

Digital database for preparation of Working Plan of Kolasib Forest Division, Mizoram

Background: Sponsored by the Government of Mizoram in the year 2001, the project aimed at preparation of a GIS-based digital database including spatial and non-spatial data to assist the State Forest Department in preparation of Working Plan. Under the project, digital forest cover maps for the entire State were prepared and a pilot study was done for estimation of growing stock of the forests in the Kolasib forest Division.

The State: Mizoram, earlier known as Lushai Hill District of Assam, became the twenty fourth State of the Union of India on 20th February, 1987. Geographic area of the State is 21,081 km². The terrain is hilly with parallel ranges running from North to South. Climate is moderate with annual average rainfall ranging between 2160 mm and 3500 mm, and average temperature between 11° C and 29° C. Total population of the State is about 0.89 million of which tribal population constitutes 94.74%. Livestock population is only 0.2 million.

Mizoram, a forest rich state, has 87.42% of its geographic area under forest cover (18,430 km²) which can be categorized into three forest types, namely Tropical Wet Evergreen, Tropical Moist-deciduous and sub-tropical pine forests. For the purpose of management and administration, the state is divided into 12 forest divisions falling under three territorial circles. The forests of Mizoram are governed by the Mizoram (Forest) Act, 1955. Major activities of Mizoram Forest Department include plantation and protection. There is not commercial utilization of forests but felling for *bona fide* use to meet the local needs is permitted.

Study Area: In this study, Kolasib Forest division of Mizoram (Fig. 8) was selected for the purpose of pilot study for estimation of growing stock through a GIS based methodology. Total geographic area of Kolasib Forest Division is 1,599 km² with altitude ranging between 55 meter and 1500 meter. Average rainfall varies from 3000 mm to 3500 mm and temperature from 5°C in winter to 35°C in summer. For administration and management the division has nine ranges. Total recorded forest (Reserved forests) area of the Division is 572 km² constituting 48.24% of the total geographic area. Total forest cover Kolasib Forest Division is 1,320 km² of which 787.19 km² is under dense forest and 532.82 km² under open forest cover.

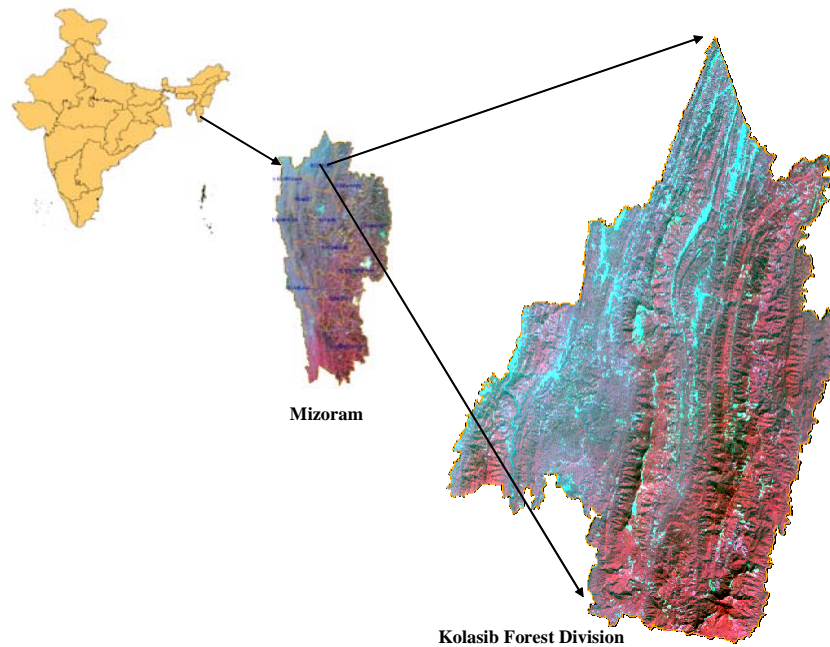


Fig 8: Study Area (Kolasib Forest Division) with satellite data draped over it

Methodology: A GIS based approach was adopted for carrying out the assessment. The spatial data used, consist of satellite data (LISS-III of IRS 1D) of the year 2000, thematic maps on 1:50,000 scale, Survey of India toposheets on 1:50,000 and 1:250,000 scale covering the study area, forest cover maps on 1:50,000 scale based on FSI's 2001 assessment and administrative maps showing boundaries of forest divisions, ranges and compartments provided by the Forest Department, Mizoram on 1:50,000 scale.

Features like contour (100 m interval), major roads, rivers and village locations were digitized from Survey of India Topographic maps. Other features like boundaries of Divisions, Ranges, compartments and Reserved forest (Fig 9) were digitized from the administrative maps provided by the Forest Department, Mizoram. Buffers of 200m from main drainages, 500m from roads and 4 km around settlements in Kolasib Forest Division were created using Survey of India topographic maps and maps provided by the Mizoram Forest Department. Digitization was done using Arc Info software (8.1 version). A Digital Elevation Model (DEM) was generated using 100 m contour layer and altitude, aspect and slope maps were then generated using Arc Info. Forest cover layer was obtained from the forest cover maps on 1: 50,000 scale prepared by FSI based on its 2001 assessment. Four forest type strata (Pure bamboo, Mixed bamboo, Miscellaneous forest and roadside teak plantations) were delineated through digital image analysis using ERDAS imagine 8.6 version software (Fig.10)

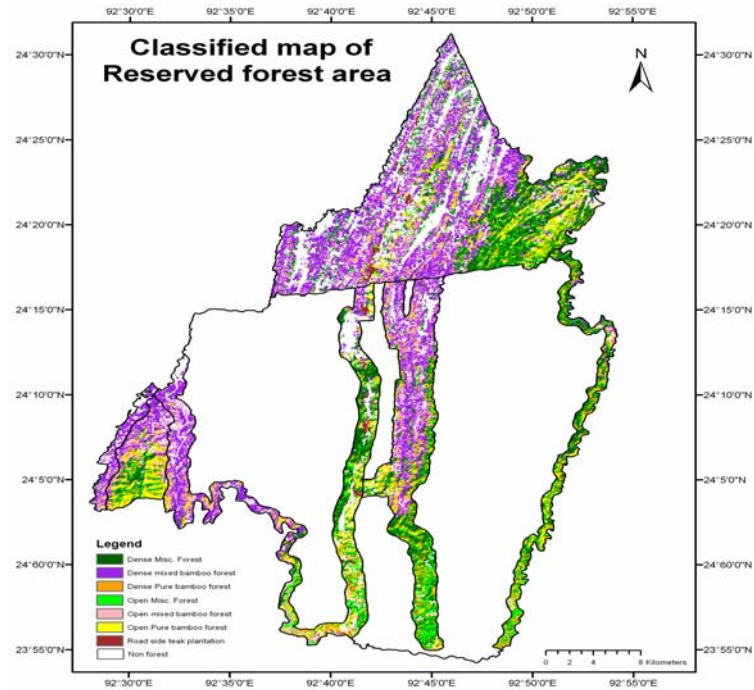


Fig. 9: Classified map of Reserved Forest Area

The entire study area was initially divided into 36 strata using the aforementioned spatial layers. It was observed that effect of altitude, aspect and slope was not significant on species composition. Therefore, for the purpose of the study, the forest cover of entire division was divided into 7 strata based on forest types and density viz. Dense Miscellanies forest, Open Miscellanies forest, Dense Mixed Bamboo, Open Mixed Bamboo, Dense Pure Bamboo, Open pure bamboo and roadside teak plantation. The remaining area was classified as non-forest. Based on a stratified random sampling method, field inventory was carried out to determine wood volume of tree species and Bamboo.

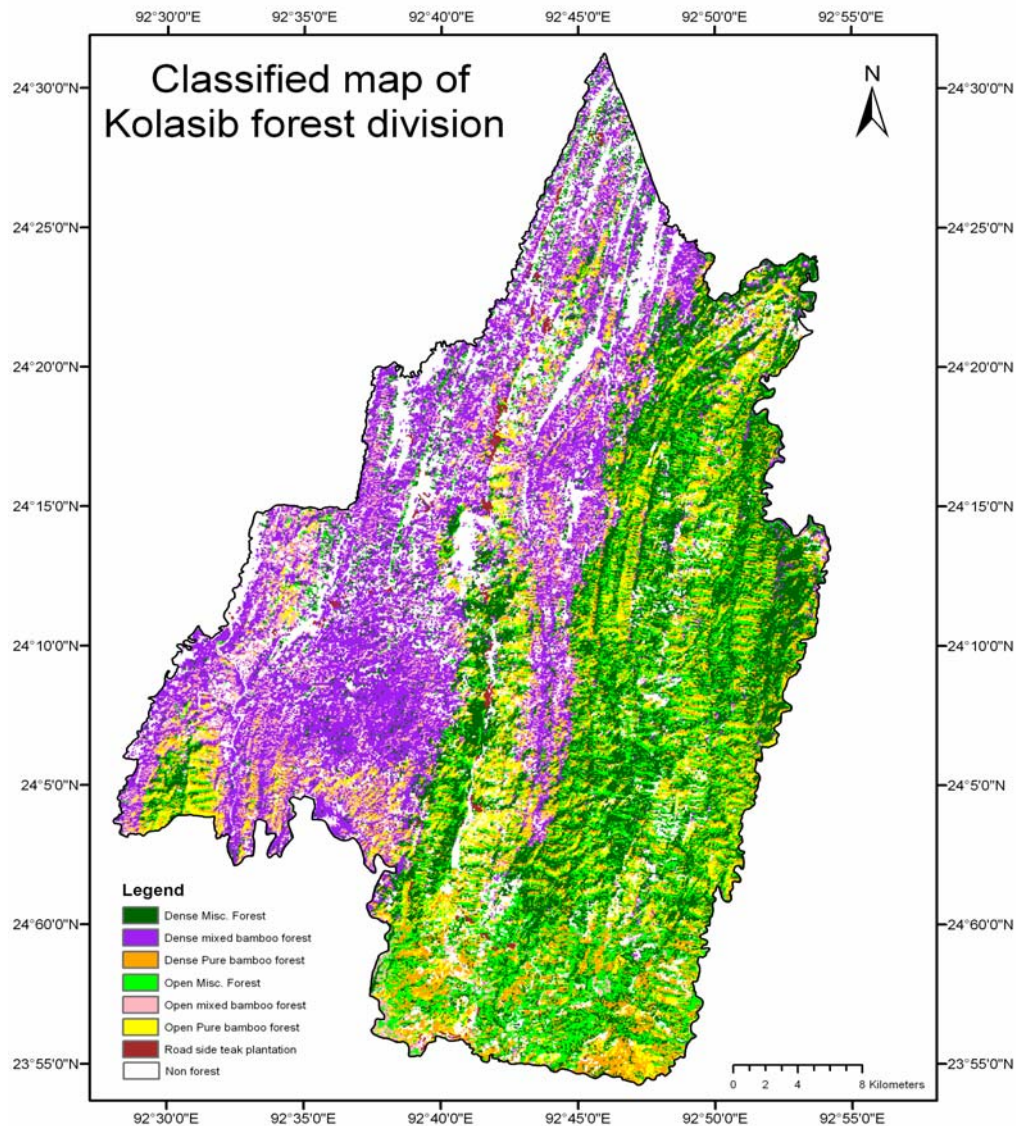


Fig. 10: Classified map of Kolasib Forest Division

Important Findings

- Total forest cover of Kolasib forest division is estimated as 1,320 km² which constitutes 85% of the area of the division. Of this 787 km² (59.6%) is under dense forest and 544 km² (40.4%) is under open forest category.
- Forest cover in the reserved forest of the division is 599 km² constituting 79.7% of Reserved Forest area. Of this 369 km² is under dense forest and 230 km² under open forest.
- Among the eight forest type/ density strata, Dense Mixed bamboo forest occupies the largest area (322 km²) followed by Dense Misc. forests (315 km²). Within reserved forest, Dense mixed bamboo forest constitutes maximum area (186 km²) in the Division (Fig. 11)

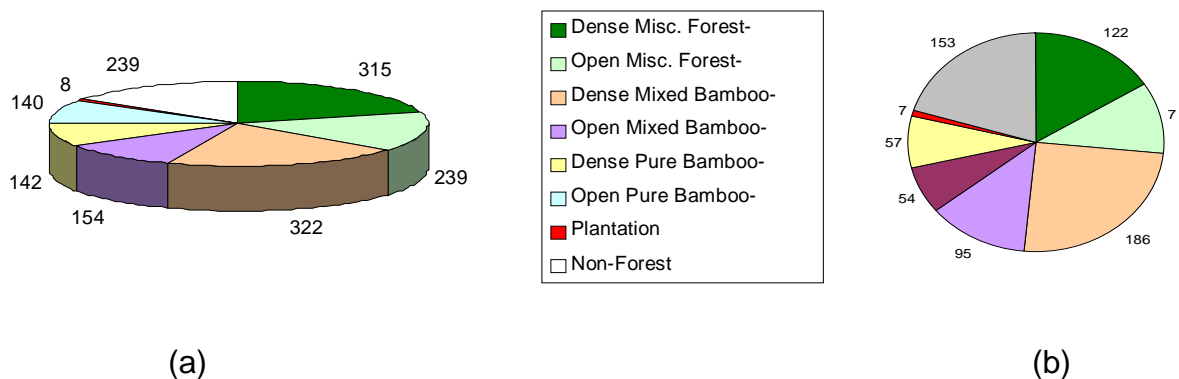


Fig 11: Distribution of Forest Type Strata in (a) total area (b) Reserved Forest (Area in km²)

- Total growing stock of trees in Kolasib Forest Divisions was estimated to be 5.361 million cu.m giving per ha volume as 32.58 cu.m (Table 12). Total growing stock of clump forming (CF) bamboo, is 66,237 tons (0.425 ton/ha) and that of non-clump forming (NCF) bamboo as 2.47 million tons (15.13 ton/ha)

Table 12: Details of Growing Stock in Kolasib Forest Division

Details	Total			In Reserved Forest		
	Trees	Bamboo		Tree Sps	Bamboo	
		CF	NCF		CF	NCF
Stems or Culms/ha (Nos.)	139	67	4891	142	7311	49
Total Stems/Culms (Nos.)	22,111,529	11,400,187	765,663,875	8748312	6073775	325887851
Volume per ha (cu. m.)	32.58			34.39		
Dry Weight/ha (Tonnes)		0.425	15.13		0.421	15.86
Total Volume (cu. m.)	5,360,781			2499581		
Total dry Weight (Tonnes)		66,237	2,472,220		31665	1164191

- Total growing stock in the RF of Kolasib forest division is estimated as 2.5 million cu.m. (46.63% of total growing stock of the division). Dry weight of CF and NCF bamboos within RF area of the division is estimated as 47.8% and 47.1% of the total dry weight of the respective classes of bamboo in the division. This shows that growing stock of trees and bamboo outside reserved forest area is slightly more than the growing stock within reserved forest area of the division.
- Maximum growing stock of trees is observed in Dense Misc. Forest strata (2.03 million cum m) for the total area of the Division. Within reserved forest area of the division, maximum growing stock of trees is however observed in Mixed Bamboo Dense forest strata.
- Kawnpui forest range has maximum area under forest cover (251 km²) followed by North Hlimen (243 km²) and Bukpai (234 km²) (Fig. 12). N.

Hlimen range has maximum percent of its area under forest cover (94.7%) followed by Bukpui (93.7%) and Kawnpui (87.73%).

- Saipum range has maximum area under reserved forest (124 km²) followed by Kawnpui (120 km²) and Bairabi (107 km²). Forest cover within reserved forests is also maximum in these ranges in the same order (111.35 km²., 98.01 km² and 85.19 km² respectively).

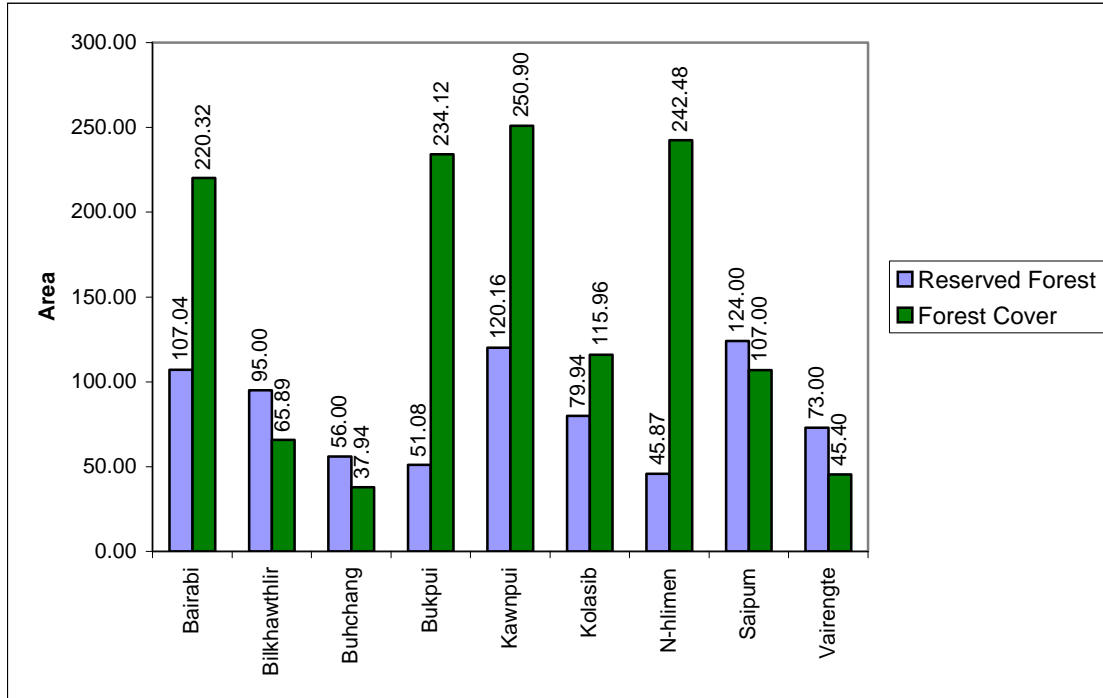


Fig.12: Range wise distribution of Reserved Forests and Forest Cover

- Dense mixed bamboo strata was found to cover maximum area in most of the ranges.
- North Hlimen range is found to have maximum tree growing stock (28,600 cum.m.). Growing stock of clump forming bamboo was found highest in Bairabi range (14,353 tons) whereas growing stock of non clump forming bamboo was recorded in Kawnpui range (0.51 million tons) (Table 13).

Table 13: Range wise Growing Stock in Kolasib Forest Division

Range name	Geographic area(ha)	Tree volume (cu m)	Volume (cu m/ha)	NCF bamboo dry wt. (tonnage)	Dry Wt.(ton/ha)	CF bamboo dry Wt.(tonnage)	Dry Wt.(ton/ha)
Bairabi	26500.00	899001.6	33.9	495990.98	18.72	14353.06	0.542
Bilkhawthlir	9500.00	283559.1	29.8	136537.02	14.37	4130.62	0.435
Buhchang	5600.00	182101.0	32.5	74662.95	13.33	2364.48	0.422

Bukpui	25000.00	881916.4	35.3	400440.94	16.02	9687.87	0.388
Kawnpui	28600.00	934335.6	32.7	505026.89	17.66	12683.81	0.443
Kolasib	15400.00	495186.1	32.2	231442.00	15.03	6689.49	0.434
N-hlimen	25600.00	1011840. 3	39.5	364529.80	14.24	9055.14	0.354
Saipum	12400.00	450482.4	36.3	183625.04	14.81	4671.44	0.377
Vairengte	7300.00	222358.4	30.5	79964.14	10.95	2600.99	0.356
Total	55900.00	5360781. 1	32.58	2472219.76	15.86	66236.90	0.425

- Within reserved forest area of the ranges, saipum range has the maximum tree growing stock (0.469 million cu.m.) followed by Kawnpui (0.382 million cu.m.) and Bairabi (0.315 million cu.m.). The clump forming bamboo has maximum dry weight in Bairabi (4,355 tons) followed by Bilkhahtlir (4114 tons) and Saipum (3902 tons). In case of non clump forming bamboo, Bairabe leads with 0.197 million tones followed by Kawnpui and Saipum (both having almost same dry weight of non clump forming bamboo (0.191 million tones) (Table 14).

Table 14: Range wise Growing Stock within Reserved Forest

Range	Reserved Forest (ha)	Tree		NCF Bamboo		CF Bamboo	
		Vol. (cu.m)	Vol. (cu m/ha)	Dry Wt. (ton)	Dry Wt. (ton./ha)	Dry Wt.(ton)	Dry Wt. (ton/ha)
Bairabi	10703.97	314518.83	29.38	196559.4	20.69	4355.45	0.41
Bilkhathlir	9500	306668.27	32.28	147664.3	26.37	4114.48	0.43
Buhchang	5600	226470.98	40.44	92855	18.18	2932.19	0.52
Bukpui	5107.59	170258.18	33.33	85154.7	7.09	1255.09	0.25
Kawnpui	12016.24	382753.33	31.85	191222.1	23.92	3170.26	0.26
Kolasib	7993.57	246141.82	30.79	111926.2	24.40	2941.67	0.37
N-Hlimen	4587.13	169364.92	36.92	70551.4	5.69	1425.96	0.31
Saipum	12400	468784.45	37.81	191076.5	26.17	3901.64	0.31
Vairengte	7300	214620.61	29.40	77181.5	1.03	2555.62	0.35
Total	75208.5	2499581.4	33.24	1164191.2	15.48	26652.38	0.35

- Extent of forest cover and growing stock was also estimated in (i) 200 m buffer along main drainage, (ii) 500 m buffer along roads and 4 km. buffer around village settlements (Fig.13). It is observed that forest cover and growing stock around the settlement is more than those along roads and drainage (Table 15).

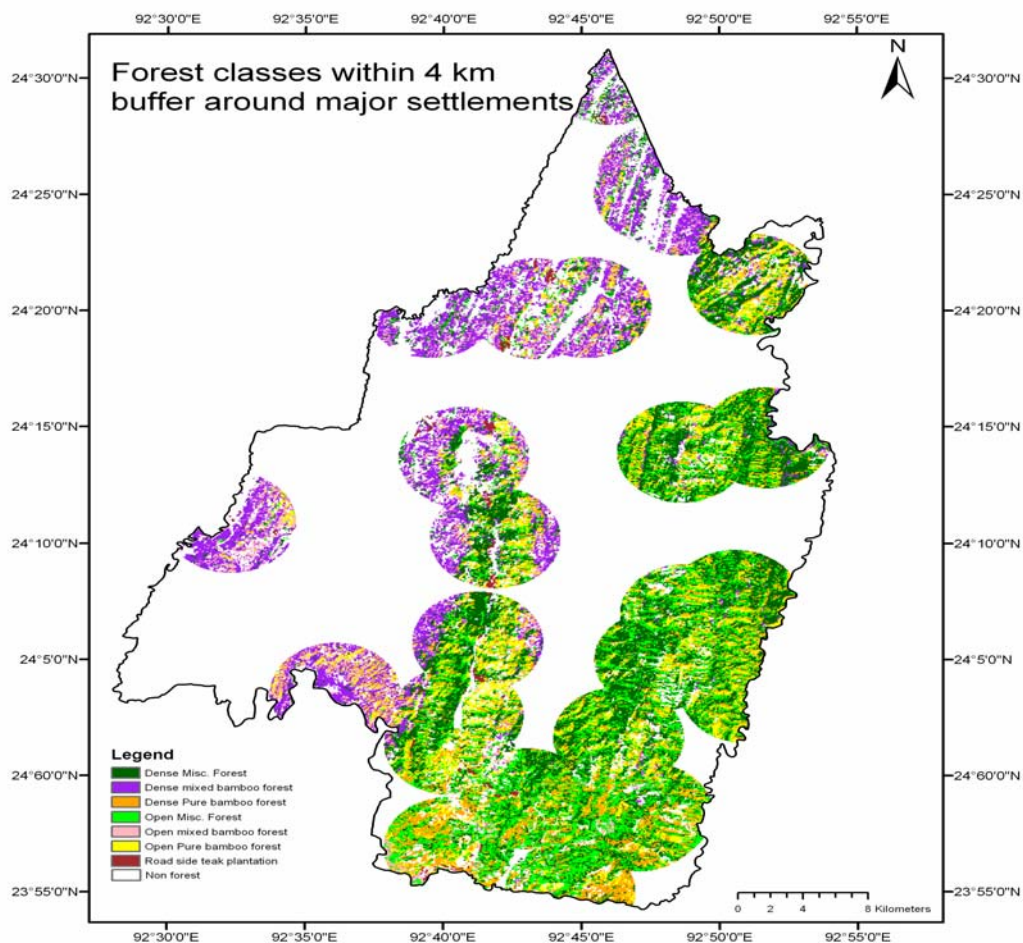


Fig.13: Forest classes within 4 km buffer and village settlements.

Table 15: Forest Cover and Growing Stock in Buffer Areas

Buffer	Area (km ²)	Forest Cover (km ²)			Growing Stock					
		Dense Forest	Open Forest	Total	Trees (cu.m)	Vol/ha (cu.m)	NCF Bamboo Dry Weight		CF Bamboo	
							Tons	Tons/ha	Tons	Tons/ha
200m Buffer along drainages	414	208	121	329 (79.46)	1368045	33.03	633038	15.28	18906	0.456
500m Buffer along roads	361	165	103	268 (74.23)	1194781	33.08	495508	13.72	14911	0.413

4 km around Village Settlements	867	409	313	722 (83.27)	288203 5	33.23	131513 3	15.1 6	38068	0.43 9
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