



## AN ANTHROPOLOGICAL OBSERVATION ON THE ROLE OF TRIBAL COMMUNITIES IN THE CONSERVATION OF BIODIVERSITY

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*Received 13/12/2015; Revised 29/12/2015*

*Accepted 11/01/2016*

### ABSTRACT

From the beginning of human evolution, the tribal peoples have been living in the lap of the Nature. They are very closely involved with nation's different biodiversities. Tribal peoples inhabit in different eco-cultural zones as well as in all biodiversity zones of India, i.e. from geo-ecological fragility in Trans Himalayan region to arid zone of Rajasthan, Coastal zones to Island zones etc. Globally tribal peoples inhabit in the 22 per cent area of total land mass representing 80 per cent of total biodiversity. Different tribal groups have different indigenous knowledge systems for the protection of biodiversity and conservation of natural resources. By their traditional knowledge, they can predict on cloud formation, lighting, wind direction, rains, drought, disaster prediction-response-mitigation, and effects of weather on crops etc. Traditional environmental knowledge of the tribal peoples of India is greatly useful in developing location specific strategies for the protection of biodiversities and also useful in mitigation plans for coping with climate change and to sustain their livelihoods. Considering the natural surroundings as their mother, the place for the ancestors or the god or as sacred one, they developed different regulatory mechanism through which they are able to protect it. They have culture specific prescriptions and taboos for the utilisation of natural products which are basically sustainable in nature. For the protection of the natural resources, they are always showing their resistance against the destroyer of the natural resources. Still due to

globalisation and external interference, they are not able to implement their knowledge system and ultimately facing problems. This paper explains nationwide some cases regarding their knowledge system and tries to explain how their traditional knowledge system will be useful in ensuring sustainable life ways and the protection of biodiversity.

**Keywords:** Tribal Communities, Biodiversity, traditional knowledge.

### INTRODUCTION

According to Lord Buddha, plant is the only living being who loves all without any hesitation and any expectation. Even if without any vacillation it spreads cool shade over the person who is cutting it. It is observed that tribal people across the world have a deep love towards plant kingdom. From the prehistoric time, tribals are growing in the lap of the Nature. They are closely connected with different store house of biodiversity i.e. forests. They are the indigenous inhabitants of these areas and once upon a time king of these areas. From the beginning of human evolution to till date, tribals are protecting different biodiversity zones in which they inhabit. Globally tribal peoples inhabit in the 22 percent area of total land mass representing 80 per cent of total biodiversity. They are living in the main forest lands of the earth, e.g. starting from American tropical forest to African and Asian main forest lands and across the globe.



## OBSERVATIONS:

India is one among the worldwide identified 12 main biodiversity rich nations. The richness of biodiversity of India in compare to world is mentioned in the table – 1.

The richness of different species found in India is mentioned in the table- 2.

From the biodiversity point of view, India can be divided into 10 zones such as:

1. Himalayan zone
2. Trans Himalayan zone
3. Indian desert zone
4. Semi arid zone
5. Western Ghats
6. Eastern Ghats
7. Deccan plateau
8. Gangetic plain lands
9. North-Eastern zone
10. Coastal and Island zone

The tribal people in India inhabit all climatic zones. However, about 52.4% of them live in areas of moderate climate and 33.5% in areas of warm and temperate climate. They also live in extreme warm climate. About 63.4% of tribal communities live in hilly terrains. They also inhabit the deserts (0.2%), the semi-arid zones (1.6%) and the islands (2.2%).

Tribal peoples inhabiting in all these above mentioned zones are incessantly involved in the conservation of biodiversity. Reciprocity – respect for and responsibility to – wildlife and natural resources is embedded in indigenous cultures. Traditional knowledge has been widely recognized in fields such as agroforestry, traditional medicine, biodiversity conservation, customary resource management, applied anthropology, impact assessment, and natural disaster preparedness and response. Traditional observations and interpretations of meteorological phenomena have guided seasonal and inter-annual activities of local communities for millennia [1]. This knowledge contributes to climate science by offering observations and interpretations at a much finer spatial scale with considerable temporal depth and highlighting elements that may not be considered by climate scientist. Traditional knowledge focuses on elements of significance for local livelihoods, security and well-being, and as a result is essential for climate change adaptation. Small population size, isolation, and the absence of recognized rights over their territories and resources may also contribute to their vulnerability to economic, social and environmental impacts brought about by a changing climate. Despite their high exposure-sensitivity, tribal people are actively responding to changing climatic conditions and have demonstrated resourcefulness and resilience in the face of climate change.

For the protection and conservation of biodiversity, tribal culture is jam-packed with different

traditional knowledge systems, norms and rituals. Since inceptions to till today, worldwide different communities have identified different plants as sacred groves [2,3,4]. These sacred groves are identified from different prospects and different angles. Around 14,000 sacred plants are recognized in India including 5,000 varieties in Himachal Pradesh, 2,000 varieties in Kerala, 1,600 varieties in Maharashtra, 1,424 varieties in Karnataka and 322 varieties in Odisha. In different places it is believed that different deities are living in different sacred plants. Due to getting foods and drinks from some plants in crisis time, people also consider such plants as sacred one. People also consider certain plants sacred due to certain reason like medicinal utility, living place of souls of their ancestors, etc. In all circumstances and obstructions they still endeavour their best for the protection and conservation of these sacred plants. For each sacred plant they have various folk tells, legends and myths. These plants are very closely connected with folk life. Diversified sacred plants are in heaps in areas of India where tribal peoples are densely populated, e.g. Western Ghats, Eastern Ghats, Central India and North-Eastern region. Though some jungles physically looks very general for outsiders, but for tribals, natives of those jungles or nearby, believe from cultural point of view that these jungles are the place of residence for different deities for which they conserve it by implementing different rituals, norms, taboos, cultural prescriptions and restrictions, customary laws etc. Tribals are worshiper of nature. In different tribal areas they dedicated certain forest areas in the name of various deities and also conserve these forests. For example, in Odisha where *Paraja* tribal peoples are residing, they named some forests surrounding their villages in the name of different deities such as *Kanda dakri*, *Ganga Maa*, *Nakiti* etc. In sacred plants, birds and animals live safely; this indirectly helps in the conservation of faunas. These sacred plants and sacred groves are connecting link between past and present biodiversity and these are also considered as the cultural heritage of tribal communities.

In different tribal communities' *clan, lineage and gotras* are named in the name of different animals as a cultural taboo, they never killed such animals. They also conserve edible fruits and flowering plants and also edible tubers, roots providing herbs and creepers. When they are collecting edible roots and tubers, instead of taking all parts of the roots and tubers, they leave some parts for future growth of that plant and for sustainable future. They also conserve medicinal plants. The sacred grove culture maintains ecological balance and also helps in the conservation of biodiversity and also helps in following aspects such as: 1) soil conservation, 2) continuous creation of water cycles, 3) increasing ground water table, 4) natural pollination, 5) naturally seed conservation and creation of new plants, 6) Protection and conservation of regional plants and animals [4]. In maximum cases it is



observed that tribal women play a pivotal role in the conservation of biodiversity [5,6]. They preserved healthy and appropriate seeds for future cultivation. For keeping land fertile forever they situate dry leaves, compost, cow dung, cow urine, and several fermented materials in the land. In eastern Odisha's tribal hinterlands 'seed-mothers' are on mission mode – identifying, collecting and conserving traditional seed varieties and motivating farming families to use them. The seed-mothers (*bihana-maa* in the local dialect) from the Koya and Kondh tribal communities have reached 1,500 families in the Malkangiri and Kandhamal districts and are still counting. These women are formidable storehouses of knowledge on indigenous seeds and biodiversity conservation. Collecting, multiplying and distributing through exchange local varieties of paddy, millet, legume, vegetables and leafy green seeds, the seed-mothers already have a solid base of 80 converted villages. As they spread their message through the hinterland, targeting another 140 villages, the women also promote zero dependence on chemical fertilisers and pesticides. The struggles of Malkangiri farmers with climate change is visible in the Gudumpadar village where seed-mothers are passionately reviving agricultural heritage and convincing the community to stay with local seeds and bio-fertilisers and pesticides.

They also created Community Seed Bank which is a platform for food & nutritional security having following features:

- a. Managed & maintained by Community
- b. Maintains local genetic diversity.
- c. Provides pure & quality seed
- d. Provides grains during emergencies.
- e. Provides storage & safety to genes, seeds, grains.
- f. Assistance at low interest rate.
- g. Available at any time.
- h. No external support

Tribal people store more amounts of seeds for future cultivation. M.S. Swaminathan Foundation at Jeypur, Koraput of Odisha when started conservation of biodiversity, able to know that some tribal women preserved seeds of different varieties of aromatic rice. This foundation also collected seeds of some different rice varieties from the preservers and try to create gene bank of these varieties of rice. The different varieties of aromatic rice of Odisha are shown in table-3.

Tribal peoples have depended on a wide variety of native fungi, plant and animal species for food, medicine, ceremonies, community and economic health for countless generations. The availability of all types of traditional foods (hunted, fished, gathered, and cultivated) has greatly diminished as ecosystems and water resources have been exploited or converted, to other uses. The productivity of remaining ecosystems may be impacted by a variety of factors including disease, pollution, invasive species and management actions. In India, all

tribal communities except three are non-vegetarians. They eat pork (64.6%), beef of cow (36%) and beef of ox (30%). The three vegetarian tribal communities are the *Toda* (except its Christian segment), the *Rabari* and the *Bharwad*. It is interesting to observe that all the three communities are pastoral. Vegetarianism in India has so far been associated with Jainism and Vaishnavism, which witnessed the transformation of a pastoral god Krishna into an incarnation of the Supreme godhood (Bramha). Pastoral communities which were involved in the growth and development of Vaishnavism were all vegetarian like the *Jats*, *Ahirs*, etc. The survival of vegetarianism among the tribes therefore shows the strength of the pastoral traditions in communities which have adopted vegetarianism. There are also vegetarian *Bhagats* who have been influenced by Vaishnavism among the *Santals*, *Oraons*, *Bhils*, *Gonds*, *Kawars*, etc. Rice is consumed by 91.2% of tribes and millet forms the staple cereal for tribal people. Wheat has been recently introduced. The tribals use animal fat (115 communities, 18.1%) as cooking medium particularly in the north-east. The use of oil seeds such as ground nut, mustard, etc. is a new phenomenon. Eighty-six per cent, i.e. 547 tribal communities still consume roots and tubers. Except for the *Bhagats*, almost all the tribal men and a considerable number of women (occasionally 49.8% and regular 22.8%) in tribal communities consume alcoholic drinks which are generally home-made [7].

Tribal people have different traditional knowledge on agricultural practices. In past, they believed in mixed farming (so many crops at a time from one land) and due to this farming, the soil fertility enhanced, pest controlled and also they were able to get various nutritive foods and for such cultivation they required no chemical fertilisers and pesticides. Till today mixed farming by tribal people is practised in some areas.

A Kondh tribal farmer Harish Saraka of Munda village in the foothills of the Niyamgiri Hills of Rayagada district, has rediscovered the key to sustainable farming in this rain-dependent hinterland of eastern Odisha state – mixed cropping. He says “All we are doing is returning to our grandfathers’ practices”. Saraka recalls that his forebears sowed three different seeds in the same field: millet, legume, oilseed and creeper bean. He told, “After the Vedanta Alumina industry in our area, the environment, the climate and the forests has changed drastically. The rains, are ‘regularly irregular’, resulting in crop losses year after year while Kondh families have grown in numbers, putting pressure on the forests they once shared with tigers and where they harvested tubers and fruits.” For Harish Saraka and other subsistence farmers in 70 Niyamgiri villages in Rayagada, adapting to changing conditions meant reverting to traditional farming methods such as mixed cropping, the use of organic fertilizers and trusted seed varieties. So, while farming has been failing elsewhere in Odisha, Harish



Saraka has been cultivating not three but 14 crop on his half-hectare land. "I now harvest 300 kg of food grains, a 200 per cent increase from the earlier single-crop high-yield paddy farming," says Saraka.

Due to monoculture farming (one crop at a time in one land), it is observed that weeds are spreading rampantly in the cultivation. With imported foods various types of wild grass seeds and weed seeds came to our nation and these weeds are now a days spreading in viral manner, e.g. *Parthenia* grass seeds came to our country by mixing with imported wheat from USA and is now growing everywhere. When cattle graze it they face severe stomach problems and their milking capacity also decreases. Now grazing lands are full of *Parthenia* grass (commonly known as *Gajar ghaas*). It is also observed that *Argimona maxicana* weed is enormously growing with mustard crop and get mixed with its seed. Oil containing *Argimona maxicana* seed creates *Dropsy disease*. Tribal peoples' mixed farming never allowed such dangerous weeds to grow in the crop. They have the traditional knowledge about the mixed farming by which a particular type of crop is grown with certain crops which restrict the growth of weeds. With the change of seasons, tribal people also changed their food patterns as per the availability of foods. Even during the food crisis, they never consumed such foods which are culturally tabooed. They never consumed fruits in immature state. While going for hunting, they neither kill any pregnant and lactating animal nor any baby animal.

Hunter-Gatherer and Forager tribes are mainly leading nomadic life and travelling across different jungles. They stayed in the jungle or near to jungle by making their traditional leaf huts. After living sometimes in one area, for the search of food they left that area and migrate to another area. Hunter-Gatherer and Forager tribes have played tremendous roll in the conservation of biodiversity. We can examine the naked truth by taking a case note about *Birhor* or *Mankirdia* tribal communities. Twenty to thirty house-holds of such communities are living in leaf huts near to forest areas. They depend on some wild animals such as monkeys, squirrels, rats, varanous, etc and also on some wild leaves, flowers, fruits and tubers as their main food items. They collect bark of *Siali* creeper for the preparation of different handicraft products such as *Sika* (hanging basket), ropes, nets and they sell these materials by roaming in different villages. For collecting barks, they cut the creeper leaving 4 to 5 feet above the ground. They never cut the creeper from the ground. *Siali* creeper generally spreads over the *Sal* and *Piasal* like timber plants and choked the growth of these plants. By cutting these creepers, timber plants are able to grow properly and as the creeper is not cut down from the ground it also survived. Through this process, *Mankirdias* are able to manage their livelihood and simultaneously conserve biodiversity. But it is a matter of wretchedness that after the declaration of reserve forests,

they are not allowed to enter into these reserve forests. Due to this, two things happened, i.e. in one way they lost their livelihood and on the other way due to spread of the creeper over the timber plants, these plants growth is blocked. Then after losing their livelihood they face so many problems and for the search of some job they try to live near to village settlements. After settling near by villages, due to lack of knowledge on agricultural activity, they start cutting fuel woods for selling it in the nearby villages. While selling fuel woods, they also face some problems. They are victimised by the forest guards, who snatch their small axe (*gutia*) and sometimes also booked under law and send them to court of law. In some cases, forest guards also bribed Rs. 5/- on each bunch of fuel wood (one bunch of fuel wood is around 25 kg). After facing problems in these fuel woods selling bussiness, some *Mankirdias* started working as agricultural labourers. They are paid half rate of payment for the same duration of work as they are unspecialised in agricultural activities. Sometimes they also joined in labour work of road construction and stone crosser industries. They also migrate to other places for *dadan* labour or as bonded labourer. In these migratory labourer cases, as they are away from family and relatives, their mental condition became full up with stress, strain and unhappiness. Due to lack of traditional merrymakings and cultural activities, for overcoming the sadness, they deeply indulge themselves in community restricted alcohol drinking. Frame shift from nomadic to settle life, enforce them to live in the devastated cultural environment, lifestyle changes. As an aftermath of it, these tribals are suffering from complex disorders such as diabetes, hypertension etc. In total, the detachment from their social and cultural lifestyle, they became isolated from their mainstream.

Tribals who are traditionally practising burn & ash cultivation (*Podu chas*), never destroy the biodiversity of the jungle. For the cultivation purpose, when they are cutting plants in the jungle, they never cut edible fruit & flowering plants and big timber plants. Whatever plants they cut, they cut it leaving some portions from the ground for regeneration. They cut the bushes and weeds, whose regeneration potentiality is very high. When there is no crop on the soil, these weeds can regenerate from its roots. After drying of the cutting bushes and weeds, they burn it and ash of the burnt plant products deposited in the soil and made soil fertile for cultivation. Tribal people cultivate on these ash. After cultivating one to two years in a place, they left that place and choose another place for cultivation. Then the first used place became covered with regenerated plants, weeds and bushes. In this process, the soil fertility became intact. In past tribal people were able to manage their livelihood by this process. That time, their population size was small and area of forest coverage was vast. But now a days situation has quite changed. Due to expansion of population in





general, everybody encroached into the forest land. In some places, where earlier tribal people practised *Podu chas* is now declared as reserve forest, so they are not allowed to enter into that forest, and they are forced to migrate to other places [8]. After leaving that place, the weed spreads so rampantly that these weeds do not allow other plants to grow. In *Banda Ghati* of Malkanagiri district of Odisha, where Banda people previously practise *Podu chas* declared as reserve forest. When Banda people cultivated that land they cultivated by cutting wild soil dates bushes. After declaration of reserve forest, the wild soil dates bushes spread entirely in that area not allowing to grow other plants. Now that entire area is full with bushes of wild soil dates.

Before declaration of Simulipal Jungle of Odisha as reserve forest, inside it different tribal communities like Mankirdia, Kharia, Bhunia, Santal, were living. After declaration of reserve forest, they were forced to come out from the core area to the buffer area or elsewhere. When these tribal communities were inside the jungle, they are protecting it. They have practise unique rituals for the protection of biodiversity. In *Raksha Bandhan* festival, they tie *Rakhies* to big plants and in this ritual all the community members participat. Through this ritual they try to spread the message of bonding between humans and plants and they are continuously trying to preserve the jungle. But now a days, saw mill owners and jungle *mafias* are creating disturbances and making timber cutting regularly.

In Bharatpur of Rajasthan *Kio Ladio Ghan* bird sanctuary is established and prior to its declaration, some local communities graze their cattle inside it. After sanctuary declaration they are not allowed to hoard their animals inside it. In protection, they received bullets from police and some people also sacrifice their life. When they stopped cattle grazing, a grass named '*Pasapalum*' spread virally in that area. As a result that area became not conducive for birds to live. Using dozer that grass is being removed with the expense of so many crores of money.

A community named 'Maldharis' graze their buffaloes inside the *Gir* jungle of Gujarat before declaration of reserve forest for lions. Sometimes lions killed their weak and old buffaloes, but they are not fed up with these incidents. They take it as a part and parcel of their life. After the declaration of reserve forest, they were not allowed to graze their buffaloes inside it. As a nature of resilience, Maldharis people keep the dead buffalos with mixing up poison in cadaver near to the reserve forest and by eating these poisonous cadavers lions start dying [9].

Sometimes for the conservation of biodiversity, tribal people sacrificed and dedicated their life. For the protection of water-land-forest (*Jala-Jami-Jangle*) they are constantly expressing movements. In all cases, starting from *Chipko* movement [10] to *Niamgiri Bachao*

movements, tribal people especially tribal women play vital role. With the involvement of tribal communities, community forests were created in different places of our country. For example, the Gond community of *Mendha* village of *Gadchiroli* district of Maharashtra created and protected area of 1800 hectare forest land in the name of community forest. Similarly villagers of *Jardhar* village of Uttarakhand protected 7000 hectare forest land. Likewise villagers of *Sankargola* of Assam [11] and different tribal groups of Odisha and Nagaland have protected several hundred hectare land as community forest. Due to the initiatives taken by tribal women, entire *Dangejhari* Jungle of Odisha was protected.

Albeit unknown to government rules and regulations, tribal communities are the real conservers and custodian of our biodiversity heritage. They had prepared their customary laws for the rule and regulation and smooth maintenance of their communities. But now due to the implementation of constitutional laws, they became tourist in their own land. They have to depend on the mercy of the Government pettiness to live on their ancestral land. In the fifth schedule of the constitution of our nation, tribal people who earn their livelihood from forest land for many generations without having any land ticket, they lose their right on Jungle and land. Their jungle land was full with minerals and metals, for which such areas were snatched. They were displaced from their own land which was full up with biodiversity. In the name of national development they became displaced and ousted from their own land where they have been inhabited from several hundred generations earlier. By using their mineral and metallic rich lands, our nation-state, industrialists, contractors all became rich whereas by losing their habitat and everything, they became ousted and poor. Today in their dense forest land somewhere either industry or mega dam are constructed, e.g. *Mahadei* dam of Karnataka, *Hirakud* and *Upper Kolab* dam in Odisha, Dams on the Subansiri river in Arunachal Pradesh, *Tehri* dam in Uttarakhand, *Polaveram* Dam project in Andhra Pradesh etc. At many places, displacing tribals from their home land jungles, national parks are created to promote tourism. At some places, urban people, hotel owners, jewellery makers, blacksmiths, etc are showing the greed of money to the tribal people and instigate them for bringing wooden charcoal from the jungle to make profit in their life. In other places now a days saw mill owners are also misusing tribal people for cutting timbers. On one hand, tribal peoples who are traditionally inhabited inside the jungle are forced for displacement, but on the other hand, saw mill industries are growing at mushrooming rate nearby jungles. For the construction and establishment of towns, markets, buildings, highways huge amount of stone pieces are required and for this purpose stone crosser industries were growing in alarming rate near to hilly areas and destroying green hills into stone pieces.



In 1972, the then Indian Prime Minister Smt. Indira Gandhi declared in the Global Summit on “Human Environment” that until unless the purchasing power of tribal people increases, they will not become empowered, up to that, they will not be absconded from the jungle for the collection of their foods and livelihoods. Are we able to provide complete employment to tribal people for their sustainable growth and development? If not, then why are we snatching their rights on water-land-forest (*Jala-Jami-Jangle*) on which they are depending for their survival?

Although other developing and developed nations had stopped using coal for industrial purpose, but in our country coal is still used rampantly for this purpose. By profusely using coal, biodiversity is destroying. The polluted materials extracted from this are polluting soil, water and air and also creating several diseases. Mainly tribal people living in these areas are seriously affected by this pollution. By coal dust everything i.e. food materials, crops, leaf, soil, water etc. became black in colour. Flora and fauna are also affected by these pollutions, and some species became endangered.

For industries and vehicles, instead of using fossil fuel, continuous & renewable source of energy can be utilised as an alternative source of fuel. Discovery of bio-diesel from *Jatropha* seed is a radical discovery. But instead of farming *Jatropha* in fertile cultivable land it should be farmed in unutilised and unfertile lands. *Jatropha* should not be cultivated in the tribal peoples’ agricultural land and forest lands.

Without considering enhancement of biodiversity, maximum time we are promoting plantation of monoculture exotic plants which has no utilitarian value for tribal people as well as for enrichment of biodiversity. For example, we take into consideration of certain cases. In whose interest we are promoting plantation of *tick* wood plants in the jungle. First of all due to different Forest Acts, tribals are losing their rights on forest. *Tick* wood plant is not so useful for tribal people. Dry *Tick* leaves are unable to decompose easily. *Tick* is a deciduous plant. As dry leaves are laid on the ground for a long time, during summer it creates the chance of forest firing. As *Tick* plant has no big branches, no edible flowers and fruits, birds cannot make their nests on it. As *Tick* plant is a dominant one, other plants are not able to grow under its shade. This plant has less potential of purifying air pollution. We can consider another plantation programme, i.e. silver oak and coffee plantation in tribal areas. Tribal people never show interest in coffee drinking. Sometimes they drink red tea (*Dikasil*). But now a days they are motivated for coffee plantation. Due to lack of coffee seed processing units at local level, they are forced to sell seeds at low price. With coffee plantation, black pepper is also cultivated. But they did not get appropriate price for black peppers. The most important thing is that, it is known from the research that

if coffee farming made under the shade of natural forest the production will not decrease and also the aroma of coffee will be increased, which will provide more enhanced market price, and it will promote the richness of biodiversity. Instead of promoting coffee plantation in natural shade, it is advised to do coffee farming under the shade of *silver oak*. It took 3 to 4 years for growth. Its wood is only useful for fuel. It is also observed that birds do also not prefer to make their nest on this plant. Its leaves also did not decompose easily. But if people are promoted to make coffee farming under the shade of mango, jack fruit tree, etc. both coffee as well as fruits can be harvested and also black pepper creepers can be grown over the plants, birds can make their nests, as flowers are there, honey bee can make its hives. Due to ignorance and selfishness we are continuously destroying our natural resources and biodiversity heritage. Eucalyptus plantation is also another example of exotic monoculture responsible for the destruction of biodiversity. For the interest of the paper industries, it is cultivated, creating hindrance in the interest of the tribal people. This plant decreases ground water table. It was also observed that water level of ponds, small reservoirs, and check dams located nearby Eucalyptus jungles decreases very fast in summer season. In some cases hand pumps either get dry or give very less amount of water. The wood of Eucalyptus is also neither good for furniture work nor for fuel. This plant is also not conducive for the habitat of birds. Sometimes it is observed that bats (macro-bates) are only residing on this plant. It does not mean that bats are only residing on this plant. They also reside on other plants. As it is a deciduous plant, it cannot able to create evergreen environment forever. Its dry leaves do not decompose easily. Eucalyptus leaves are not edible for cattle. This jungle is also not good for animals. For the industrial purpose, Eucalyptus can be cultivated in the unused and less fertile personal lands instead of on agricultural land and land of commons. For promoting paper industries and for the conservation of biodiversity, bamboo jungles should be created. From research it is known that bamboo pulp is good for paper. The royalty generates from selling bamboo to paper industry is twenty time less then royalty generating from the cottage industries where bamboos are used for different arts and crafts production. Other than pulp for paper industries and art & craft production, bamboo forest has so many other utility. As the regeneration potentiality of bamboo plant is very high, once it is planted, new plants generated to its surroundings. As its roots strongly bind soil, it checks soil erosion. Bamboo forest is very conducive for the growth of the different varieties of fauna. Many herbivorous animals are very fond of eating bamboo leaves. Starting from house construction to make different furniture, bamboo is very useful. Using bamboo, different musical instruments as well as interior decorating art and craft materials are also made. Bamboo is also used for fuel



purpose. For the annual consumption, people prepare pickles from bamboo shoots and also by chopping & drying bamboo shoots (*Hendua*) for preparing curry in future. In North-Eastern region of India, people used bamboo for cooking rice, due to which, dish is very tasty and aromatic. No tribal group cut entirely the bamboo bushes, because bamboo is closely connected with their

life. But presently situation is different. In some places, tribals are not allowed to cut bamboos from the jungle, for which now they are cutting other trees for fulfilling their needs. Instead of creating *Eucalyptus* jungle, bamboo jungle should be enhanced and tribal people should get permission for collecting bamboos from the forests for their domestic requirement.

**Table 1. Comparison: India Vis a Vis World**

Group	India	World	%
Mammals	372	4629	7.6
Birds	1228	9702	12.6
Reptiles	428	6550	6.2
Amphibians	204	4522	4.4
Fishes	2546	21730	11.7
Flowering plants	17000	2,50,000	6.0

**Table 2. Biodiversity in India**

Sl. No.	Category	No of species	%
1	Bacteria	850	0.67
2	Algae	2500	2
3	Fungi	23000	18.23
4	Lichens	1600	1.3
5	Bryophytes	2700	2.14
6	Pteridophytes	1022	0.8
7	Gymnosperms	64	0.5
8	Angiosperms	17000	13.5
9	Protozoans	2577	2.04
10	Molluscs	5042	4
11	Crustaceans	2970	2.35
12	Insects	50717	40
13	Invertebrates	11252	9
14	Protochordates	116	0.1
15	Pisces	2546	2.02
16	Amphibians	204	0.16
17	Reptiles	428	0.34
18	Aves	1228	1
19	Mammals	372	0.3
Total		1,26,288	100

**Table 3. Varietal Distribution of Aromatic Rice in Odisha**

Sl. No.	Local Name of the Rice	Areas of Odisha where aromatic rice preserved
1	Kalajira	Cuttack, Puri, Ganjam, Malkanagiri, Koraput
2	Jubraj	Keonjhar, Deogarh, Sambalpur, Bolangir, Jharsuguda
3	Badsabhog	Bolangir, Balasore, Koraput
4	Neelabati	Bhadrak, Balasore
5	Durgabhog	Keonjhar, Mayurbhanj, Phulbani
6	Pimpudibasa	Keonjhar
7	Mugajai, Rangasura, Makarakanda	Phulbani, Rayagada, Koraput
8	Krishnabhog	Nimapada



9	Govindabhog	Salepur
10	Chinikamini, Saragdhuli, Padmakeshari	Konark, Astarang
11	Karpurakeli, Kusumakenda	Nayagarh
12	Kalikati	Kalahandi, Rayagada, Nabarangpur
13	Thakurabhog	Puri
14	Karpurakranti, Suragaja, Laxmibilas	Bolangir, Sambalpur, Deogarh
15	Tulasiphoola	Puri
16	Gangaballi	Ganjam

## CONCLUSION

When planning and policies are formulated for the conservation of biodiversity, instead of making only national parks and reserve forests etc, tribal people should also be involved in these activities. Giving respect to their views, rich cultural traditions, and traditional knowledge system; if these are utilised for the conservation of biodiversity and also if they get their intellectual property rights; and their knowledge system patented then it will accelerate the process of conservation of biodiversity. Likewise plantation of more number of sacred plants, edible fruit and flowering plants, medicinal plants should boost. Simultaneously plantations of such trees are required from which birds and animals will get their food. For rising ground water table, small check dams should be constructed. Food securities should be provided to tribals. They should give skill development trainings and vocational training. They should be encouraged for formulation of more number of Self Help Groups (SHG). Providing training for preparation of art and craft products and for development of cottage industries and also for these, raw materials should be provided to the SHGs. New avenues should also create for selling of their products, by which they can enhance their economic status. There should be plans for employment regeneration in the village or nearby villages. Tribal people should be included as members in the forest protection committee. Women members should also get

equal chances to be member of these committees. Forest department should keep good relationship with the tribal people. They should get rights on collection and selling of minor forest produces and fuel wood. Above all, Government must take initiative for the improvement of their health and educational status. Stone crusher industries and saw mills which are established near to jungle should be banned. Liquor shops should be banned in the tribal areas. Above all there should be importance on the rise of qualitative life of tribal people. In conclusion it can be said that all the things which are connected for the conservation of natural water and jungle are important wings of biodiversity conservation. So before taking any decisions, we should think on it that there must not be any adverse effect on the livelihood and lifestyle of tribal people. Because there are no alternatives of these natural resources which are part of our heritage and which took more than several thousand years for formulation, we should preserve these and never allow obliterating simply. Otherwise, within coming some decades the earth will lose her existing beauty and heritage.

**ACKNOWLEDGEMENT:** None

**CONFLICT OF INTEREST:**

The authors declare that they have no conflict of interest.

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