

## Spatial and temporal patterns in forest plantations in India

Additions to forest and tree cover constitute an important element of India’s Intended Nationally-Determined Contributions to reductions in global carbon emissions. This Data Brief describes the enormous efforts that have been undertaken by the Union Ministry of Environment, Forests, and Climate Change, as well as the Forest Departments at the state level in raising plantations across India’s varied

geography. Government of India makes data on forest plantations available on a dedicated website and updated on a continuous basis. With additional resources being devoted to raising forest plantations and large-scale funds being made available to states to accelerate coverage of plantations, it is an appropriate time to examine the scale of the effort, and identify potential challenges.

Table 1: Number of Plantations across States (2009-2015)

State	2009	2010	2011	2012	2013	2014	2015	Total
Andhra Pradesh	28	380	656	687	551	633	541	3,476
Chhattisgarh	64	233	140	203	157	215	58	1,070
Himachal Pradesh	58	99	58	139	228	128	50	760
Jharkhand	0	520	154	130	130	152	99	1,185
Karnataka	192	636	559	475	217	151	119	2,349
Maharashtra	190	401	975	858	788	327	37	3,576
Odisha	1,222	243	118	70	13	479	299	2,444
Rajasthan	0	115	117	195	259	326	255	1,267
Telangana	30	139	368	392	234	176	202	1,541
Uttarakhand	7	73	163	148	200	113	76	780
Total	1,791	2,839	3,308	3,297	2,777	2,700	1,736	18,448

This rich dataset and openness with which data is shared on a public website deserves to be applauded, in spite of obvious shortcomings. Here we describe the main features of the data through tables and figures, and also share the data described here in a downloadable format for use by interested readers. The Data Brief covers 18,448 plantations across ten major states undertaken during 2009-2015 (See Table 1 below). For the sake of convenience and comparability, we divided the data between

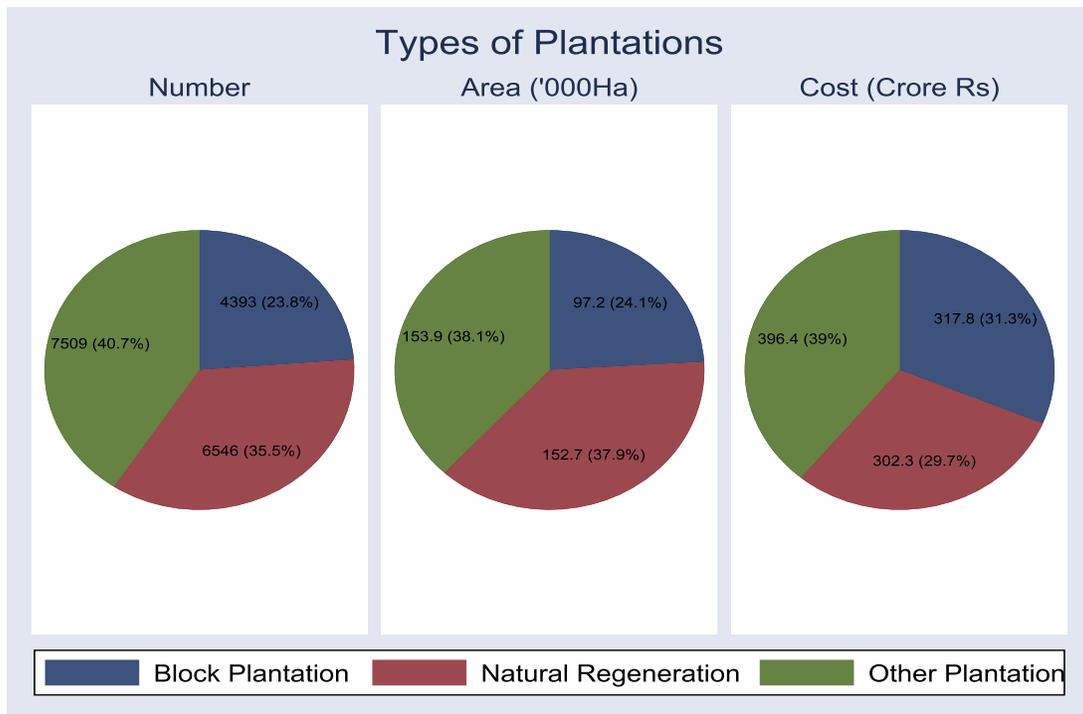
Telangana and Andhra Pradesh for years before 2014. We used information provided on the [e-Green Watch](#) portal of the Government of India (Integrated e-Governance Portal for Automation, Streamlining & Effective Management of Processes related to Plantation & Other Forestry Works). From the data available, we picked the ten states with the highest frequency of plantations recorded on the website. We hasten to add that this is not an exhaustive census of all plantations undertaken during this period.

Notable exclusions included Gujarat, a state with vigorous plantation activity but only three plantations recorded on the portal. Even in the states we included in the analysis, there were clearly delays of multiple years in uploading the data to the portal, leading to a severe underestimate of the total number. We also excluded extreme values that indicated typing errors, and restricted our analysis to plantations with an area between one hectare and 100 hectares. Therefore, any analysis of these plantations should not be construed as covering all plantations in India.

The 18,448 plantations cover slightly more than 400,000 hectares, with more than 90% occurring on land classified as Notified Degraded Forest. There are only two exceptions to this rule – Chhatisgarh (74%) and Uttarakhand (36%) buck

this trend, with 25% of plantations in Chhatisgarh and 63% in Uttarakhand undertaken on Revenue Department land. Only two-thirds of the plantations (67%) in the dataset had information on expenditure, and these plantations entailed a total of INR 1016 Crores across all states. The data listed 82 different schemes under which the plantations were undertaken. Most of these were specific to a state, and only a few were spread across all states. Based on preliminary research, we classified the schemes into two major categories for Types of Plantations – Block Plantations and Natural Regeneration. However, we could not classify 7,509 plantations (40.7% of total) with enough confidence, and therefore classified these into a residual Other Plantations category. The figures for these respective categories are provided below.

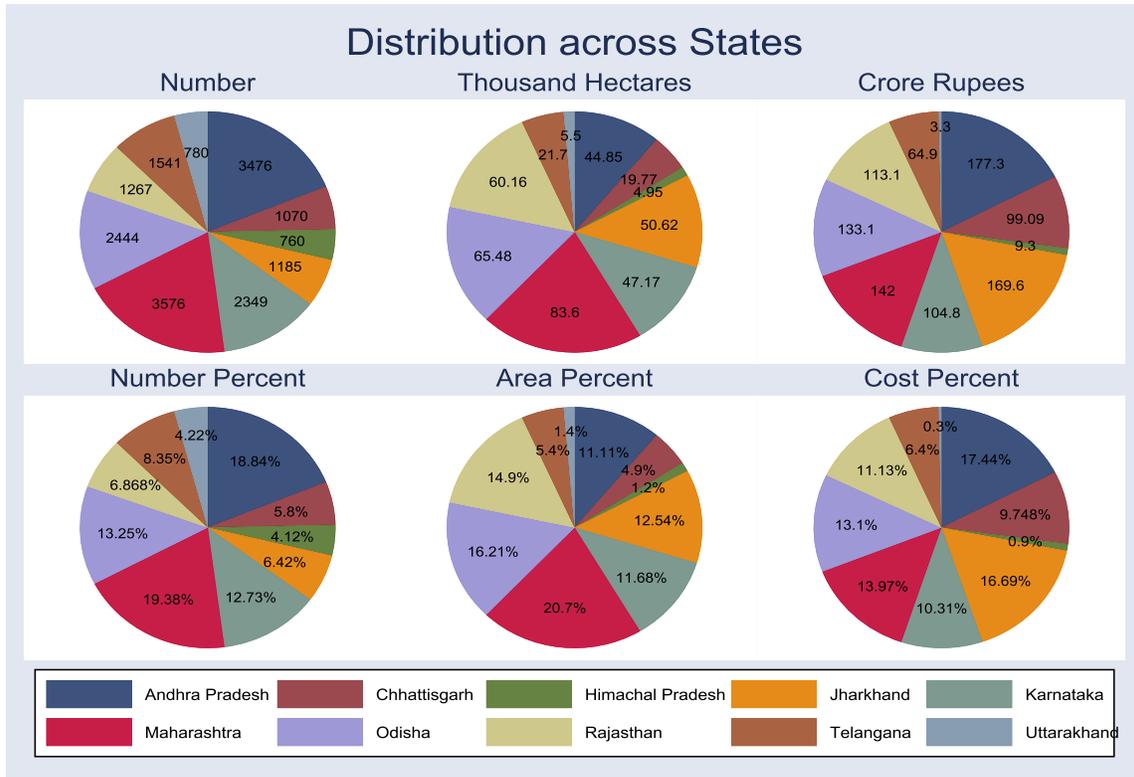
Figure 1: Number, Area, and Cost of Plantations across types



The plantations are distributed somewhat disproportionately across states in terms of number of plantations, total area covered by plantations, as well as expenditure on different kinds of plantations. Andhra Pradesh,

Jharkhand, Maharashtra, and Odisha stand out as the leading states on all three parameters. The distribution across states is shown in Figure 2 below.

Figure 2: Number, Area, and Expenditure on Plantations



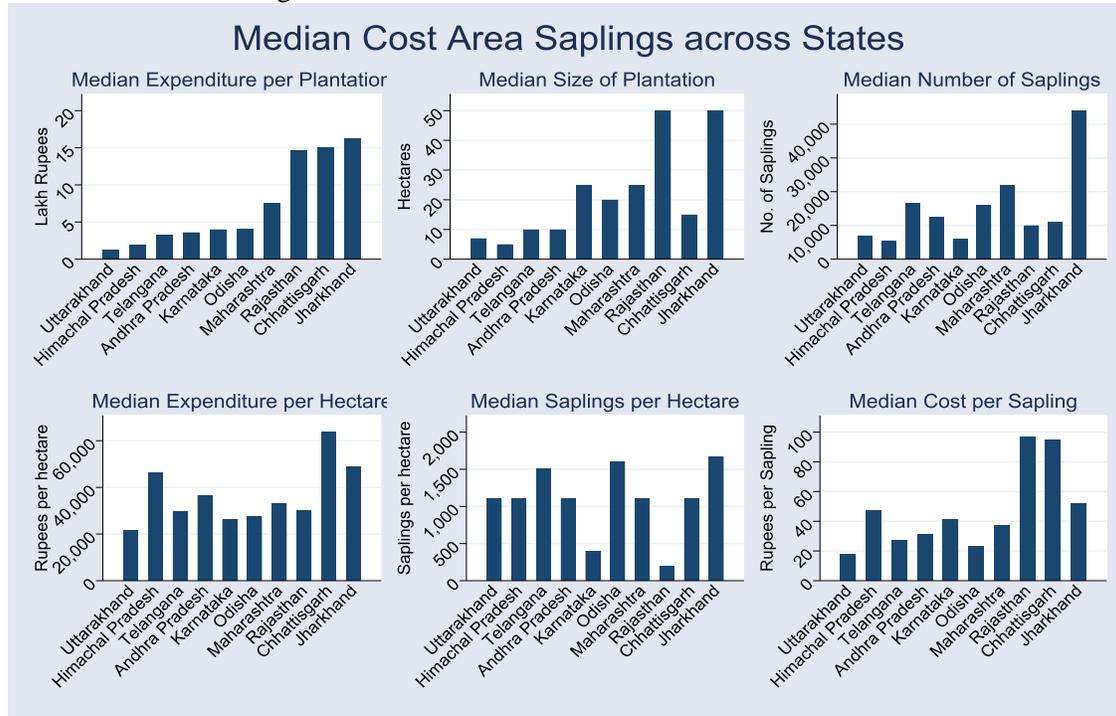
There is also great disparity in area, cost, and number of saplings at the plantation level. Jharkhand appears at the top of the table for all metrics of size, with the highest values on median cost of plantation, median size of plantation, median number of saplings in a plantation, as well as median number of saplings per hectare of a plantation. The comparative statistics for median values on six metrics of size are provided in Figure 3 below. The median expenditure per plantation ranges between just

over one lakh for Uttarakhand to more than 15 lakhs for Jharkhand. The median size ranges from less than five hectares for Himachal Pradesh to 50 hectares for Jharkhand and Rajasthan. Karnataka and Himachal Pradesh have the lowest median number of saplings proposed to be planted per plantation at less than 6000, while Jharkhand is way ahead of every state at a median value of 44,000 saplings per plantation.

There is less disparity between states in terms of cost per hectare, saplings per hectare, and cost per sapling. Median expenditure per hectare ranges between INR 21,525 for Uttarakhand and INR 63,680 for Chhattisgarh. Rajasthan has the least value on the median number of saplings per hectare at 200, with Jharkhand leading once

again at 1666 saplings per hectare. Rajasthan and Chhattisgarh lead the table on median cost per sapling with values exceeding ninety rupees per sapling, with the lowest values coming from Uttarakhand (INR 17.50) and Odisha (INR 23.18).

Figure 3: Median Values on Size Metrics across States



As state governments gear up for another season of forest plantations, it is a little sobering to consider the challenges facing us in meeting stated objectives and goals. In a country as diverse as India, no single model will work even in most places. Careful analysis of data will provide insights on where we are able to meet our targets, and build on these spaces of hope. On other occasions, the data also provide a view into our failings, and cause for introspection and deeper analysis in order to improve our performance. Of course, these data are unable to say much about the actual performance of forest plantations. However, the open data website e-Green Watch also provides spatially-explicit

data on the location of these plantations. This should enable us to learn much more about where the gaps are and identify spaces where we can learn from. We are pleased to provide these data, both the data analyzed here in this data brief as well the spatially-explicit location data for more than 5,200 plantations, as links for download below.

For questions, clarifications, and comments, please write to [bharti\\_institute@isb.edu](mailto:bharti_institute@isb.edu). Data used in the description and analysis presented in this brief can be downloaded [here](#). Spatially-explicit data on location of plantations can be downloaded here ([KML](#) and [XLS](#)).