

Tribal life in the environment and biodiversity of Tripura, India

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(Received: March 25, 2010; Accepted April 28, 2010)

ABSTRACT

Tripura is a landlocked small hilly state of north-eastern India and part of richest reservoir of biodiversity. Aggressive civilization, rapid growth of industrialization and pollution results loss of different species from the earth causes danger to biodiversity. Different tribes of Tripura still lives on and near forest and depend on local flora and fauna for the food, shelter, medication and ritual ceremonies. Environmental hazards and destruction of forest resulted permanent loss of different flora and fauna for the earth. This also causes great changes in the lives of tribal people of the state. Now this is appropriate time of demand to ensure the biodiversity and conserve it to protect the traditional life of tribal people and the world environment.

Key word: Biodiversity, Environment, Conservation, Tribal people, Tripura.

INTRODUCTION

Natural products have always played an important role in human society for food, health care system and economy. Human societies grow with nature for thousand of generation.^{1,2} A setting for cultural process, activities and beliefs system by natural environment provides to develop subsequently, landscape from a diverse cultural archive of human endeavors.³ Different cultures interact with nature in different ways; local environment and biodiversity have great impact on human life.⁴ Human society has great capability to adopt changes depending upon nature but drastic change in nature can destroy it. The biological and cultural diversity are interrelated. Biological diversity support the resilience of natural system and cultural diversity has capability to increase the resilience of social systems.⁵ The maintenance and preservation of biodiversity and environment became a necessity for our future.

India is one of the ten mega diversity centre with 16 agro-climate zones 10 vegetative

zones and 15 biotic provinces. It shares about 10% of global biodiversity. Tripura is one of the seven states in the north-eastern part of India located between 22°56' and 24°32' north latitude and between 90°09' and 92°20' east latitude. Tripura experience humid subtropical type of climate though features of climate differs in the various parts of the state. Tripura is one of the biodiversity "Hot Spot" of India with large number of animal and plant species.^{6,7} The total geographical area of the state is 10,486,00 hector (0.3% of the country's geographical area) with total human population of 3.2 million, which is 0.3% of the country's population according to 2001 census but it consists 12.78% of the plant resources species found in the country with maximum plant diversity index 5.23, which is one of the highest in India.⁸ Different plant grows naturally and have important role on the lives of tribal peoples of Tripura. About 30% population are tribal comprises about 19 ethnic groups with diverse languages and cultures. *Tripuri* and *Reang* are the main tribal group and *Kokborak* is one of the main language for communication.^{9,10} The climatic condition is very much suitable for cultivation of

various vegetables and rice, which is staple food of people of Tripura. "*Jhum*" cultivation is one of the important method of cultivation generally practice by the tribal people of hilly areas. Indigenous people possess a vast knowledge of their environments and also depend on it for their daily food, shelter, healthcare requirements. Tribal communities of Tripura not only interact with biodiversity on a daily basis but their ever involving values, knowledge, economy, ritual ceremony and perception strongly center on nature. Change in environment has impact on tribal life of Tripura. Environmental hazards and growing civilization are changing the nature rapidly. This paper concentrates on the tribal life of Tripura due to the changes of environment and biodiversity.

Environment and biodiversity

Nowadays stress on environment is changing the society in various means. The quality of environment depends on three physical parameters viz air quality, water quality, noise level and other parameters. Recent study have revealed that the urban areas of the state have witnessed a significant rise in pollutant level due to increase in number of industries and also due to the rise in the number of vehicles. The soil is also getting polluted due to the vigorous use of pesticide and insecticide by the farmers in agricultural fields to get better yield. Pollution of soil, environment and decrease in the total forest area is changing the tribal life of Tripura.

Air Quality

The quality of air is determined in terms of identified parameters such as suspended particulate matter (SPM), respiratory particulate matter (RPM), sulphur dioxide (SO₂), nitrogen oxide (NO_x), carbon monoxide (CO) and lead (Pb). The survey report is produced here with regards to the respective department of Govt. of Tripura, conducted in eight different stations of West Tripura district to know the air quality. Seven stations are located in commercial area (near to the residential area) and one station located in industrial area (near to the residential area). The location and result of the monitoring stations is given in Table no 1.

Water Quality

For knowing water quality, test report for ground and surface water quality of different areas

of state are reported with regards to the respective department of Govt. of Tripura.

Ground water quality

The ground water sampling were carried out at 19 different stations in all four districts of Tripura (West Tripura: 11, South Tripura: 3, North Tripura: 4, Dhalai: 1). Different parameters were analyzed to study the physical character, mineral constituents, toxic metals and induction of organic pollution. The ground water quality in four stations out of nineteen is tabulated in Table no 2.

Surface water quality

Surface water also monitored in twelve stations include eight main rivers (Howrah, Deo, Manu, Dhalai, Juri, Feni, Khowai and Muhuri) in four districts, two lakes in South Tripura (Amarsagar and Jaganathdighi) and three effluent water sampling stations in West Tripura district.

River water study shows TDS, TSS, Chloride, fluoride, sulphate, calcium, magnesium, arsenic, cadmium, copper, lead etc. are within the permissible limit but dissolved oxygen level little higher in Deo and Howrah river. However all water soluble appear highly polluted from bacteriological standard and coliform bacterial loads including faecal coliform bacterial load exceed the tolerance limit. Oil and grease appears to be very high in Howrah river at Chandrapur, this may due to large number of automobile garages.

Water quality of lakes shows most of the parameters are within limit but concentration of phenolic compounds, oil, grease are well above tolerance limit, this is largely attributed to dumping of waste product. Bacteriological quality shows high level of total and faecal coliform, making the water unsuitable portability.

Influent sampling station located near industries. Though most of the parameters confirmed within the standard but BOD value appeared very high. High level of total and faecal coliform bacterial load found in the sample.

Noise level Quality

Noise level are measured in four township and semi-urban centers in North district (Kailashar,

Kumarghat, Kanchanpur, Dharmanagar), three in Dhalai district (Manu, Ambassa, Kamalpur), six in West district (Agartala, Khowai, Bishalgarh, Jirania, Melaghar, A.D. Nagar) and five center in South district (Amarpur, Udaipur, Matabari, Sabroom, Belonia).

Hazardous Chemicals

About 100000 chemicals are estimated to be in daily use in different application for the benefit of human society and approximately 7000 are produced commercially in large quantities. Almost all of them have little or severe adverse effect on environment some of them are fatal in respect of human and animal health as well as to natural environment, these effect may be acute or chronic. Most of the industrial units in Tripura are small scale in nature and most of them do not use the Material Safety Data Sheet (MSDS). Therefore inventorisation of hazardous chemicals can only be done for medium scale industrial units. Some of the industrial sector storing and using hazardous chemicals in Tripura are gas gathering stations, drug intermediate producing unit, latex processing unit, LPG bottling plant, bottling plant of alcoholic beverages.

Flora and fauna

India is one of the largest biodiversity of the world with 91,200 animal species, 45000 different plants species, 23000 fungi, 2500 algae, 1600 lichens, 1800 bryophytes, 13 million microorganisms, fish fauna includes two endemic families and 127 monotypic genera but according to the International Union for Conservation of Nature India has 413 globally threatened faunal species.^{11,12} According to WHO 80% of world people depend on herbal medicine and about 25% of modern medicines are derived from plants sources. Current statistics shows herbal medicine business is increasing by 7% per year. In India, almost, 70% modern medicines are derived from natural products, though India has a very small share (1.6%) of this ever-growing herbal global market as statistics shows annual export of medicinal plants from India is valued at Rs. 1200 million.^{13,14} The state is located in the bio-geographic zone of 9b-North-East hills and possesses an extremely rich biodiversity which is getting increasingly threatened. Flora and fauna of the state have a very close affinity

and resemblance with Indo-Malayan and Indo-Chinese sub regions. Tripura has diverse ecosystems ranging from forests and grasslands to freshwater wetlands. More than 1700 different species of higher plant exist in the forest of Tripura, among them maximum variety have medicinal importance. In the state more than 200 species of plant have been identified by the Indian medicine manufacture authority and record shows that more than 194 plant species from Tripura are used for treatment of 50 diseases and ailments.^{15,16} Tripura is endowed with 90 species of land animals of which 21 are endangered, 341 bird species of which 58 are migratory in nature, 289 species of aquatic flora and fauna of which 78 are fish species. Among the total area of 10,492 sq km forest covers an area of about 6292.681 sq km in all over the state from hilly tract to plain. Tripura being endowed with fertile soils, abundant moisture, good rainfall, adequate temperature and sub-tropical climate offer immense scope for production of a wide variety of tropical and sub-tropical plants.

Large kinds of animals are available in the forest of Tripura though due to destruction of forest and result of rapid growing civilization responsible for decreasing species diversity. Wildlife sanctuaries of the state include Sipahijola wildlife sanctuary (18.4 sq. km), Gumti wildlife sanctuary (389.54 sq. km), Rowa wildlife sanctuary (0.86 sq. km) and Trishna wildlife sanctuary (194.71 sq. km) are the major approaches taken by government to maintain the existence of natural wildlife. Some of the fauna that are used in treating the diseases as well as food are *puthi* fish (*Putius sophore*), flesh of snail or *Jinuk* (*Lemelidense* spp.), *kuicha* fish (*Monopterous kuchia*), pig meat and fat, gall of python, dry fish, *kabutar* (pigeon) etc. Different plants are also used by the tribes for their food, medicine and ritual functions. In Table 3 includes some of the plants used by tribal people.

Climate, cultivation and rainfall

The average maximum temperature is 35°C in May-June and the average minimum temperature is 10.5°C in December-January. Tripura is land of high hills, hillocks, interspersed with rivers and valleys having moderately warm and humid climate with average annual rainfall of 2200 mm. Tripura gross state domestic product for 2004 is

estimated at \$2.1 billion in current prices. Agriculture is one of the mainstays of the people of Tripura. At present about 62% of the net sown area is under food crop cultivation. Paddy is the principal crop, followed by tea, oil seed, pulses, potato and fruits. Rubber is the important crops of the state as Tripura has been declared the *Second Rubber Capital of India* after Kerala by the Indian Rubber Board.

Among the 1.05 million hectare of land area (10,491.6 sq. km) has nearly 27% of total under agriculture (0.28 mha). Good rainfall helps the agriculture, the statistics of rainfall in the state during the year 2006-08 given in Table 4. Table 5 shows total area and production of rice through *jhum* cultivation.

RESULTS AND DISCUSSION

Tribal people developed themselves socio-economically since 10 to 15 years back and thus their lifestyle gradually declining their traditional sensation. The environmental hazards for Tripura are some what different than rest of countries, as the available data supporting the environmental protection in respect to increasing of population. Generally tribal were dwelling in the hilly areas, but now a days many of them came down and settled in town areas taking facilities of modern concept. Many trees in forest has already been devastated due to the needs of woods for furniture, house and also plants were killed due to '*Jhum*' cultivation by the tribal people of the hilly areas. Many of the plants and animals are now not available due to change in the environment, reduction of forest areas, needs of human and thus tribal people still live on hilly areas are deprived to have to avail the facilities from the traditional knowledge of their ancestors in regard to vegetation, medication etc. Now this is appropriate time of demand to ensure the biodiversity, otherwise the bed impact already been fallen on tribal communities can not be revived.

Air quality result shows that SPM level is high in Agartala motor stand (420.02 $\mu\text{g}/\text{m}^3$) and low in Jirania-Kunjaban (142.31 $\mu\text{g}/\text{m}^3$) in 1997 and the average concentration of SPM at West Tripura district was 278.96 $\mu\text{g}/\text{m}^3$ in 1997 but the SPM level decreased in 2001. According to National Ambient

Table 1: A comparative study of air quality in terms of different parameters at eight different centers of West Tripura district, Tripura

Location	SPM ($\mu\text{g}/\text{m}^3$)		RPM ($\mu\text{g}/\text{m}^3$)		SO ₂ ($\mu\text{g}/\text{m}^3$)		NOx ($\mu\text{g}/\text{m}^3$)		Pb ($\mu\text{g}/\text{m}^3$)	
	1997	2001	1997	2001	1997	2001	1997	2001	1997	2001
Agartala Motor Stand	420.02	461.63	400.01	137.43	30.68	2.83	51.38	136.47	0.36	0.61
Dukli Industrial Estate	149.09	84.70	NA	38.07	14.64	7.10	29.97	23.53	BDL	0.52
Jirania-Kunjaban	142.31	48.87	NA	20.43	12.14	9.00	30.04	86.47	BDL	0.36
Jirania-Jirania bazaar	410.55	175.87	NA	45.63	18.27	6.27	49.38	86.13	BDL	0.44
Khowai	176.95	76.17	NA	59.37	10.37	6.43	17.94	57.23	BDL	0.25
Sonamura	279.29	39.90	NA	26.67	13.76	5.80	34.81	44.70	NA	0.45
Radhanagar Bus Stand	327.72	142.97	NA	34.00	18.54	5.80	39.09	65.20	BDL	0.26
Bishalgarh	325.77	78.53	NA	38.33	17.35	5.80	30.89	56.23	BDL	0.45

Air Quality Standard (NAAQS), in 2001 in all the areas except Agartala motor stand ($461.63 \mu\text{g}/\text{m}^3$), the SPM level was within the permissible limit prescribed for 24 hours values ($200 \mu\text{g}/\text{m}^3$). Though the systemic data not available to compare the status of RPM in the district but present data shows the average concentration of RPM was $49.99 \mu\text{g}/\text{m}^3$ in 2001 which is within the limit of NAAQS for residential areas ($100 \mu\text{g}/\text{m}^3$). The average concentration of SO_2 in West Tripura district was $36.97 \mu\text{g}/\text{m}^3$ in 1997 and in 2001 it was decreased as in Agartala motor stand it was $2.83 \mu\text{g}/\text{m}^3$ compare to $30.6 \mu\text{g}/\text{m}^3$ of 1997. Nitrogen oxide concentration was increased in 2001 in compare to 1997. Concentration of SO_2 also found within the limit of NAAQS ($80 \mu\text{g}/\text{m}^3$). According to NAAQS, the limit of 24 hours average concentration of NOx for residential areas should be $80 \mu\text{g}/\text{m}^3$, but in 2001 NOx concentration in Agartala motor stand, Jirania-Kunjaban, Jirania-Jirania bazaar found 136.47, 86.47, $86.13 \mu\text{g}/\text{m}^3$ respectively which was beyond the limit. No data available to compare status of Pb but the concentration of Pb lies within the limit as per NAAQS in residential areas ($1.5 \mu\text{g}/\text{m}^3$). But rapid growth of industry, vehicles and civilization in modern era causes air pollution rapidly. Ground water study shows that quantity of arsenic, lead, cadmium, chromium, oil, grease, phenolic compound, TDS, TSS, chloride, fluoride, sulphate are within the prescribed limit. No faecal coliform was found in any sample. Though the results showed that in some areas like Khowai and Kumarghat conductivity, TDS, hardness, calcium, magnesium,

alkalinity, iron, chloride is high in 2001 compare to 1997 and in Dukli and Jirania all those parameters decreased in 2001 compare to 1997 but all those levels are in prescribed limit. These results indicate that ground water quality is suitable for drinking and irrigation purpose. Ambient noise level was higher in commercial, residential and industrial areas in all four districts of Tripura. Progress in society and modernization of human civilization causes more production of hazardous chemical leads deterioration of human health and environment. Thus management of hazardous chemicals has become an important environmental and health issue and concern with the ever growing evidence of serious consequences of indiscriminate disposal. The control and management of hazardous chemicals should draw a high level of public interest and socioeconomic role in such efforts. The floral and faunal diversity have a direct impact on the lives of the tribal people of the state. Now a days though tribal population migrates in modern society but still a large number of tribal people live in and around forest and hills. They are greatly dependent on the nature. The traditional foods processed and prepared by tribal of Tripura are intimately connected to their socio-cultural, ecological, spiritual life and health. Local flora and fauna are the major source of ethnic foods and medicines not only demonstrate the creativity and treasure of food heritage of tribal but also their incremental learning to sustain the life and ecosystem as a whole. Data related to flora and fauna shows the dependence of tribes on the nature. Cultivation based on rain fall and climate is

Table 2: A comparative study of ground water quality at four different centers of Tripura

Parameters	Dukli		Jirania		Khowai		Kumarghat	
	1997	2001	1997	2001	1997	2001	1997	2001
Conductivity	433.0	110.0	303.0	160.0	128.0	202.0	128.0	152.0
TDS	282.0	80.0	197.0	120.0	83.0	128.0	83.2	115.0
pH	6.9	6.0	6.9	6.5	6.7	6.3	6.5	6.6
Hardness	78.7	40.0	78.7	64.0	51.7	92.0	53.2	76.0
Calcium	14.6	8.0	15.5	16.1	9.1	15.0	9.3	13.2
Magnesium	10.2	4.8	10.0	5.8	7.1	17.6	7.3	10.5
Alkalinity	56.5	56.0	115.0	90.0	31.8	105.0	36.7	85.0
Nitrate	1.1	0.02	32.26	0.011	0.55	0.02	0.88	0.02
Chloride	8.7	0.6	NA	11.3	2.9	8.5	3.1	11.3
Iron	.017	0.37	0.21	0.26	0.06	0.21	0.02	0.29
Fluride	BDL	<0.003	BDL	<0.003	BDL	<0.003	BDL	<0.003

a very primitive form of agricultural practice which is well rooted in the cultural ethos of the tribal people of the state. Tribal people are mainly cultivating by the traditional practice named 'Jhum'. They cultivated rice, different vegetables by the *jhum* cultivation. From the survey it was found that about 6% of the forest land is used for *jhum* cultivation, which is one of the reasons for destruction of biodiversity. 'Jhum' cultivation is shifting agriculture mainly practiced in hilly areas. This involves clearing of area of land followed by several years of harvesting or farming until the soil loses fertility.

Once the land becomes inadequate for crop production, it is left to be reclaimed by natural vegetation, or sometimes converted to a different long term cyclical farming practice. *Jhum* cultivation destroys the protective and productive vegetation in preference to a very brief period of immediate crop production and these results in soil loss and other consequential damages.

Traditional tribal herbal medicine is gradually decreasing due to rapid raise in population leads decrease in forest covered area. Modern

Table 3: Some floral diversity and their uses by the tribal people of Tripura

Kokbarak name	Scientific name	Parts use	Uses
Amchukai	<i>Oxalis corniculata</i>	whole plant	food
Bel	<i>Aegle marmelos</i>	fruit	food
Basok	<i>Terminalia chebula</i>	leaf	leaf juice in cough
Borchuk	<i>Bombax ceiba</i>	leaf, shoot	vegetable
Boroi	<i>Ziziphus auritainia</i>	fruit	fruit
Durpa	<i>Cynodon dactylon</i>	whole plant	in religious ceremony
Goyam	<i>Psidium guayava</i>	leaf, fruit	food and young leaf in dysentery
Haching	<i>Zingiber officinale</i>	rhizome	as food and medicine for cough
Pepui	<i>Piper longum</i>	seed	as spice
Risum	<i>Allium sativum</i>	rhizome	as spice and medicine for cough
Swtwi	<i>Curcuma domestica</i>	rhizome	as spice
Tulsikosom	<i>Ocimum sanctum</i>	leaf	in religious ceremony, as leaf juice in cough, stomach problem
Kelikadam	<i>Leucaena leucocephala</i>	fruit, seed	vegetable
Kanta doga	<i>Amaranthus spinosus</i>	stem, leaf	vegetables
Mritinga	<i>Bambusa tulda</i>	young saplings	food
Makhna	<i>Euryale ferox</i>	seed	food
Tha ganga	<i>Dioscorea hamiltonii</i>	tuber	staple food
Tha duk	<i>Dioscorea alata</i>	tuber	food
Dry khamka sicum	<i>Solanum torvum</i>	fruit	vegetable
Subra	<i>Flacortia cataphracta</i>	fruit	vegetable
Makal	<i>Trichosanthes bracteata</i>	seed	vegetable
Chamal	<i>Artocarpus chaplasha</i>	fruit	food
Amloki	<i>Emblica officinalis</i>	fruit	used in pickle
Neem	<i>Azadirachta indica</i>	leaf, bark	curing fever and in skin diseases
Golachi	<i>Plumaria rubra</i>	flower, latex	flowers in ritual ceremonies and latex in the treatment of tonsil
Thankuni	<i>Cetella asiatica</i>	whole plant	as food and treatment of amoebiasis
Pathar kuchi	<i>Kalancho pinnate</i>	leaves	to stop bleeding and treatment of amoebiasis
Jaba	<i>Hibiscus rosa-sinensis</i>	bud, root, flower	in irregular menstruation and flowers used to perform rituals

Table 4: Rain fall in Tripura during 2006 to 2008

Month	Normal Rainfall (mm)	2006			2007			2008		
		Actual rainfall (mm)	Departure from normal (%)	Remark	Actual rainfall (mm)	Departure from normal (%)	Remark	Actual rainfall (mm)	Departure from normal (%)	Remark
Jan	12.3	0.00	-100	No rain	0.00	-100	No rain	36.3	195	Excess
Feb	28.1	0.00	-100	No rain	62.3	122	Excess	13.0	-54	Deficient
Mar	69.3	0.4	-99	Scanty	52.4	-24	Deficient	41.6	-40	Deficient
Apr	172.3	166.9	-3	Normal	313.4	82	Excess	53.1	-69	Scanty
May	314.8	510.7	62	Excess	267.2	-15	Normal	218.5	-31	Deficient
Jun	449.0	484.4	8	Normal	638.0	42	Excess	324.3	-28	Deficient
Jul	370.8	237.0	-36	Deficient	617.3	66	Excess	321.2	-13	Normal
Aug	328.9	265.0	-19	Normal	304.5	-7	Normal	385.5	17	Normal
Sep	240.0	254.2	6	Normal	399.7	67	Excess	174.1	-27	Deficient
Oct	168.6	63.9	-62	Scanty	273.5	62	Excess	237.2	41	Excess
Nov	37.7	9.4	-75	Scanty	185.5	127	Excess	0.00	-100	No rain
Dec	4.6	0.00	-100	No rain	0.00	-100	No rain	0.00	-100	No rain
Annual	2196.4	1991.9	-9	Normal	3013.8	37	Excess	1804.8	-18	Normal

Table 5: Net 'jhum' cultivation area and production of 'jhum' rice in the state

Name of the District	2005-06		2006-07		2007-08		2008-09	
	Area (Hector)	Production (Metric Ton)	Area (Hector)	Production (Metric Ton)	Area (Hector)	Production (Metric Ton)	Area (Hector)	Production (Metric Ton)
West	2415	2074	2347	1931	2392	2015	2683	2259
South	4283	3817	4036	3464	4176	4587	3785	4156
North	4610	4365	4279	5364	4093	5112	3105	3878
Dhalai	4607	5594	5005	4755	5042	4042	5054	4053
TOTAL	15915	15850	15667	15515	15703	15756	14627	14346

civilization and the effect of modern science results absence of literary practice, non availability of trained personal in traditional medicine and limiting the traditional knowledge within the tribal family are also important causes for rapid decline of herbal treatment among tribes. Though Tripura has a geographical area of 10,490 square km. of which 6292 square km. (59.98%) is the forest area as per legal classification in the state but as per FSI report on 1999, only 21.23% of forests are well stocked, the remaining forest areas are degraded causes destruction of different species of animals, birds and plants from the state which may lead to disbalance of ecosystem.

The status of biodiversity is formed by a vast amount of linkages and characteristics of nature. One of the major problems for biodiversity conservation is the knowledge and public understanding of the meaning and value of biodiversity is not sufficient and people do not consider the crises to be their problem. There is also lack of basic knowledge for the assessment and measures based on scientific knowledge. But major steps need to be taken to save the nature. This is the appropriate time for biodiversity conservation, including restoration of nature, this will help not only the tribal people to maintain their traditional life but also the future generation for their healthy and pollution free environment.

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