

Forests and the Economy of India

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Abstract. Forests are an important component of the local economy for communities living in or near them. But this effect seems to be localised; their contribution to the national GDP is quite low. On top of that, it is rather sparsely documented, so we cannot easily make analyses based on immediately available data. Given this problem, we are, in this project, interested in finding out a few results. First, to roughly estimate national economic reliance on Forestry and track it over a period of time post-independence. Second, we would like to identify local hotspots that rely on forestry more than others, via indirect methods such as examining forest cover. Lastly, we want to see if given this data we can track patterns that match known historical events, possibly opening up avenues for making further claims by analysing data.

Keywords: Forest statistics · Indian Economy · Data Analysis.

1 Introduction

The contribution of forests to the economy is primarily in the form of wood - timber, industrial consumption, firewood - paper, and paper-based products. Despite the abundance of 'useful' produce, a study [1] by the Food and Agricultural Organization of the United Nations (FAO) reported that forests formally contributed, around the turn of the century, only 1.7% to India's GDP. While not too surprising given the existence of sectors like Agriculture, Industry, and Service, it is very likely that economic reliance on forestry was more prominent in the past, and is still as prominent in specific pockets of the country. That is to say, we may be able to draw inferences about the economy of a place by analyzing forest data and vice versa. This would apply to both study of present systems and those in the past.

Keeping these in mind, the primary goals of the project can be summarized as follows:

- *The national economic reliance on forests over time*

Using data from 1950-2014 available to us, we examine the contribution Forestry has had on the national GDP to see if there is any correlation between the two. Since approximations are made here, we check for correctness against the available FAO data [1].

- *Identifying pockets/states where the impact of Forestry on the economy is greater than in the rest of India.*

While India as a whole is shown to not rely on Forestry much for its economy, we can make an argument that some states, especially those with a high percentage of land forest cover, will rely on such. This is a multi-step process.

1. *Developing methods to identify such areas*

Due to lack of sufficient directly available data on forestry [3], we resort to looking at other related data and make inferences from such.

Assessment: Several studies [5,6] have referred to the importance of forestry to the North-East Indian states, so we attempt to see if the same conclusions can be reached by using these methods

2. *Analyzing contribution of Forests to Economy in selected States*

Using the methods developed in the previous step, we analyze the information in more depth.

- *Analyzing recorded historical events through this lens*

Using these tools developed, we try to look for a correlation of the data with known events.

2 Data sources

The Forest Survey of India [2] publishes a report every two or so years with data about Forest cover, mangrove cover, forest fires, and the like. Since we are interested mostly with forest cover, we primarily use that report. It covers a variety of information; methods, land coverage, percentage land coverage, change from the previous year. The Survey has been doing this on a largely regular basis since the first one in 1987.

The Planning Commission of India publishes databooks with the Sector-wise breakdown of National GDP, and also reports for statewise breakdowns as well. The National GDP report covers the time period of 1951 to 2013-14, and also contains a lot of information about per-capita growth, that we're not interested in at the moment.

3 Related Work

(Poffenberger, 2006) [6] wrote a "FOREST SECTOR REVIEW OF NORTH-EAST INDIA" for World Bank. It details forest resources in the area and goes on

to describe problems facing the region like deforestation, and proposes solutions. We are given in this data as-is, raw figures about the forested area coverage of the states and percentage of community control. (P. S. Roy, 2010) [5] also details the deforestation of the region, and goes into a bit more detail on the effects of Shifting Agriculture.

(Enters, 2000) [4] is a field study of a wildlife sanctuary. It attempts to establish the role of the forest in the day-to-day lives of people. Interestingly, as he finds, well-to-do families living further from the forest made the most utilization of it, followed by poorer families near the forest. Poor families far from the forest made the least use of it.

(Barik and Mishra, 2008) [3] is the work closest to my chosen topic. It is an assessment of the contribution of forests to the economy of the states of North-east India. In the paper they bring out several points tackled by me as well, including the lack of direct data available and the dangers of extrapolation as is done. I also use this as a source for some GDP contribution values that I could not otherwise obtain.

4 National economic reliance on forests over time

4.1 The Data

The data for sector-wise contribution to the National GDP is collected from the December 2014 Databook published by the Planning Commission of India (can be accessed at this link). The original file contains for each sector a number of statistics for both 2004-05 and 2014-15 prices. For purpose of analysis, I used only the percentage contribution to the GDP in the 2014-15 prices. A snippet of the data has been provided in Table 1.

Year	Agriculture & Allied	Agriculture Industry	Mining & Quarrying	Manufacturing Services		
1950-51	51.81	45.48	14.16	0.75	10.51	33.25
1951-52	50.67	44.56	15.00	0.79	11.04	33.59
1952-53	50.05	44.43	14.38	0.83	10.54	35.22
2011-12	17.86	15.50	27.22	2.65	14.73	54.91
2012-13	17.52	15.10	26.21	2.37	14.07	56.27
2013-14	18.20	15.79	24.77	2.13	12.89	57.03

Table 1: Sector-wise contribution to the National GDP at 2014-15 prices

4.2 Correlation between National Economy and Forest Contribution

Since the data is sector-wise contribution to the GDP in percentages, we just need to plot it to get a picture of the situation. However, there's a problem - we do not have any 'Forestry' data. We need to estimate it by some means.

Estimating Forest contribution Forestry data is not immediately available to us. Under sector-wise contributions, we only have 'Agriculture and Allied' and 'Agriculture', where the 'and Allied' stands for Fisheries and Forests.

However, based on existing statistics, forestry in one year accounted for 8% of the 'Agriculture and Allied' sector in the country. I make here the simplifying assumption that this will hold across all the years in consideration. This is not necessarily the case, as we shall explore soon.

The plotted graph thus gotten is Fig. 1.

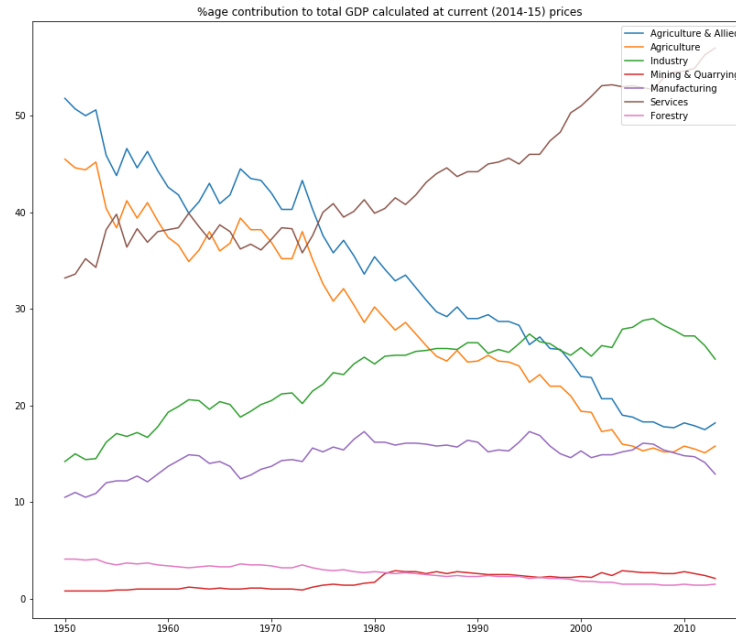


Fig. 1: Sector-wise percentage contribution to total GDP calculated at current (2014-15) prices

The graph shows clearly the correlation between Forest Produce and the National Economy - low to begin with, and decreasing.

We can verify that this is a reasonably good approximation. The Forest contribution to GDP around the time of the FAO report is in the range of 1.6-1.8, close to the actual value of 1.7.

However, it does not entirely make sense to look at forest contribution to the Indian State as a whole. The Indian State has classically been an agrarian econ-

omy, as we can verify from the plot above, and of late, Services and Industry. Not to mention that the metropolitan cities - major economic centers of the country - do not rely much on forest produce. In the face of this, traditional forest products like wood aren't particularly major players in the National (or Global) stage.

On top of that, India isn't exactly covered in forests. The latest survey by the Forest Survey of India (FSI) in 2017 [2] reported 21.54% landmass coverage, but this figure includes open forests as well, which are defined as 'greater than 10% tree coverage' using satellite imagery to survey. There are places within the country - states, sometimes - that have a greater proportion of forests than others, and it makes sense to focus on them, as places with more (and easier access to) forests are more likely to use them.

We can verify that by recalling that places near forests have a local economy that's heavily reliant on forests [4]. If we want to look for trends in economy, it makes sense to look more closely at these areas. But we'll need to identify said areas in the first place.

Aside: Better Estimation of Forest contribution Instead of approximating contribution as a fixed percentage of Agriculture and Allied, we can add other factors to modulate it. As we see later, Forest Cover is correlated with the Economic Output generated by them. We can adjust the percentage take as a function of this value.

Likewise, agricultural patterns like slash-and-burn have an indirect effect on the Economy not directly captured in the traditional GDP assessment [3]. We can look at that as well.

5 Identifying states with a high impact of Forestry on the economy

Barik, S. K. and S. K. Mishra [3] studied the contribution of forests to the economy of the northeastern States of India. As they summarise,

"... However, for historical, topographical, logistic and complex sociological reasons, quantitative data on most of the economic and environmental components of forests are lacking. Quantification of both tangible and intangible forest benefits remains a neglected research area."

When it comes to data on forests, there isn't much of it. Especially not when considering their GDP contribution. In such a case, how do we calculate the necessary figures?

5.1 Indirect method 1: Use known Geography

The economic data by Sector provided by the government classifies Agriculture, Forestry, and Fisheries under one heading.

But, alongside, since 'Agriculture' is its own category in itself separately specified, the difference between the two is the contribution of Forestry + Fisheries. Now, it is safe to assume that for Inland States without any major body of water (sea/river), the contribution of Fisheries is probably negligible, and not as prominent as that of the Forestry - so at least 90% of this category would be the contribution of just Forestry.

For coastal States we can (1) assume equal contribution from both, or (2) if it is relatively forest-less, assume that most contribution comes from the Fisheries.

5.2 Indirect method 2: Correlate forest cover to forest usage

We hypothesize that the reliance of a local (or state-level) economy to forestry should have some correlation with the forest cover of the area, i.e., a state with low forest cover will probably not have much contribution to its economy from its produce.

This is just a hypothesis, so we will need to examine it experimentally. There is the possibility that an area has a high percentage of forest cover due to restrictions placed on the felling of trees, so this need not necessarily correlate in its entirety. It does serve, however, as a useful indicator to be used alongside other methods at least.

5.3 Getting Data

Sector-wise data for each state for the year 2004-05 is available from The Planning Commission's website: [here](#). The file provided contains, again, contribution for each industry. We clean it to extract only 'Agriculture' and 'Agriculture and Allied' tables.

For Forest Cover, the Forest Survey of India has detailed records [2] dating from 1987 to present day. From this, we take the percentage of forest cover statistic for the years 2017, 2013, 2009, 2003, 1997, 1993, 1987.

5.4 Using the data

Plotting the contribution of Forests and Fisheries to the Agriculture Sector Given state-wise sector contribution data, we can get the average ratio of fisheries+forest to agriculture as:

$$value_{state} = \frac{agriculture_{state} - agricultureAndAllied_{state}}{agriculture_{state}}$$

We plot states in descending order of this contribution Fig 2.

Percentage Forest Cover We take the data from 2017 and plot in descending order of percentage cover Fig 2.

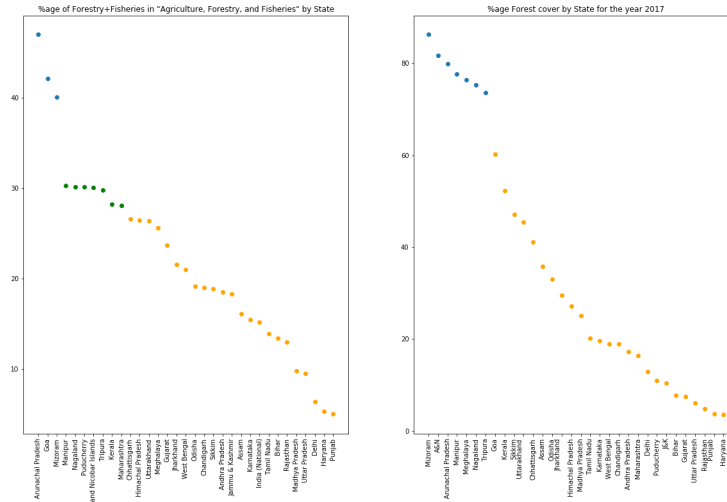


Fig. 2: Empirical methods to estimate State-reliance on Forests

5.5 Analyzing the Data

We identify the top 8 observations in Plot 1 as outliers. Of these, there are 5 northeastern states and 3 coastal ones (Table 2). Using our method of geographical elimination, we can identify that the northeastern states, at least, rely on forests and not fisheries.

In plot 2, the top 7 observations are very clear outliers. We tabulate the observations (Table 3). Here, in fact, 6 of the 7 observations are Northeastern States.

Interestingly, Meghalaya is the only state with a high percentage of forest cover that doesn't feature even in the top 10 of non-agricultural usage.

Also, Assam does not show up on either list.

Contribution of F+F				
$\geq 40\%$	<i>NE States</i>	Arunachal Pradesh	Mizoram	
	<i>Coastal States/UTs</i>	Goa		
$\sim 30\%$	<i>NE States</i>	Manipur	Nagaland	Tripura
	<i>Coastal States/UTs</i>	Puducherry	A&N Islands	

Table 2: Outliers in the Forest+Fisheries Data

Forest Cover							
$\geq 70\%$	<i>NE States</i>	Miz.	Arun. P.	Manipur	Megh.	Nag.	Tripura
	<i>Coastal States/UTs</i>	A&N					

Table 3: Outliers in the Forest Cover data

6 Applying methods to real events: Detecting Illegal Logging Activity

The Supreme court in 1997 (AIR 1997 SC 1228) placed a restriction on the felling of trees. As a result of which the GDP contribution of forestry to several North-eastern states came crashing [3]. Table 4 makes the drop rather apparent.

Year	Net state domestic product(million INR)	Forest contribution (Million INR)	Forest contribution(%)
1990	2311.1	221.2	9.6
1991	2642.4	223.9	8.5
1992	2710.7	307.3	11.3
1993	8121.3	932.4	11.5
1994	8726.8	1198.2	13.7
1995	10714.5	1165.5	10.9
1996	10827.1	1168.7	10.8
1997	11921.8	536.8	4.5
1998	13538.2	709.7	5.2
1999	14570.8	729.9	5
2000	15948.6	712.8	4.5
2001	17302.1	771.3	4.5
2002	17443.6	759.2	4.4
2003	19706.6	767.5	3.9

Table 4: Contribution of Forest Produce to the GDP of Arunachal Pradesh, 1990-2003

Evidently, the restriction had hurt the economy a significant bit, as forest contribution to the GDP (in percentage and absolute value, both) fell by a good 50%. How worth it was the move?

The judgement had been passed with the intention of preventing deforestation. In the years following, however, it was reversed. How successful was it? We can examine the change in forest cover in these states in Table 5.

State	1993	1997	2003
Arunachal Pradesh	82	81.92	81.22
Manipur	78.9	78.01	77.82
Meghalaya	70.3	69.8	<i>75.08</i>
Mizoram	88.7	89.06	87.42
Nagaland	96.5	85.78	82.09
Tripura	52.8	52.89	<i>60.01</i>

Table 5: Percentage forest cover in the northeastern states before and during the restriction on logging

Only Tripura and Meghalaya show improvements in forest coverage - for the rest, it is business as usual. The rate of change in forest cover before and after the imposition of the restriction remains constant. Why?

Evidently, permitted logging is not happening - the industry took a massive hit, as evidenced by the Arunachal statistic 4. For this to happen, two things could have happened:

1. Illegal Logging

The more likely event, unless permitted logging before was done in an entirely sustainable manner. Forest cover should have increased, and not decreased/remained constant as it did.

2. No illegal logging

Unlikely, as this requires sustainable logging to be carried out. Especially unlikely in 20th century India.

7 Conclusion

Despite the strong local importance, forests do not particularly show up on the national map when considering their contribution to the GDP of the nation. When exploring in the local context, however, it is possible to use information on them to make inferences.

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