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Environmental Impact of Cutting of Trees due to Road Expansion in Bhadrak, Odisha

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Abstract

Akhandalamani Temple at Aradi Odisha, India is dedicated to very famous Lord Shiva (Baba Akhandalamani), so many tourist and devotees pass through that green tunnel between Bhadrak-Kothar-Aradi road. So this research was carried out in Bhadrak-Kothar-Aradi road to assess the impact of cutting of trees due to expansion on environment and the effect of cutting of trees for road expansion on local dwellers and their livelihood. Total 5066 no trees have been cut out of which 2440 and 2626 no of trees were along L.H.S and R.H.S of the road respectively. Diversity of the cut trees was assessed and found that there was 64 species of trees of around 23 families like *Peltophorum ferrugineum (1146) ,Samanea saman (690),Alstonia scholaris (508),Cassia seamea (287),Azadirachta indica (259),Phoenix sylvestris (245),Acacia mangium (238), Albizia lebbeck (201),Terminalia arjuna (159),Lagerstroeimia parviflora (151)*etc. Biomass estimation of cut trees was done by *Brown et al.,'s* pan-tropical equation and found that approx. 4978.04 tons of total biomass removed from the site along with the loss of 2737.92 tons of carbon stock loss. People will suffer a lot during hot seasons and decreased aesthetic value of the road will definitely make the heart of regular traveler's sorrow stricken. So, change in policies of government, adoption of new technologies like translocation of whole mature tree, or diversion of road, if possible, should be done at priority basis to avoid such felling.

Key words : *road expansion, cutting of trees, biomass estimation, impact.*

Introduction

The environment includes land, water, air and the interrelationship which exist between these elements and human beings, other living creatures, microorganisms, plants, and property (Environmental protection act, 1986, sec2a). All living things of the world fully depend upon the environment to survive. It fulfills the basic needs of our life. But now a day's many species were became extinct due alteration in ecosystem or environment by the human activities which ultimately results imbalance in nature. Among all anthropogenic activities deforestation is one of the major causes for degradation and destruction of the environment. Forest loss and damage is the cause of around 10% of global warming. There's simply no way we can fight the climate crisis if we don't stop deforestation. The indiscriminate felling of trees has resulted in a reduction of 3.16% in the global forest cover from 1990 to 2015 (1). From 2002 to 2022, India lost 393 kha of humid primary forest, making up 18% of its total tree cover loss in the same time period. Total area of humid primary forest in India decreased by 3.9% in this time period. From 2001 to 2022, India lost 2.19 mha of tree cover, equivalent to a 5.6% decrease in tree cover since 2000, and 1.11Gt of CO2 emissions. Odisha had lost 127kHa of forest area since 2001-2022 (Global forest watch). Odisha cut 1.85 cr. trees to widen roads in 10 years, planted only 29 lakh reported by (1).

Diversion of the forest land for non-forest use and wanton cutting of trees for road-widening are one of the major causes of frequent natural calamities like floods, cyclones and droughts in the state. This year in 2023 a large no of trees has been cut for the road expansion in Bhadrak-Kothar-Aradi road, Bhadrak, Odisha on which our research is based on. Bhadrak-Kothar-Aradi (State Highway-35) road serves as a major path which connects Baba Akhandalamani temple to district headquarters, Bhadrak. The temple is the most famous tourism spot of Bhadrak. Lakhs of tourist throng across that road each year especially during Mahashivaratri and srawan month. The road had also a special identity for its aesthetic value but unfortunately due to cutting of trees it lost its beauty. For expansion of this road from single lane to double lane, trees on the either side of the road were cut. For a district like Bhadrak whose forest cover is already very less (<2%) it is very vital to raise concern over it. Road expansion will have an undesirable consequence on environment as well as the local people and their livelihood. It is very important to know the consequences with facts and figures so that it will be easy to convince people and raise awareness among them.

Materials and Methods

The present investigation was conducted during the month of June to September 2023 in Bhadrak-Kothar Aradi Road i.e. State Highway 35 (0km to 33km).This road has been taken up to assess the sudden changes in environment and effect of road expansion (from single

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Table-1 : No. of trees cut along R.H.S and L.H.S of the Bhadrak-Kothar-Aradi road (0-33Km).

Name of the Range	No. of trees cut		Total
	L.H.S	R.H.S	
Bhadrak (WL) Range	771	907	1678
Dhamnagar Range	1669	1719	3388
Grand Total	2440	2626	5066

lane to double lane) on local people and their livelihood due to recent cutting of trees from the roadside. Primary data from June to September, 2023 gathered mainly through questionnaires and interviewing roadside residents, local travelers, tourists, shopkeepers nearby the road. The data was collected through interviews based on the questionnaire administrated to the 50 respondents. The secondary data was collected from various sources such as data or information published by public works department, Govt. of Odisha, reports published by different agencies, journals, articles, books, reports from Government offices such as Divisional Forest office, Chandabali, Bhadrak & Bhadrak Range office, Satabhauni, libraries, thesis submitted by researchers and electronic sources etc. Abstract of number of trees cut on both sides of the road i.e. along right hand side and left hand side along with their species composition, girth class, diameter class was collected from Divisional Forest office, Chandabali , Bhadrak followed by data analysis.

The allometric regression model used to estimate tree's biomass by converting the forest inventory data, based on allometric relation using biomass from stem diameter and/or tree height to estimates of aboveground biomass (2,3). In this study general regression equation given by Brown *et al.* (1989) for tropical areas having rainfall less than 1500mm was used to estimate above ground biomass of tropical trees.

$$AGB = 34.47 - 8.068(D) + 0.6589 (D^2)$$

Where, AGB= above ground biomass in kg, D= Diameter at breast height in cm, (Diameter >10cm, rainfall <1500mm)

According to Woldegerima *et al*., (2017), it is possible to determine BGB by multiplying AGB by a factor of 0.26 based on root shoot ratio relationship (Ravindranath & Oswald, 2008) i.e BGB = AGB × 0.26 and Total biomass = TAGB+TBGB, TAGB of Girth class = n × AGB of individual tree of that girth class, Where, n = no of trees in that girth class .

The calculation of carbon stock offered by Winrock (1997), to convert from biomass to carbon stock: C = 0.55 × biomass (total). Weight of CO_2 sequestered in tree can be calculated Wco2 = 3.67 × Wc, Where, Wco2 = weight of carbon dioxide sequestered and Wc = weight of carbon

Results and Discussion

Diversity and no of tree species lost : Total 5066 no trees have been cut out of which 2440 and 2626 no of trees were along L.H.S and R.H.S of the road respectively (Table-1). Diversity of the cut trees were assessed from the data collected from Divisional Forest office, Chandabali, Bhadrak and it was found that there was 64 species of trees of around 23 families. Among major species which were present more in number are *Peltophorum ferrugineum* (1146), *Samanea saman* (690), *Alstonia scholaris* (508), *Cassia seamea* (287), *Azadirachta indica* (259), *Phoenix sylvestris* (245), *Acacia mangium* (238), *Albizia lebbeck* (201), *Terminalia arjuna* (159), *Lagerstroeimia parviflora* (151) etc. (Table-2). No of trees cut in each girth class was assessed from secondary data obtained and found that maximum no of trees i.e. 1592 were cut in girth class 60-90cm constituting 31.42% of total trees cut followed by girth-class 90-119cm and lowest for 360-419cm gbh class (Fig.-1).

Biomass and carbon storage estimation of cut trees : Biomass is calculated by using Brown *et al.,*'s (1989) pan-tropical equation for tropical trees in dry life zones, rainfall (=1500mm) and it was found that approximately 3950.83 tons of above ground biomass has been removed from the road side through cutting.

Effects of road construction development on environment :

1. Air quality : Rapid growth in road transportation sector may leads to increased emission of vehicular exhaust, resulting in deterioration in the quality of ambient air. Font *et al. (*2014) also recorded that after the completion of the road widening or construction activity, there was an increase in all the pollutants from the road during rush hour: 1 µg m-3 PM2.5, 2-4 µg m-3 for PM10, 8 and 40µg m^{-3} for NO_2 and NO_X, respectively illustrating a notable deterioration in residential air quality.

2. Soil quality : Dislodge and compressed soils resulting in loss of biomass productivity. Altered conditions that change plant growth, soil pH, and the vegetative community structure (i.e., water retention and light levels; temperature, soil displacement, and compaction; and dust) given by (4).

Table-2 : Species wise no. of trees cut along the road side.

Sl. No.	Common Name	Scientific Name	Family	No of trees cut		Total
				RHS	LHS	
01	Ambada	*Spondias pinnata*	Anacardiaceae	2	3	5
02	Acacia	*Acacia auriculiformis*	Fabaceae	3	12	15
03	Achu	*Morinda tinctoria*	Rubiaceae	15	16	31
04	Asoka	*Saraca asoca*	Fabaceae	-	1	1
05	Arjuna	*Terminalia arjuna*	Combretaceae	96	63	159
06	Aswastha	*Ficusr eligiosa*	Moraceae	38	20	58
07	B.Sisso	*Dalbergia latifolia*	Fabaceae	6	13	19
08	Babul	*Acacia nilotica*	Fabaceae	44	17	61
09	Baburi	*Acacia farnesiana*	Fabaceae	19	39	58
10	Badam (Katha)	*Sterculia foetida*	Malvaceae	1	-	1
11	Bara	*Ficus benghalensis*	Moraceae	17	9	26
12	Barakoli	*Ziziphus mauritiana*	Rhamnaceae	13	8	21
13	Bottle Brush	*Callistemon viminalis*	Myrtaceae	5	7	12
14	Baula	*Mimusops elengi*	Sapotaceae	2	1	3
15	Bela	*Aegle marmelous*	Rutaceae	17	9	26
16	BilatiKayan	*Pithecellobium dulce*	Fabaceae	7	4	11
17	Jhaun	*Casuarina equisetifolia*	Casuarinaceae	-	4	4
18	Chakunda	*Samanea saman*	Fabaceae	326	364	690
19	Chhatiana	*Alstonia scholaris*	Apocyanaceae	250	258	508
20	Coconut	*Cocos nucifera*	Arecaceae	55	30	85
21	Debadaru	*Polyalthia longifolia*	Anonaceae	-	2	2
22	Dimiri	*Ficus racemosa*	Moraceae	5	5	10
23	Eucalyptus	*Eucalyptus spp.*	Myrtaceae	4	1	5
24	Fasi	*Anogeissus accuminata*	Combretaceae	3	1	4
25	Gambhari	*Gmelina arborea*	Lamiaceae	3	4	7
26	Gangasiuli	*Nyctanthes arbor-tristis*	Oleaceae	6	-	6
27	Guava	*Psidium gujava*	Myrtaceae	-	1	1
28	Gohira	*Acacia pinnata*	Fabaceae	15	-	15
29	Hinjala	*Baringtonia accutangula*	Lecythidaceae	7	-	7
30	Panasa	*Artocarpus heterophyllus*	Moraceae	2	3	5
31	Jamun	*Syzygium cumini*	Myrtaceae	4	5	9
32	Jandakhai	*Phyllanthus reticulatus*	Phyllanthaceae	67	35	102
33	Kadamba	*Neolamarckia cadamba*	Rubiaceae	22	22	44
34	Kaitha	*Limonia acidissima*	Rutaceae	1	6	7
35	Kaniari	*Cascabelathevetia*	Apocyanaceae	4	-	4
36	Kanchan	*Bauhinia variegate*	Fabaceae	4	1	5
37	Karanja	*Millertia pinnata*	Fabaceae	29	37	66
38	Khajuri	*Phoenix sylvestris*	Arecaceae	105	140	245
39	Krushnachuda	*Delonix regia*	Fabaceae	51	45	96
40	Mahagony	*Swietenia macrophylla*	Meliaceae	21	12	33
41	Mahala	*Ailanthus excels*	Simaroubaceae	3	12	15
42	Mahaneem	*Melia azedarach*	Meliaceae	7	12	19
43	Mahula	*Madhuca indica*	Sapotaceae	2	-	2
44	Mango	*Mangifera indica*	Anacardeaceae	2	4	6
45	Mangium	*Acacia mangium*	Fabaceae	132	106	238
46	Malabar neem	*Melia dubia*	Meliaceae	3	-	3
47	Nagachampa	*Couroupita guianensis*	Lecythidaceae	2	6	8
48	Neem	*Azadirachta indica*	Meliaceae	135	124	259
49	Palasa	*Butea monosperma*	Fabaceae	5	5	10
50	Patali	*Lagerstroemia speciosa*	Lythraceae	78	73	151
51	Pesta	*Terminalia cattapa*	Combretaceae	14	5	19
52	Dhau	*Anogeissus latifolia*	Combretaceae	0	10	10
53	Radhachuda	*Peltophorum ferrugineum*	Fabaceae	598	548	1146
54	Sanachakunda	*Cassia siamea*	Fabaceae	128	159	287
55	Sahada	*Streblus asper*	Moraceae	3	7	10
56	Sajana	*Moringa oleifera*	Moringaceae	1	-	1
57	Simili	*Bombax ceiba*	Malvaceae	39	46	85
58	Sirisa	*Albizia lebbeck*	Fabaceae	120	81	201
59	Sisso	*Dalbergia sisso*	Fabaceae	4	1	5
60	Gopigolapa	*Spathodia campanulata*	Bignoniaceae	4	-	4
61	Sunari	*Cassia fistula*	Fabaceae	1	-	1
62	Tala	*Borassus flabellifer*	Arecaeae	50	43	93
63	Tentuli	*Tamarindus indica*	Fabaceae	24	-	24
64	Teak	*Tectona grandis*	Lamiaceae	2	-	2
	Grand Tota			2626	2440	5066

Table-3 : No of trees cut in each girth class and their percentage.

Girth class (cm)	No of trees cut		Total	Percentage (%)
	LHS	RHS		
Under 30	-	1	1	0.01
30-59	239	214	453	8.94
60-89	711	881	1592	31.42
90-119	704	703	1407	27.77
120-149	381	378	759	14.98
150-179	189	225	414	8.17
180-209	106	115	221	4.36
210-239	55	52	107	2.11
240-269	25	19	44	0.86
270-299	9	9	18	0.35
300-329	8	5	13	0.25
330-359	3	5	8	0.15
360-389	0	5	5	0.09
390-419	0	2	2	0.03
420-449	0	3	3	0.05
450-559	4	3	7	0.13
above 560	6	6	12	0.23
Grand total	2440	2626	5066	100

Table-4 : Estimation of biomass and carbon stock.

Sl. No.	Biomass and carbon stock (Tonnes)	
1.	Total below ground biomass (TBGB)	1027.21
2.	Total above ground biomass (TAGB)	3950.83
3.	Total Biomass	4978.04
4.	Carbon stock removed from the site	2737.92
5.	Total weight of co2 that can be added to atmosphere	10,048.16

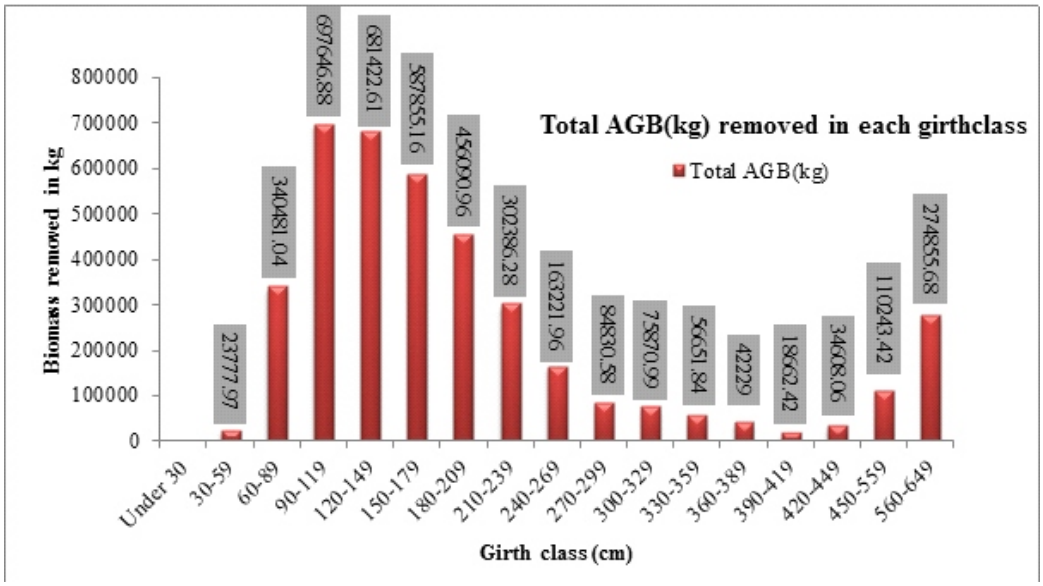

Fig.-1 : Biomass (kg) removed from each girth-class.

3. Water quality : Historically, construction activities have identified as a main source of pollutants to natural water bodies such as lakes, rivers and streams. The sources of water pollutants at construction sites primarily include soil erosion, oil and diesel, solvents, paint, cleaners and other harmful chemicals and construction dirt and debris. Pollutants generate from these sources are added to the water bodies through both direct discharge by workers at the sites and as well as nondirect discharge, which results with the storm water runoff leading to physical, chemical and biological degradation of quality of water (5,6).

4. Socio-economic condition : The common adverse impacts of highway development include damage of natural landscape, habitat and biodiversity, destruction of cultural and social structure of affected communities, creation of air and water pollution and generation of noise and vibration. Evidences recommend that road infrastructure have an influence on rural economic development given by (8,9,10).

Conclusions

Large areas of forest are destroyed during road construction, which not only results in economic losses, but also changes the conditions of the environment. Road construction is a hazardous operation on the landscape and also causes substantial damage to the ecosystem. In plain terrains, to prevent soil erosion clearing of trees should be kept to a minimum. When working close to waterways, it is necessary to take preventative measures to prevent sediment from washing into streams. Precautions may include installation of silt traps or silt screens. Different environmental elements will be demeaned by the construction work like forest, wetland, hydrology, fisheries, soil, air, water, agricultural land etc. But, taking precautionary measures and adopting eco-friendly technologies can reduce these impacts. Also, the mitigation measures would be sustainable and long term durable of the proposed road construction project and nearby occupation and habitats will not destroy. We can recommend that Urban forestry work for expansion should include 'Large Tree Transplanting System' (LTTS), which assure more reliable relocation of large trees without felling which will ensure sustainability of the environment and parallel plantation of indigenous and locally suitable species must go on, on priority basis with due care to avoid hug loss of greenery along with proper preliminary survey of the area should be done and the project implications should be thoroughly assessed with respect to environment and after that the decisions should be taken.

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