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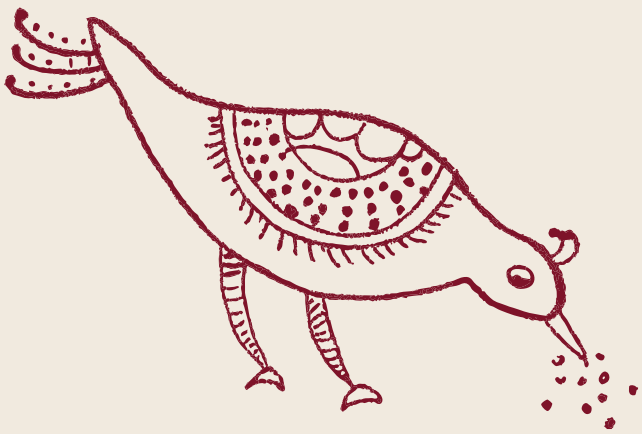
REPORT

Documentation of Traditional Knowledge Systems of various Tribes in India

ENVIRONMENTAL KNOWLEDGE FOR UNDERGRADUATE CURRICULUM



A Study Report on:

ENVIRONMENTAL KNOWLEDGE FOR UNDERGRADUATE CURRICULUM

For Project Titled:

Documentation of Traditional Knowledge Systems of various Tribes in India

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Study Report:

Environmental Knowledge for Undergraduate Curriculum

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1. Introduction

Human beings, since times immemorial, have lived in harmony with their natural environment. Over these years, they've come to adapt and modify the environment to their suitability. As human civilisations came into existence and the world got more and more connected, modern forms of scientific knowledge gained prominence, especially in the western world. This led to ignorance of the local knowledge systems, and people started ascertaining an inferior status to them. But currently, the infallibility of modern scientific knowledge is being questioned and the importance of traditional systems of environmental knowledge is being realised. This becomes far more important for a country like India where the tribal population forms 8.5% of the total population.

2. Defining Traditional Ecological Knowledge (TEK)

Traditional Ecological Knowledge or Indigenous environmental knowledge are terms that are interchangeably used in context of local knowledge systems. While IEK is a more comprehensive term, TEK is the term which has become established, among others, through the work of the International Conservation Union for Nature(IUCN). However, there is no universal definition of Traditional Ecological Knowledge. This is because of the ambiguity with respect to the definitions of 'traditional' and 'ecological knowledge' in the academic sphere.

Yet, Fikret Berkes, has managed to provide a working definition of the term, which can be stated as follows:

Traditional Ecological Knowledge (TEK) refers to a cumulative body of knowledge, practice and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and their environment.

This definition centers on the relationships between all living organisms (including humans) and not just a one-to-one relationship between humans and nature. Various Western thinkers used to believe that humans are in control of the nature.

In contrast, TEK assumes that humans are, and shall always be connected to the natural world as a part of it. It is based on the premise that humans should not view themselves as responsible for nature, i.e., we are not stewards of the natural world, instead we are a part of that world, no greater than any other part (Pierotti and Wildcat, 1997b).

Another important aspect of Traditional Ecological Knowledge is the context in which it has evolved. Separating IEK from its social and institutional context (the culture) is inappropriate, as doing so can lead to loss of the reasoning required in attaining that particular piece of knowledge.

3. Relevance of TEK/ IEK

Indigenous environmental knowledge has been an important part of daily lives of the tribal people. The importance of IEK is highlighted in renowned documents like Our Common Future (WCED 1987) and Agenda 21 (Earth Summit, 1992) which stands as a testimony to the acceptability of the relevance of traditional environmental knowledge in contemporary society. This recognition has something to do with the subtle realization regarding conservation efforts all over the world. This realization is that people do not pay any heed to conservation messages if they are not relevant to their everyday lives and concerns (Osark, 2005), and an integral part of indigenous knowledge is that it is intricately intertwined in the lifestyles of indigenous people.

The relevance of indigenous environment knowledge in sustainable development can also be determined by looking at a few features of the same:
Locally appropriate: the IEK has evolved with the local environment and it is specifically adapted to the requirements of local conditions.

Restraint in resource exploitation: The production activities are for subsistence only, with no commercial motive and hence, no over-exploitation.

Diversified production systems: risk is often spread out by utilizing a number of subsistence strategies rather than depending on just one.

Respect for nature: as forests and land are considered sacred, a form of 'conservation ethic' exists among the indigenous people.

Flexible: IEK is able to adapt to new conditions and incorporate outside knowledge gradually.

Social responsibility: existence of strong family and community ties among the tribals, with a feeling of obligation and responsibility towards nature keeps a check on the activities of the local people.

4. Methods of Documenting the Traditional Environmental Knowledge

The traditional ecological knowledge is usually transmitted orally through generations. This makes it prone to risk of loss and unwanted variations, and the emerging threat of biopiracy looms large over it. Because of this, documentation becomes a necessary activity to preserve indigenous environmental knowledge.

Over here, we shall be discussing four important methods of documenting indigenous environmental knowledge. These methods of documentation of TEK derive from the social sciences and are not mutually exclusive, i.e., they can be combined or used interchangeably according to the need of the researcher. However, certain considerations need to be adhered to while using any of the four methods:

1. The researcher must understand and respect the cultural and spiritual contexts in which the interactions take place.
2. Appropriate ethical principles must be followed in the conduct of TEK research such that individual and community rights are respected.
3. The criteria of selection of participants should involve the identification of key informants rather than selecting a random sample from the community. Local knowledge can be broadly put into three categories on the basis of the holder of knowledge:

   a. **Common knowledge:** held by most people of the community (eg., almost everyone knows how to cook the local staple food)

   b. **Shared knowledge:** held by many, but not all community members (eg., villagers who raise livestock might know more about them than others)

   c. **Specialised knowledge:** held by a few people who might have had special training or an apprenticeship (eg., only few people in the community have knowledge of medicinal plants)

With these points in mind, let's move to the four main methods of documenting the TEK:

Semi-directive interview: In a semi-directive interview, participants are guided in discussions by the interviewer, but the direction and scope of the interview are allowed to follow the participants' trail of thought. Due to the conversational nature of the interviews, there are no questionnaires or any specific time limit. This method is useful when the informants are not comfortable with the direct question-answer format or when the researcher is not sure that the questions are understood as intended.

Questionnaire: A questionnaire is a set of fixed questions, printed or written for the purpose of a survey/research. It is useful when the interviewer knows in the advance what they are going to be asking. A major merit of using questionnaires is that it simplifies comparison between respondents, and hence is good for quantification. However, if quantification is not the ultimate motive, some questions can be left open-ended.

Analytical workshop: Analytical workshops provide a platform for the researchers and the holders of IEK to come together and find a common understanding on the matter concerned. Through these workshops, the two sets of people try to develop priorities for future research and management jointly. In the absence of a formal cooperative body, ad hoc workshops can be convened to address particular topics of interest.

Collaborative Fieldwork: One of the most common and efficient methods of documenting is collaborative fieldwork. This allows the researcher/observer to engage in the daily activities of the informants alongside them and understand the TEK as well as its cultural and spiritual connotations. It has often been used to locate study sites, obtain specimens and interpret field results. It has also been found that locally hired field assistants have often contributed far more to research than mere logistical support.

5. Weather Forecasting Knowledge

Indigenous people have evolved in close communion with nature. Their practices and lifestyles are based on and linked with forests. However, as they turned towards agriculture and their crops depended on rain, weather conditions became the main object of concern. The recognition of phenological signals in plants and peculiar behaviour of animals which were to precede some characteristic weather events were most probably accidental discoveries. These were then followed by a quest for knowing more about them, and thus, developed the corpus of indigenous environmental knowledge on weather prediction.

5.1 Sumi Naga tribe of Nagaland

Sumi Nagas is one of the major ethnic groups among Nagas in Nagaland. This community is considered to be the original inhabitants of Zunheboto region of Nagaland. Sumi Nagas are believed to be nature worshippers and they are known for their knowledge of several ecological indicators to predict seasonal variations, which is gathered through generations of observation and passed down orally and through cultural practices. A few of the observations are:

- If the locally reared bees do not leave their hives in the morning, it indicates a prospect of rain.
- If new shoots of Phyllostachys genus of bamboo rises higher than the parent plant, one can expect high rainfall that year.
- Flowering of the Bambusa pallida plant is an indication of upcoming famine.

Bambusa pallida Source: CABI digital library

Amur Falcon

Source: ebird.org

- Fruiting of mulberry trees indicates the onset of spring, and their harvest indicates summer's arrival.
- Arrival of Amur Falcons, migratory birds from Siberia indicates beginning of winters in the region.
- The thickness of skin of locally caught catfish indicates the intensity of winters, i.e., the thicker the skin, the harsher the winters.
- The song of cuckoo bird propels the farmers to start sowing in their fields.
- While making a fire, if smoke rises unswervingly, the sky is expected to be clear.
- If the nest of Rusty-Capped Fulvetta bird is near the crown of the tree, the tribals expect the occurrence of a flood.

5.2 Hmar Tribe of Mizoram

Hmar tribe or the Mhar tribe is an indigenous group that belonged to the Chin-Kuki-Mizo ethnic group. They are a recognised Scheduled Tribe from Mizoram, and are known for their rich cultural heritage, particularly their folk dance, Chon Lam, and their festival, Thangkawngvailak. With agriculture being a dominant occupation, they have a vast knowledge base regarding weather predictions.

- If a field cricket brings new soil particles out of its hole during the dry season, it is thought that rain is coming soon.
- When winged termites come out of soil after rainfall, it is believed that rain won't occur again for some time.
- Amid rainfall, if domesticated chickens search for food, wet weather is expected to persist all day.
- If Bamboo Partridge are continuously seen perching on lower branches of the tree, it acts as an indication of an upcoming storm.

Bamboo Partridge Source: ebird.org

- If peach or plum flowers grow from the basal region to the terminal of the tree in the flowering season, it is predicted that there will be good rain and higher crop production than in other years.
- When clouds are thick and black in colour, and arranged perpendicular to the orbit of the sun in the morning, rain is said to be approaching.

5.3 Bhils of Southern Rajasthan

Southern part of Rajasthan is an abode of various tribal groups of India. Out of these, the prominent ones (numerically) include the Bhil tribe, the Garasia tribe, the Damor tribe, etc.
Bhil, one of the largest tribal groups, are said to be excellent archers coupled with deep knowledge about local geography and environment. They are mostly involved in agriculture, particularly slash and burn type, and their ecological knowledge helps them harmonize with nature to get the best results.

Bhil woman Source: Mythodea *Garasia man* Source: tripoto.com

Another important tribe of the region, the Garasia tribe claim to have emerged from a division in the Rajput community. The colonization of their lands by the British led to marginalization of these people. However, their environmental knowledge has still remained with them as a local treasure.

The region inhabited by these communities is characterized by the dry deciduous vegetation pattern of the Aravalli hills. Because of this, weather prediction, particularly rain forecasting, becomes an important area of concern, which has been dealt with through local environmental signals observed by the tribals.

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- Mahuwa, a large deciduous tree with cream-colored flowers and fleshy baccate fruits, is used to prepare local liquor and is also handy in predicting weather. When the tree is found heavily laden with fruits not normally seen, it is an indication of plentiful rains.

Madhuca Longifolia (Mahua) Source: keralanaturals.com

- Kadai, a rare tree found on hilltops and sides, with olive-yellow flowers borne in terminal panicles is also an indicator of good rains when the inflorescence and leaves are seen together as an uncommon feature.
- Timru is another 'indicator' plant of the region and is cherished for its bidi leaves with sweet edible fruits. However, an unusually bountiful fruit setting in Timru is not taken as a good sign as it is said to indicate a famine.
- Salar, a medium-sized deciduous tree with papery bark and white flowers, is found on hill tops. While the gum extracted from the tree is used as an incense in rituals, appearance of ample 'beej' (fruit) on this tree acts as an indicator of appropriate weather for grain ripening by the Garasia tribe.

6. Ethnozoological Knowledge of Tribals

Hunting is one of the oldest known human activities, and animals have been hunted for utilitarian reasons as well as for defense against large predators. Products derived from these animals have been used by humans in food, clothing, medicine, weaponry, etc. This enduring relationship is the basis of the discipline of Ethnozoology. According to Marques (2002), Ethnozoology is considered as "The transdisciplinary study of the thoughts and perceptions (knowledge and beliefs), sentiments (affective representations), and behaviours (attitudes) that intermediate the relationships between human populations and the species of animals in the surrounding ecosystems."

A few examples of ethnozoology in the Indian context are stated as follows:

Bird Hunting techniques of War Khasi tribe of Meghalaya

Khasi, or War Khasi residing in the Khasi and Jaintia hills of Meghalaya. They are supposed to have migrated from Southeast Asia to the hills of North-east India, and consist of various sub clans like Lyngdoh, Diengdoh, Marbaniang, etc. A vast majority of Khasis are Christians, with few following Hinduism and Islam. Women are accorded a high status in Khasi societies, and their community is said to be a form of matrilineal society. The War Khasis are skilled in land-based livelihoods, viz. Agriculture, fisheries and Forestry.

In the War area of Meghalaya, the art and science of bird hunting has been passed down through generations, as birds have been an important part of human diets. It is mostly done by the men of the community, and usually makes use of a natural glue (*Ka Pnah*) on glue sticks (*Diengthriang*).

- **Preparation of glue:**

The hunting techniques of War people start with the preparation of a glue substance made from the latex oozed out of the Weeping Fig's bark. The latex is left for a week to harden, after which it is collected in a bamboo basket and cooked in a pot. As latex is highly inflammable, it is usually cooked in open spaces away from the houses. It takes about an hour for the latex to be completely liquefied in a strong fire. After that, the fresh latex in its liquid state is mixed by pouring it into the pot so that it gets sticky.

It is then applied on very thin bamboo sticks known as Diengthriang. A Diengthriang is about 45 cm in length and about 1.5-2 mm in diameter. One third of the stick is covered in glue, while the remaining part is sharpened to be held by the hunter. The sticks are then kept in a bamboo container called Tyndong in order to keep it away from dust and other particles.

- **Suh Sim Um technique:**

During the months of December-March, as the perennial streams dry up, only one stream acts as a source of drinking water for birds in the War region. The hunters make use of this fact and place a few tree branches without their leaves around the water. The birds use these branches to stand on while drinking water. After a week, when birds get accustomed to the branches, the people insert the glued sticks on these branches. Thus, when the birds sit on the branches, now they get trapped on the glue.

This technique is usually practiced by the adolescent (<20 yrs old) and the older (>60 yrs old) members of the community.

- **Suh Sim technique:**

In this technique, people first survey the ripe fruit trees in the forest where birds come and feed. After identification, people climb up those particular trees at night and insert the Diengthriang in the branches in an inclined position of 35o-45o. The angle of inclination depends on the size of the birds that naturally feed on that tree.

Usually before eating, the birds sit together underneath the diengthriang, and the glue sticks to their feathers, restricting their ability to fly. This makes it easier for men to capture the birds. This technique is followed mainly by men between the age group 20-40 years, because of the climbing of trees.

- **Suh Lynglit technique:**

This is a special technique for catching the migratory birds that visit the War area during the months of March-June. In this technique, diengthrang is inserted to the top of the tree branches after clearing their leaves. Then, a domesticated song bird is used as a trapping tool, which calls up with a high-pitched screeching and very melodious chattering. This attracts the migratory birds and as they perch on the tree branches, they get trapped because of the glue.

Most of these birds are kept alive for sale as song birds, and fetch a price ranging between 100 and 250, depending on the quality of their songs.

- **Riam Shynroh technique:**

In this technique, glue is pasted around a bamboo stick of about 1 m in length and 2 cm in diameter. A hole is made in the middle of the stick and a small bamboo piece is passed through it at an inclination of 40o. On this piece, 3-4 termites are placed as a bait. Thus, when termite-eating birds land on the stick, they get trapped.

After every hour, the termites are replaced by live ones for easier recognition by the birds. It is mainly practiced by adolescents and older people.

- **Riam Dkhoh technique:**

Riam Dkhoh or the Owl trap technique makes use of baby owls as bait for other owls. These little owls are placed on branches covered in glue. As other owls gather around them while they dance and shake their tail, they get caught up on the glue. This technique is usually practiced by youths of ages ranging between 20-40 yrs of age.

- **Imitation technique:**

In this technique, the hunter calls the birds by imitating their songs by whistling using their fingers. It is generally practiced during the mating period of the birds every year in the months of July-September. The hunters are able to distinguish between the males and females, since to attract a male the hunter has to imitate the female and vice versa. When the birds come to the trees nearby, they get caught in the glue, and are captured by the hunters. This technique is also employed by local people living in North-eastern Brazil.

The insight into the bird hunting techniques of War khasi people also makes us ponder upon the sustainability of their practices. It has been observed that while they do act as important pieces of indigenous knowledge, these hunting techniques have great impact on the local bird diversity.

Fish Harvesting techniques of Khasis of Meghalaya

The Khasi people of Meghalaya are also known for their knowledge and techniques of fish hunting. Fishing is an important part of tribal routine amongst the War Khasi. Over the years, they have come to devise certain techniques to hunt fishes in a sustainable and non-threatening way. These techniques are specialized according to structure and size of stream, season and species of fish intended to be harvested. A few of the techniques used are:

- **Riam Kriah**

Riam Kriah literally means a basket trap in the local language. It is used specifically for harvesting a specific species of fish, called *Garra lissorhynchus* McClelland, in the months of April-July, when the fish migrate from lower to upper course of the river for breeding.

In order to make this trap, a suitable site is selected where a 60o inclined block of around 1 m height and 5-10 m width is constructed. This block is made of bamboo mesh, with its pillars made of tree branches. *Phyrnium* leaves and *Musa* stem are used to seal the interstitial spaces especially at the base of the construction, and the whole structure is called the Kriah.

After that, two holes are made on the Kriah, where an elongated basket with a trap locally known as Ka Shit, is fitted. The basket with trapped fish is kept overnight and collected in the evening the following day. This technique is used only in smaller streams because it is practiced during the breeding seasons and the hunters do not want to disturb the aggregate fish population. On an average, 2-3 kg fish/day/Kriah are obtained.

- Riam Khohka

Riam Khohka is similar to Riam Kriah, with the only major difference being that while Riam Kriah is used on fishes migrating upstream, Riam Khohka is used on fishes migrating downstream. In order to bring about a strong flow of water current, a depression is made on one corner of the river bank, where an elongated trap is set up in the opposite direction. This whole structure is known as Riam Khohka.

As most of the fish breed upstream in the shallow waters, they start migrating downstream post-monsoon, and as the water starts receding, they get trapped in the Riam Khohka. This technique provides the tribals with around 2-10 kg fish/day

- **Buh Kroh**

Buh Kroh literally stands for ‘making home for the fishes.’ It is the most important type of fish-harvesting method practiced by the majority of the people in the community. It is also one of the most sustainable methods of hunting used by the tribals. The technique can be further subdivided into three types depending upon the season:

- Kroh tlang: January-February
- Kroh pyrem: March-April
- Kroh synrai: October-November

Out of the three, Kroh tlang is made in slow water current areas, whereas the other two are made in fast water current areas. The reason for this is that in winter months, the fishes prefer to stay in holes in the slow current areas.

First, the area is cleared by removing the pebbles and cobbles to make the place smooth and flat, leaving only fine sand in the bottom. The diameter of the structure ranges between 1-3 m depending on the size of the stream.

After that, three pebbles are placed in a triangular pattern, supporting a flat slab stone known as Mawpyniap (killing stone). Then, a number of stones are systematically placed around and on top of Mawpyniap. This is followed by placing three layers of stones of various dimensions on the top of Mawpyniap, with the fourth layer being of smaller stones. The artificial breeding space created provides a better place for fishes to thrive than the natural ones. The fishes are allowed to get accustomed to the hole, and when the stones turn brownish due to the impact of moss, the Kroh is considered ready for harvesting.

More than two people are required in the harvesting process. They use a thin and white cloth called Nep Sala or a mosquito net to cover the Kroh. After that, the stones are removed gradually and the hunters make their way to the Mawpyniap. Then, the hunters remove the Mawpyniap and capture the fishes present there, yielding an average of 2-5 kg/kroh/harvest. Due to construction of an artificial habitat for the fish without disturbing their natural life cycles, this method is considered to be sustainable in nature.

- **Riam Kyllong**

In this type of fish harvesting, the tribals construct an enclosure of 3-4 m breadth and 7-8 m length using the bamboo tree branches. The enclosure has a flat and smooth bottom and hosts the bait for the fishes to be trapped. By using the Musa stem and the Phrynium leaves as a blockage at the base, it is made sure that there are no holes in the enclosure.

The entrance of the structure is made with a special door, kept open and suspended in the air with the help of a rope. Three to four additional ropes are tied just above the water level in this enclosure where baits are tied. As the fish get habitual in visiting the enclosure during the night within 3-4 weeks, the fisherman cut the rope at the entrance one night and capture the fishes trapped. A particular enclosure is used 3-4 times for this type of harvesting, with a yield of 10-25 kg per harvest.

- **Ring Khashiar**

Ring Khashiar technique of fish harvesting is generally used for capturing one type of fish, locally called Khashi-iar. The tribals noticed a pattern in the breeding activities of this fish. Every winter, the fish used to breed in the corners of the river.
Accordingly, they started removing the stones from the riverbed near the places the fish usually bred. Then, they created an enclosure of around 1 m in diameter using stones, with its entrance in the opposite direction of the current. This allowed the fish to enter but not exit the trap. The fishermen then place a basket at the mouth of the entrance and capture the fishes during nighttime.

- **Bia Doh Pieh**

Bia Doh Pieh is the traditional method of catching frogs used by the War Khasi people. This is usually done during the night time where fire is made by burning bamboo. The light from the fire makes the frogs immobile and easier to catch.

After being caught, the frogs are dried immediately within 3-5 hours. Then they are cooked with turmeric and salt in hot water, after which they are kept over a wooden rack (mynding) hanging over the fire. The heat and the smoke from the fire aid in the preservation of the frogs for a period of one month.

Meliponiculture by Nagas

The Nagas consist of various sub-tribes that are linked with Assam and Myanmar. Each of these tribes is divided into as many as 20 clans, and speaks around 60 different dialects. Their main occupation is cultivation of rice, millets and taro potato. Along with that, Nagas also practice Meliponiculture, the act of rearing stingless bees for honey, wax (cerumen) and pollen.

Stingless Bee Source: krishijagran.com

Stingless honey bees belong to the family Apidae and come under the subfamily Meliponinae. Due to the absence of a sting, or just a rudimentary presence of it, the bees are highly social and easier to rear. Around eight species of stingless bees are reported from the Indian subcontinent. Due to their short flight range, they are the ideal pollinators for green house cultivated crops.

Coming to Nagaland, three species of stingless bees are observed in the region: Tetragonula iridipennis, Tetragonula laviceps and Lophotrigona canifrons. Out of these, T. iridipennis and T. laviceps construct their nests terrestrially in hollow crevices and tree trunks as they prefer mild light intensity and stenothermal climate. The nesting behavior of the underground stingless bees, L. canifrons is subterranean. Their sites are usually observed within the bushy forests, at sloppy places engulfing shady small trees and shrubs preventing light.

The Nagas capture the bees and rear them in traditional apiaries. In the case of terrestrial bees, they first search for flowering plants and observe their visitors (bees/butterflies/birds), and if they find the stingless bees, they follow them to locate their colony. They squat down on the ground and look upwards towards a light to easily spot the bees. After finding and marking the nests, they cut the trunk/branch with a saw without disturbing the colony. After cutting, the logs are sealed with wooden planks and cerumen, and shifted to the apiary at dusk.

The feral nests of L. canifrons are also located and marked by the tribals. Once located, the farmers first pluck out the entrance tubercles and keep it away safely. Thereafter, using long and flexible grass straws as direction indicators for entrance, they start digging. The depth of the nests varied from a few inches to even 5 ft or more. The digging continues till the buzzing sound of bees is heard, after which the nest is slowly cut along with the soil with the help of a knife, and placed in an earthen pot. After placement, the empty spaces in the pot are filled with thermocol, and the peripheral gaps are sealed with cerumen. The plugged entrance tubercles are then fitted at the hole of the earthen pot with the help of cerumen. The pot is kept in the location till dusk to allow all the bees to return back to their colony, and in the evening, it is taken to the apiary.

After capturing, the Nagas use various methods of rearing the bees. Traditionally, they keep the colonies in log hives with varied sizes. These log hives are cut from hollow tree trunks and their open sides are closed with wooden discs. Along with these, many tribal locals also use a rectangular wooden box, joined with nails for meliponiculture. The wood is locally sourced, preferably Gamhari, and a small hole is made at the lower front portion of the box for entry-exit. When it comes to harvesting, three products are of value to the tribals, the honey, the pollen and the cerumen. The beekeepers first close the entrance to the colony with a cloth, and then use a hand or sharp wooden strip to pluck and pull the honey pots. Some people also use honey pickers made of bamboo and wood to puncture the honey pots and ooze the honey out of it. This honey is then cleaned and filtered with a muslin.

After honey harvesting, the beekeepers harvest surplus pollen by knife and take it out of the colony. However, a sufficient amount of pollen is kept in the hive for growth and development of a colony. The honey harvested is then sold in the market fetching a price as high as Rs 3000/kg.

Ethnoveterinary practices of the Karbis of Assam

Karbis are one of the dominant tribes in the state of Assam. From a point of view of habitation, the Karbis are divided into three groups, namely, Chinthong, Ronghang and Amri Marlong. They are also divided on the basis of clans called ‘Kur’, which are: Terang, Teron, Enghee, Ingti and Timung. Although all the five clans are socially on an equal level, Ingti, being a priestly clan, was supposed to have a higher status in former times.

Among the Karbi farmers, pig rearing, or piggery, is a prominent and age-old traditional practice. Pig rearing is considered to be one of the most profitable livestock enterprises due to its short generation interval, large litter size, and most importantly, the ability to convert inedible kitchen waste materials into edible animal protein.

Pig Rearing of the Karbis

It has been observed that Karbis practice pig rearing with a very low to no input basis through supplementation of feed with large numbers of locally available plant-based feed resources. This occupation predominantly a woman domain among the tribals, with backyard pig farming being an important mode. Usually, the pigs are kept in a fencing system, with or without a roof followed by girth tethering with or without shelter. The floor structures of the pig pen are mostly non concrete, with mud and raised wooden floors.

The pigs raised by the tribals are usually fed kitchen waste, vegetable and animal by-products. The farmers mostly base the pigs' diet on the locally available leaves and fruits, which are either used in raw form or in a cooked form alongside rice bran. These plants are usually collected by women farmers. There are various plants which are also used in disease management among the pigs. A few of these plants along with the disease/ailment they are supposed to cure are:

Sr. No.	Common Name	Part(s) used	Disease cured for pigs
1	Rusty Mimosa/ Thembra	Bark	Diarrhea
2	Aloe Vera/ Bap engsu	Leaves	Skin infection
3	Bishohori/ Mirve	Leaves	Post-castration
4	African chili/ Birikso	Fruit	Conjunctivitis
5	Indian Fig tree/ Thebo	Latex	Fracture
6	Spiny gourd/ Karela	Leaf	External parasite infestation

7. Ethnobotanical Knowledge of Tribals

Along with hunting, gathering of wild produce has also been an integral part of tribal peoples' routines. The presence of a variety of plants in the forests with many of them being poisonous and fatal to humans if consumed, makes it important for tribals to devise indigenous methods of identifying the poisonous plants, and also traditional cooking procedures to dilute the effect of poison. These plants are also used as the main source of medicines among the tribals. This branch of knowledge is referred to as Ethnobotany.

Botanical Knowledge of Monpa tribe of Arunachal Pradesh

Monpa tribe is one of the five tribes to inhabit the west Kameng district. They belong to the Tibeto-Mongoloid racial stock and usually follow the lamaistic tradition of Mahayana Buddhism. Due to a slight variation in dialects, they are further subdivided into six linguistic groups.

The Monpas have social structures like caste and clans, but no social hierarchy. With agriculture being their major occupation, animal husbandry has started rising up as a complementary source of income. The Monpas are well known for their wood carving skills, painted religious scrolls called Thangkas, and paper making and weaving skills.

- **Knowledge of Local beverage (local beer) plants**

Consumption of alcoholic beverages has been a part of lifestyles of various ethnic communities. Monpas are also known for one such beverage, locally called 'Bhangchang'. It is prepared from rice, maize, finger millet and buckwheat, and has been traditionally used in all festive occasions, birth and marriage anniversaries. It is mainly prepared by Monpa women.

The women make use of some wild plants as antimicrobial agents to help the growth of yeast during the process of fermentation. Young leaves and twigs of certain species like betel are common growth supplements.

- **Knowledge of Ethno-veterinary plants**

Monpas also have knowledge of certain plants used to improve the health of their livestock. The leaves of Cannabis sativa are given to the cattle and goat to cure dysentery and diarrhea. Similarly, the stem of Musa paradisica L. is regularly given by the tribals to cattle particularly during pregnancy to enhance the yield of milk.

Another important plant species that comes in very handy to the tribals in livestock management is Gymnocladus assamicus. The ripe pods of the plant are soaked in water and used as a disinfectant for cleaning wounds and parasites like leeches and lice on the skin of the animals. The fully ripe pods of the plant are used as a soap for bathing the animals due to their gentle nature.

- **Knowledge of poisoning plants**

In addition to agriculture, the Monpa tribe also practices community seasonal fishing using a technique called poison fishing. While the practice is banned all over India, it is still practiced in remote areas.

In this technique, the tribals take aid of poisonous plants which they release after macerating the appropriate parts with the help of wooden sticks or hammers into the water environment. Depending on the time and conditions, the fish begin to float to the surface in some time and can be easily collected.

A plant used in arrow poisoning to kill animals like bears, pigs, etc is the underground tuber of the Aconitum ferrox plant.

Aconitum ferrox Source: entheology.com

Ethnobiological knowledge of Tai Khyamang tribe

The Tai Khyamangs or Khamjangs are a section of the great Tai stock of people. Popularly known as Shyams, they represent a great branch of the Mongoloid population of mainland South Asia. Tai Khamyangs migrated to Assam in the eighteenth century, and are today recognised as a distinct Scheduled Tribe of the state. With agriculture as the main occupation amongst the people, they are known for their ecological knowledge pertaining to plants.

- **Nou-Heib dish amongst the tribes**

The food habits of the Tai Khamyang people mainly consist of traditional glutinous rice called Bora as a staple. An important dish that is famous among the tribals is the Nou-Heib, a fermented bamboo shoot that is mainly consumed as a side dish to enhance taste and provide flavour to the meal. It is usually prepared using bamboo shoots of local species like *Bambusa balcooa, Bambusa tulda,* etc. which are widely available in the homestead plantations of the tribals.

The fermentation process for the dish begins by removing the outer leaf sheaths of the young shoots, which are sliced into small pieces after being cleaned thoroughly. Then, these pieces are pressed into a bamboo tube which is sealed using leaves and bamboo strips. This tube is then stored for a period of about one to two weeks under natural anaerobic conditions, after which it becomes ready for consumption.

- **Multiple uses of *Livistona jenkinsiana* Griff (Tokou)**

The Tokou plant, of the family Arecaceae, grows naturally in the forests and is also cultivated in the homestead plantations of the tribals. Its leaves, after drying, are used widely as an eco-friendly roofing material for traditional houses. These last usually for 4-5 years. Along with that, tokou leaves are also used for constructing roofs of cow sheds, and sheds of other domesticated animals. The dried leaves and the bamboo strips of the plant are also used to make a traditional headgear (Kup) locally worn by the tribals, and the large sized fresh leaves are used as mats for placing and cutting meat and fish.

Ethnomycological knowledge of tribals of Assam

Assam is the home of various indigenous communities, a few of which are Karbi, Biate and Khelma. They generally practice Jhum cultivation, and in the months of May to September, they are also engaged in collecting wild mushrooms. Many of these mushrooms can be poisonous as well, and hence, they use their traditional ethnomycological knowledge (knowledge of fungi) for the same.

Around 20+ species of wild mushrooms have been identified that are consumed by these tribal people. The growing season of most of these mushrooms is from June to September. Among the recorded, Schizophyllum commune Fries had the longest growing period, whereas Tricholoma sp had the shortest growing period. The studied communities can easily distinguish between poisonous and edible species of mushrooms using their own traditional protocols. For example, the Bodo community considers mushrooms growing on the decomposed cow dung without annulus as poisonous. Similarly, the presence of pink fluid in the fruiting body in Agaricus sp determines the edibility of the mushroom. Many times, the traditional processing and cooking knowledge determined the edibility of the mushrooms.

Generally, mushroom collection is not a dedicated activity among the tribals as the farmers usually collect them while returning from their jhum fields. It has also been observed that women of the community are more involved in the activity than men. Most of these mushrooms are eaten fresh, with only a few being stored for future consumption. After sun drying for 1-2 days, these mushrooms can be preserved for another one or two days, and in a few cases, even for a few months.

Coming to traditional cooking methods, these mushrooms are mostly consumed as boiled mushroom curries with only salt and traditional soda (Foda). Sometimes, they are also fried with brinjals, tomatoes and fried fish. All this while, precautions are taken by the elderly women who wash the fruits and vegetables to identify any poisonous mushroom that is mistakenly collected by the locals. Even though mushroom poisoning is not so prevalent among these tribals, the locals do have some cures for them. For example, if someone suffers from poisoning induced nausea, stomach pain and diarrhoea, they are given copper and silver coins dipped in water for drinking. Recently it has also come to light that mushroom collection is not just a self-sustenance activity among the tribals and it can add value to their household income, fetching a market price ranging from Rs 20-30 per kg to Rs 600-700 kg.

8. Conclusion

In conclusion, tribal environmental knowledge in India is a vital aspect of sustainable development, biodiversity conservation, and ecosystem management. It has accumulated over centuries of living in harmony with nature and holds significant potential for addressing the current environmental challenges. The integration of this traditional knowledge with modern scientific approaches can lead to the development of effective and culturally appropriate conservation and management strategies. From ethnobotanical knowledge to the indigenous methods of forecasting weather, when tribal knowledge is extensively documented and preserved, its importance and relevance is appropriately understood. It is crucial to recognize and respect the value of tribal environmental knowledge and to empower tribal communities to participate in decision-making processes related to natural resource management. By doing so, we can foster a more sustainable and equitable future for both tribal communities and the environment.

9. References

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