661                                                  | 0.7%                             | $46,834,064             | $174                                             | $1                                                     | $80,667,938            | $303                                             | $2                                                     |
| Tamil Nadu          | 13,147                                                 | 3.3%                             | $229,166,214            | $174                                             | $6                                                     | $398,549,937           | $303                                             | $10                                                    |
| Tripura             | 4,750                                                  | 1.2%                             | $82,797,560             | $174                                             | $2                                                     | $143,995,756           | $303                                             | $4                                                     |
| Uttar Pradesh       | 6,173                                                  | 1.6%                             | $107,601,965            | $174                                             | $3                                                     | $187,133,853           | $303                                             | $5                                                     |
| Uttarakhand         | 18,896                                                 | 4.8%                             | $329,377,408            | $174                                             | $8                                                     | $572,830,274           | $303                                             | $14                                                    |
| West Bengal         | 7,117                                                  | 1.8%                             | $124,055,891            | $174                                             | $3                                                     | $215,751,115           | $303                                             | $5                                                     |
| TOTAL               | 395,845                                                |                                  | $6,900,000,000          | $1,200,000,000                                   |                                                       | $428,571,429           | $303                                             | $11                                                    |
| AVERAGE             | 14,137                                                 | 3.6%                             | $246,428,571            | $174                                             | $6                                                     |                                                    |                                                   |                                                        |

*aSource: India State of Forest Report (MEFCC 2015).  
*bNote: the state of Andhra Pradesh split into two states of Andhra Pradesh and Telangana on June 2, 2014.*
Forests span three of Earth’s hotspots of biodiversity—the Eastern Himalayas, Indo-Burma, and the Western Ghats (Mittermeier 2004). In the Himalayas, deforestation is driven by agricultural expansion and settlements; in Northeast India by shifting cultivation, logging, and mining; in the Western Ghats by dams, plantations, agriculture, and infrastructure development; and in the Deccan plateau by agriculture (Reddy et al. 2016). Large amounts of replanting have taken place as well; commercial plantations and orchards comprise around 88,000 km² that could potentially be classified as forest (Ravindranath et al. 2014).

Forty-five percent of India’s forests are government-owned (Brandt et al. 2017), including 5% of forests within protected areas and 40% of forests for which the central government provides policy directions and guidelines on common issues and state governments are responsible for management and protection (Ministry of Environment, Forest, & Climate Change 2014). Thirty-eight percent of India’s forests are under community management while 14% are privately owned (Brandt et al. 2017).

Authority for land-use and forest-management decisions in India has ebbed and flowed between the central and state governments over the decades (Chaturvedi 2016). Today, state governments are “powerful actors” that are “actively shaping policies and programmes” (Chaturvedi 2016). They have the authority to approve small development projects (e.g., roads, transmission lines) and can grant “in principle” approval for large development projects (e.g., mines, dams, irrigation). They can allow encroachment on forest lands, subject to the constraints of the 1995 Supreme Court decision. While the central government sets the policy contours of the India Forest Service, state governments influence its personnel through their control of transfers, promotions, and allocation of posts. Central government funding for forest management is low and in some cases requires cost sharing that state governments have historically been unable or unwilling to provide. Neither timber operations nor international donors provide significant sources of funding due to policy restrictions (Chaturvedi 2016).

India’s EFTs provide an excellent test case of the premise that conditional payments can result in the increased provision of ecosystem services by state governments. While we hypothesize that the reform would not yet have produced noticeable results in its first 1 to 2 years of operation, we expect that in the medium-term the following actions will occur as the result of a sustained forest-cover-proportional fiscal transfer:

(1) State governments increase budgets for forest management.

(2) State governments increase the use and effectiveness of existing pro-forest policies within their control.

(3) State governments devise new ways to encourage pro-forest actions by local governments within state boundaries.

(4) State governments devise new ways to encourage pro-forest actions by private actors, e.g., citizens, landholders, or businesses within state boundaries.

(5) As a result of 1–4, state-level forest cover increases, composed of both reduced deforestation (which can be detected by satellites instantaneously) and increased reforestation (which can be detected only after a lag of several years).

Discussions on REDD+ at the United Nations Framework Convention on Climate Change (UNFCCC) involved considerable energy negotiating safeguards to ensure that new financial incentives for forest conservation would not have adverse social and environmental impacts, resulting in agreement on the Cancun Safeguards and Safeguards Information Systems. India’s EFTs are conditional on forest cover alone and have no social and environmental safeguards constraining the means by which states protect and restore forests. Thus it will be useful to observe India to see whether or not two additional actions occur:

(6) Lack of social safeguards promotes repressive and unjust exclusion of local people from accessing forest resources.

(7) Lack of biodiversity safeguards promotes reforestation with fast-growing commercial species at the expense of restoration of native forest.

In this article, we present a preliminary test of hypothesis (5); we reserve tests of the other six hypotheses for future work. We suggest that 5 years after the reform may be a reasonable length of time after which to rigorously evaluate its early effects. Such an evaluation could in turn be used to estimate the effects of the reform in dollar-per-hectare-of-forest or dollar-per-ton-of-carbon-dioxide terms.

**Preliminary analysis**

After the EFTs were introduced, net loss of very dense or moderately dense forest cover decreased by 51%, from 1,960 km² of net loss between 2011 and 2013 before the reform to 969 km² between 2013 and 2015 spanning the reform, according to the India State of Forest Reports (Ministry of Environment, Forest, and Climate Change 2015; Figure 2). However, on its own a decrease in net forest-cover loss after the introduction of the EFTs provides little information about the effects of the reform.
because deforestation rates are influenced by many other time-variant factors besides this single policy.

To rigorously estimate the causal impact of the reform, it would be necessary to compare observed rates of forest loss and gain to a counterfactual scenario in which the EFTs were not enacted. However, because the dollar-per-hectare incentive was applied uniformly across the entire country (Table 2), it is not possible to develop a counterfactual scenario based on untreated control regions from within India nor variation in treatment levels across India. Potentially a counterfactual scenario could be developed using data from many countries and synthetic control methods (e.g., Sills et al. 2015), but that is beyond the scope of this analysis.

But while the dollar-per-hectare transfer for forest cover was uniform across all states, we expect that the incentive effect of the forest-cover-proportional transfer would be larger in states where it comprises a greater share of total state revenue from all sources. However, we found no significant correlation ($r = -0.03; P = 0.89$) across states between the forest-cover-proportional fiscal transfer as a share of total state revenue and improvement in forest cover, as indicated by the increase in a state’s net increase in very dense or moderately dense forest cover as a percent of land area between 2011 and 2013 before the reform and 2013–2015 spanning the reform (Table 3). This finding is consistent with our hypothesis that 1 year is too soon for the reform to have had a noticeable effect.

As a supplementary analysis, we examined an alternative data set on gross forest-cover loss (Hansen et al. 2013/GFW), which is not directly comparable to India’s official data due to differences in forest definition and reporting of net versus gross changes. This independent data set showed that India’s gross forest loss (30% tree-cover threshold) increased by 81% from an average of 70,000 hectares/year during 2012 and 2013 before the reform to an average of 127,000 hectares/year during 2014 and 2015 almost entirely after the reform (Hansen et al. 2013/GFW) (Figure 2). Again, we found no significant correlation ($r = -0.20; P = 0.31$) between the forest-cover-proportional fiscal transfer as a share of total state revenue and decrease in forest-cover loss as a percent of land area between the period 2012 and 2013 and the period 2014 and 2015, consistent with our hypothesis that 2 years is too soon for the reform to have had a noticeable effect.

Comparing state-level changes in net forest-cover increase before and after the reform is only a first-order indication of the effect of the reform; it does not control for the effect of factors that vary across both space and time, such as commodity price fluctuations or the designation of new protected areas. A spatially explicit analysis that attempts to control for such potentially confounding factors is beyond the scope of this analysis.

**Discussion**

India’s EFTs do not appear to have had a positive influence on forest cover yet, at least not consistently across states. This is consistent with our hypothesis that 1 to 2 years is too soon for the tax revenue distribution reform to have had a noticeable effect. We stress that this is the result of a simple preliminary analysis and that more rigorous analysis over longer time scales will be necessary to fully understand the influence of the reform.

However, while the reform does not appear to have had an immediate effect, there are several reasons to expect that its effect might grow with time. First, state governments’ attention to the fiscal opportunity provided by the EFTs might increase, as might their expectation that forest cover will be retained as an element of the horizontal devolution formula beyond 2019. Second, it might take time for increased attention by state governments to be reflected in state budgets, policies, and land-use decisions, e.g., related to the approval of development projects and encroachments, and for these decisions to translate into changes in forest loss and gain. And third, while deforestation can be detected instantaneously, newly planted trees take time to grow so there is necessarily a lag of several years before reforestation can be detected by satellites. Even so, it is worth considering reasons why the reform might not have a noticeable effect—an offer of increased state revenue in the near future might not incentivize public policy changes today; or the fiscal incentive might be too small to influence policy (while large in absolute terms, $5.7 billion per year is still only 1.8% of total state revenues); or it might be that...
| State                     | Forest transfer as share of state revenue from all sources, 2015 | Forest transfer as share of total fiscal transfer, 2015 | Land area (km²) | Net increase in very dense or moderately dense forest cover 2011–2013 (km²) | Net increase in very dense or moderately dense forest cover 2013–2015 (km²) | Increase in net increase, as % of land area | Gross loss of forest cover 2012+2013 (km²) | Gross loss of forest cover 2014+2015 (km²) | Decrease in gross loss, as percentage of land area |
|--------------------------|---------------------------------------------------------------|---------------------------------------------------------|-----------------|--------------------------------------------------------------------------------|-------------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|-------------------------------------------------|
| Andhra Pradesh/Telangana | 1.3%                                                          | 7.0%                                                    | 275,045         | −163                                                                            | −236                                            | −0.03%                                       | 91                                          | 59                                          | 0.01%                                            |
| Arunachal Pradesh        | 41.3%                                                         | 66.5%                                                   | 83,743          | −145                                                                           | −137                                            | 0.01%                                        | 236                                         | 254                                         | −0.02%                                         |
| Assam                    | 2.1%                                                          | 7.1%                                                    | 78,438          | −59                                                                            | −80                                             | −0.03%                                       | 256                                         | 360                                         | −0.13%                                         |
| Bihar                    | 0.3%                                                          | 0.7%                                                    | 94,163          | 116                                                                            | −3                                              | −0.13%                                       | 1                                           | 0                                           | 0.00%                                           |
| Chhattisgarh             | 6.2%                                                          | 22.1%                                                   | 135,192         | −56                                                                            | −20                                             | 0.03%                                        | 49                                          | 32                                          | 0.01%                                           |
| Goa                      | 1.0%                                                          | 5.2%                                                    | 3,702           | 0                                                                              | −6                                              | −0.16%                                       | 1                                           | 0                                           | 0.00%                                           |
| Gujarat                  | 0.5%                                                          | 4.0%                                                    | 196,244         | −11                                                                            | 0                                               | 0.01%                                        | 49                                          | 32                                          | 0.01%                                           |
| Haryana                  | 0.1%                                                          | 0.8%                                                    | 44,212          | −4                                                                            | −1                                              | 0.01%                                        | 1                                           | 0                                           | 0.00%                                           |
| Himachal Pradesh         | 3.8%                                                          | 23.0%                                                   | 55,673          | 0                                                                              | 0                                               | 0.00%                                        | 8                                           | 1                                           | 0.01%                                           |
| Jammu and Kashmir        | 3.1%                                                          | 14.7%                                                   | 222,236         | 0                                                                              | −24                                             | −0.01%                                       | 4                                           | 0                                           | 0.00%                                           |
| Jharkhand                | 2.3%                                                          | 9.4%                                                    | 79,716          | −253                                                                           | −3                                              | 0.31%                                        | 5                                           | 2                                           | 0.00%                                           |
| Karnataka                | 1.7%                                                          | 8.1%                                                    | 191,791         | 0                                                                              | −112                                            | −0.06%                                       | 47                                          | 37                                          | 0.00%                                           |
| Kerala                   | 1.3%                                                          | 7.7%                                                    | 38,852          | 94                                                                             | −106                                            | −0.51%                                       | 66                                          | 65                                          | 0.00%                                           |
| Madhya Pradesh           | 3.3%                                                          | 12.6%                                                   | 308,252         | −73                                                                            | −22                                             | 0.02%                                        | 8                                           | 7                                           | 0.00%                                           |
| Maharashtra              | 1.4%                                                          | 9.3%                                                    | 307,713         | −61                                                                            | −31                                             | 0.01%                                        | 17                                          | 12                                          | 0.00%                                           |
| Manipur                  | 7.2%                                                          | 19.4%                                                   | 22,327          | −59                                                                            | −170                                            | −0.50%                                       | 212                                         | 323                                         | −0.49%                                          |
| Meghalaya                | 11.1%                                                         | 27.7%                                                   | 22,429          | −70                                                                            | −105                                            | −0.16%                                       | 143                                         | 364                                         | −0.99%                                          |
| Mizoram                  | 7.7%                                                          | 23.0%                                                   | 21,081          | −182                                                                           | −42                                             | 0.66%                                        | 171                                         | 395                                         | −1.07%                                          |
| Nagaland                 | 6.2%                                                          | 23.0%                                                   | 16,579          | −190                                                                           | −43                                             | 0.89%                                        | 228                                         | 370                                         | −0.86%                                          |
| Odisha                   | 3.7%                                                          | 13.3%                                                   | 155,707         | −86                                                                            | 153                                             | 0.15%                                        | 91                                          | 114                                         | −0.01%                                          |
| Punjab                   | 0.1%                                                          | 0.8%                                                    | 50,362          | 0                                                                              | 1                                               | 0.00%                                        | 2                                           | 0                                           | 0.00%                                           |
| Rajasthan                | 0.4%                                                          | 1.4%                                                    | 342,239         | −24                                                                            | 6                                               | 0.01%                                        | 0                                           | 0                                           | 0.00%                                           |
| Sikkim                   | 5.1%                                                          | 12.7%                                                   | 7,096           | 0                                                                              | −1                                              | −0.01%                                       | 1                                           | 0                                           | 0.01%                                           |
| Tamil Nadu               | 0.8%                                                          | 5.7%                                                    | 130,060         | −122                                                                           | 315                                             | 0.34%                                        | 23                                          | 20                                          | 0.00%                                           |
| Tripura                  | 3.5%                                                          | 23.1%                                                   | 10,486          | −45                                                                            | −28                                             | 0.16%                                        | 47                                          | 94                                          | −0.45%                                          |
| Uttar Pradesh            | 0.2%                                                          | 0.7%                                                    | 240,928         | −12                                                                            | 82                                              | 0.04%                                        | 5                                           | 2                                           | 0.00%                                           |
| Uttarakhand              | 6.7%                                                          | 31.5%                                                   | 53,483          | −33                                                                            | −540                                            | −0.95%                                       | 18                                          | 14                                          | 0.01%                                           |
| West Bengal              | 0.6%                                                          | 2.0%                                                    | 88,752          | −513                                                                           | 3                                               | 0.58%                                        | 16                                          | 8                                           | 0.01%                                           |
| TOTAL                    | 1.8%                                                          | 7.5%                                                    | 3,276,501       | −1,951                                                                         | −1,152                                           | 0.02%                                        | 1746                                        | 2536                                        | −0.02%                                          |

Correlation with forest transfer as share of all state revenue

| P-statistic (two-tailed) | Correlation with forest transfer as share of total transfer |
|--------------------------|----------------------------------------------------------|
| 0.89                     | 0.31                                                     |
| −0.08                    | −0.33                                                    |
| 0.70                     | 0.09                                                     |

Note: the state of Andhra Pradesh split into two states of Andhra Pradesh and Telangana on June 2, 2014.
too much deforestation is beyond the influence of state governments.

Future Finance Commissions should retain forest cover in the horizontal devolution formula as a way of meeting long-term forest cover and climate goals. For the EFT to operate as an effective forest-conservation instrument, the year of the forest cover indicator needs to be contemporaneous, that is, updated at least every 5 years rather than fixed circa 2013.

For conservationists in India, EFTs provide an opportunity to convince state government policy makers that increasing forest protection and restoration can be a profitable public investment in future state revenue, and that decisions that divert forest to other land uses will have a fiscal cost. Conservationists may also seek to educate state policy makers on the importance of restoring native forests rather than reforesting with plantation monocultures, given the lack of any inherent requirement or incentive to do so.

India’s pro-forest tax revenue distribution reform could potentially be adapted by any country in which revenue is devolved across multiple levels of government, including Indonesia (Mumbunan et al. 2012; Irawan et al. 2014), Brazil’s federal government (Droste et al. 2017), and China. Mobilizing financial resources in support of forest conservation is particularly important in the context of climate change, as protecting and restoring forests make up one-quarter of the climate mitigation pledged by countries (Grassi et al. 2017).

Acknowledgments

The authors are grateful for funding from the Norwegian Agency for Development Cooperation. Helpful comments on early stages of the manuscript were provided by Tim Christophersen, Michele de Nevers, Jagdish Kishwan, Bill Savedoff, Frances Seymour, Luca Tacconi, and two anonymous referees.

Endnotes

1. In this paper we use “conditional” in its ex post sense of being contingent upon something else having happened first, as in “conditional cash transfers” (Fernold et al. 2008), payments for ecosystem services (Wunder 2005), and India’s description of its forest-cover-proportional fiscal transfers in its international climate pledge (Government of India 2015), rather than in its ex ante sense of being earmarked for a specific purpose, as used in the report of India’s 14th Finance Commission (Government of India, 2014) and previous fiscal transfers literature (Bird and Smart 2002; Ring et al. 2011).

2. Distinct from the 14th Finance Commission’s tax revenue distribution reform, in 2016 India’s Parliament passed the Compensatory Afforestation Fund Bill to unlock more than 400 billion rupees (around US$6 billion) in unspent funds for “conservation, protection, improvement and expansion of forest and wildlife resources” that had accumulated from penalties paid by states for the “diversion” of forest land to other uses. 90% of these funds would be divided between state Compensatory Afforestation Fund Management and Planning Authorities (CAMPAs) on the basis of the states from which the original payments into the fund were made, while 10% would rest with a national CAMP (Government of India, 2016).

3. Technically, the incentive effect of the reform should be related to the increase in the forest-cover-proportional transfer. But since the post-reform fiscal transfer is around 30 times larger than the pre-reform grant-in-aid it replaced, for simplicity we consider the incentive effect of the post-reform transfer only without subtracting incentives arising from the much smaller pre-reform grant-in-aid. Note that because both the pre- and post-reform transfers are proportional to states’ forest cover this simplification should have almost no effect on the correlation coefficient.

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