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Sustainable Resource Management: Understanding the Oil Extraction Of Paudi Bhuiyan

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Abstract

Indigenous peoples, with their diverse cultures, stand out as custodians of traditional wisdom and sustainable resource management practices. Indigenous oil extraction methods—used to derive oil from fruits, nuts, and seeds—reflect a deep connection to local environments. These practices, which often involve manual labor and simple traditional tools, prioritize sustainability and draw from generations of accumulated knowledge.

The Paudi Bhuiyan community of northern Odisha exemplifies this approach. Through community-led practices and rich ethno-ecological knowledge, they have developed sustainable methods for oil extraction and natural resource management. Their way of life is deeply intertwined with the forest, prompting the development of systems that ensure both the use and conservation of these resources. The Paudi Bhuiyans' traditional ecological knowledge contributes significantly to sustainable development. It offers tested strategies for enhancing community resilience, managing resources, and adapting to climate change. Integrating this knowledge into broader development frameworks can lead to more equitable, effective, and lasting outcomes—for both the community and the region. Therefore, it is essential to protect and wisely utilize these natural resources, recognizing and valuing the Paudi Bhuiyan's continued stewardship and expertise in sustainable practices such as traditional oil production and preservation.

Keywords: Sustainable resource, Indigenous, Oil extraction, Traditional knowledge

Introduction

How the PaudiBhuyans use land and forest resources promotes long-term availability and reduces waste. Their methods, like the sustainable collection of non-timber forest products and wild foods, guarantee that ecosystems remain resilient and productive. Their conventional approaches to forest and agricultural land management support preserving biodiversity and soil health, both essential for sustainable development.Being in the forest, the PaudiBhuiyans have a deep relationship with the natural world. Everything in nature is constantly known to them. Over the years, their understanding of being reliant on nature for

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generations has shown to be a valuable resource. Included in this information is the process of making oil from seeds. They are well acquainted with every fruit and seed found in the forest, and they know the advantages and applications of each fruit and seed. They applied their knowledge to develop the *'Tel-ghana'*, a tool built of forest wood, to streamline oil production from seeds or fruits.

Theoretical Background

To make the interaction between humans and nature easier to understand, this heading has been broken up into two subheadings. The two distinct viewpoints—the biological and bio-cultural perspectives—that provide a more comprehensive illustration of the link form the basis of the classification.

All living things require food, shelter, and protection to survive and produce offspring. Due to their adaptive traits, which occur at the behavioural, cultural, genetic/demographic, and physiological or biological levels, humans have always outperformed other species. These adaptation responses occur to adapt to various settings. At the behavioural level, quick adaptations to abrupt changes in the surroundings occur.Physiological reactions take longer than behavioural adaptation. A longer duration of the physiological alteration triggers the onset of genetic reactions. Long-term exposure to cold can result in lasting alterations, such as lung expansion, but these genetic changes take many generations to manifest (Bateson, 1963).

Ultimately, nature has the power to destroy organisms that are unable to adapt to their changing surroundings, regardless of the tactics they may use to live. Man and nature have a close relationship; when nature changes, man adapts by making some physiological adjustments, but nature always comes first and rules over all living things, including humans (Darwin, 1859).

In some ways, the bio-cultural worldview is a survival technique that humans have adopted. A historical and/or ecological viewpoint should be used to examine how biological and cultural factors interact with nature. For instance, in West Africa, the expansion of malaria and agriculture is connected to sickle-cell anaemia and culture (Livingstone, 1958).

There are many people on our planet, and they live in various places. Some of them live in cold climates, while others live in hot climates, and some live at high elevations. Every population has learnt to adapt to their surroundings, and over time, this has become their

culture, which unites them as a group. Culture is adaptive in nature, much as human biology has a trait known as adaptation. One is born into a culture, but depending on the environment they live in, they can simultaneously adapt to different cultures in order to exist for a long period.

A cultural practice for higher and faster agricultural yields to increase the likelihood of making money, the various modern technologies utilised in agriculture can also be considered. Environmental influences were thought to have the greatest impact on technology and material culture. If we compare the history of our ancestors' material culture with that of now, we can observe the rapid growth and diversity of material culture today, which is a direct result of the increasing technological advancements, which are again the result of human abilities for improved livelihood.

The growth of agriculture has been found to significantly increase the spread of the sickling gene. Plasmodium falciparum malaria is spread by mosquitoes (Anopheles gambiae), which nest in forests cleared for agriculture. People who are carriers (heterozygotes) of the sickling gene have been shown to have a stronger immune system against malarial infection than either normal people without the gene or people who are homozygous for the gene. Comparing hunting and gathering populations to those that are more reliant on agriculture, it is evident that the sickling gene is less common in the former.Because the sickling gene confers a higher level of fitness to heterozygous people, this suggests that the growth of agriculture is linked to the distribution of the gene. This is referred to as the heterozygotes' selection advantage. It offers a clear illustration of how biological and cultural adaptations to the environment interact in human populations.

According to Barnett and Morse (1963), non-renewable and renewable resources—especially non-renewable mineral resources—increased rather than decreased. New technologies enabled the exploitation of previously known but unprofitable resources, reduced the cost of discovering new resources, caused less scarce resources to be substituted for more scarce resources, and decreased the quantity required to produce finished goods and services.

Furthermore, Almeida (2002) asserts that modernisation overshadows the concept of development. Because of this, third-world nations are evaluated using the same criteria as industrialised nations, all of which have undergone prior modernisation. This type of ethnocentrism has led to the implementation of a distinct modernisation model globally, and as a result, it has associated the less developed nations with "the lateness." The line

separating modernisation and development doesn't seem to be very distinct. One highlights the ability of a social structure to produce modernity, while the other relates to the many social actors' will to change their society.

Additionally, Kirkby et al. (1995) observed that despite several efforts to realise development in the South through aid programs, particularly following the end of World War II, it is clear that comparatively little has been accomplished. It is referred to as the "crisis of development." Similarly, they also brought up "the environmental crisis," bolstered by the idea that the planet's ability to sustain civilisation diminishes as its population grows by 100 million people annually. Erekson et al. (1999) refer to this as "carrying capacity," a notion that emerged from the biological underpinnings of population ecology approximately 70–80 years ago.

According to Simatele&Simatele (2014), environmental governance in sub-Saharan Africa has evolved into a top-down management structure that involves elite bureaucrats and party royalists who are disconnected from the realities of rural life and continue to prescribe how members of rural communities should manage their natural resources. Consequently, rural residents' knowledge and potential needs are unimportant (Simatele & Simatele, 2014).

Objectives

This paper tries to explore a holistic picture by integrating both individual experiences with broader community perspectives and investigating the traditional oil extraction process in a way that ensures the sustainability of resources and its management and culture friendly. The objectives of study are;

1. To document the traditional oil extraction methods practiced by the Paudi Bhuiyan community, highlighting their cultural significance and indigenous knowledge systems.
2. To analyze the sustainability of these traditional practices in terms of ecological impact, resource conservation, and community resilience.
3. To explore the relationship between the Paudi Bhuiyan’s oil extraction practices and their broader approach to forest and natural resource management.
4. To assess the role of community participation and knowledge transmission in maintaining these practices across generations.

Methodology

This study was conducted in Paudi Bhuiyan villages located in the Deogarh and Sundargarh districts of Odisha. Fieldwork began in 2022 and was completed by the end of October 2023. The villages covered in Deogarh district include Debichua, Pacheripani, Baldhi, Kodoldhi, Muldiha, Burabhuin, Rugrakudor, Saronkot, and Koladu. In Sundargarh district, the study focused on the villages of Kulposi and Dhukamunda. Notably, all households in these villages belong to the Paudi Bhuiyan community. Debichua village lies approximately 5 kilometers from the main road. Nearby villages such as Netrabahal and Jharabahala are predominantly inhabited by the "Chasa" community. The nearest weekly market (hata) to Debichua is held at Bamparda on Saturdays, while a larger market takes place at Kala Hata every Tuesday, located about 6 kilometers from Bamparda. Villages like Pacheripani, Saida, Koladu, and Rugrakudor are situated close to Kala Hata, facilitating regular social and economic interaction. Data collection employed a mix of qualitative methods, including participant observation**,** unstructured interviews, and focus group discussions**.** Unstructured interviews were conducted with household members, local medicine men, elders, and members of the younger generation. These interviews enabled a deeper and more nuanced understanding of the cultural, traditional, and ecological dimensions of oil extraction practices.

Focus group discussions were particularly useful in capturing collective memory and intergenerational perspectives, especially among elderly participants. Direct observation allowed for firsthand insights into practices, rituals, and beliefs—many of which are challenging to grasp through interviews alone.

Additionally, a case study approach was used to explore specific instances of oil-making in detail, providing contextualized and focused examples of traditional techniques. To enrich the documentation, photographic, video, and audio recordings were made. These visual records captured the complexity of preparation, usage, and symbolic significance of oil-making practices, offering perspectives that textual descriptions alone might not convey.

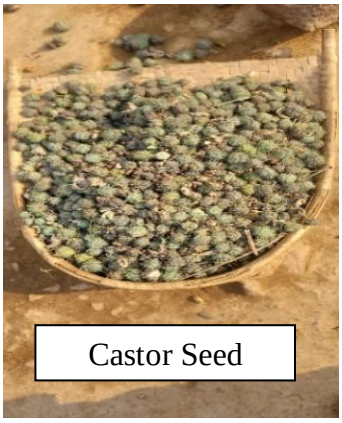
Findings

Seeds and Preparation of Oil

Joda Tel

Common name: Castor oil

Botanical Name of Plant -*Ricinus communis*


Castor Seed

The Paudi Bhuiyan community follows a traditional, multi-step process to extract castor oil, using locally available tools and techniques that emphasize sustainability and resourcefulness. Castor fruits are first collected and sun-dried thoroughly to reduce moisture content. The dried castor fruits are then boiled in water. This helps soften the seeds and initiates the release of oil. The boiled fruits are crushed using a traditional wooden device called a *denki* (manual pounding tool), breaking down the seeds to release the oil more effectively. The crushed material is again boiled in water. During this process, the oil begins to separate and float to the surface. The floating oil is carefully collected using a feather or similar traditional tool, which allows gentle skimming of the oil without disturbing impurities. The collected oil is then transferred to a *kadai* (iron pan) and boiled further to purify it. This final heating step ensures removal of residual moisture and improves the oil's shelf life. Once cooled, the oil is stored in clean containers for household use.

Traditionally, castor oil is valued for its medicinal and therapeutic properties**.** It is commonly used for **r**elief from body pain and headaches, improving eyesight and hair nourishment and scalp health

Tulo Tel

Common Name-Buttercup/Mahua

Botanical Name of Plan- *Madhualongifolia*

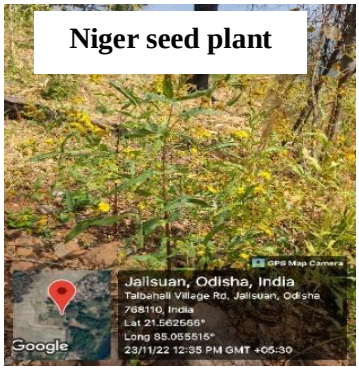

***Tulo* Seeds**

In the Paudi Bhuiyan community, the extraction of oil from mahua seeds follows a traditional, labor-intensive process that reflects deep ecological knowledge and cultural practice. The seeds of the mahua fruit are first thoroughly dried in the

sun to remove moisture. Once dried, they are crushed using a traditional wooden machine known as a *Denki*. Water is boiled in a pot, and the crushed seeds are placed on a *jalhari handi*—a perforated container—positioned above the pot. The seeds are steamed until they become hot and pliable. The steamed mahua pulp is then fed into a traditional wooden oil press called a *Gondi*. Pressure is applied gradually, typically using 5 to 6 weighted lever arms (*pressurerac*), to extract the oil. The oil flows out from the lower section of the press and is collected carefully. The extracted oil, known locally as "Tulo" or "Tor Telo"**,** is stored for various uses.

Rashi Telo

Common name- Niger seed plant



Botanical Name of Plant-*Guizotiaabyssinica*

Niger seeds are an important traditional oilseed among the Paudi Bhuiyan community. The seeds are first thoroughly dried in the sun, then lightly roasted to enhance their oil content and aroma. After roasting, the seeds are crushed using a traditional wooden press**,** and the oil is extracted through manual methods.

This oil is primarily used for massaging newborn babies, a practice believed to strengthen muscles and promote healthy growth**.** The Bhuiyan community attributes medicinal and nurturing properties to this oil, making it a valued part of early childcare traditions.Niger is typically cultivated in shifting cultivation areas, reflecting the community's close relationship with seasonal cycles, indigenous agricultural knowledge, and forest-based farming s ystems.

Sorso Telo

Common name-Wild turnip

Botanical Name of Plan -*Brassica rapa*

To extract mustard oil, mustard seeds are first thoroughly crushed and then allowed to rest, a process that enhances oil release. The rested seed paste is then pressed using a traditional wooden machine to extract the oil. In contemporary times, many members of the Paudi Bhuiyan community take mustard seeds to the market, where they are processed using modern mechanical oil presses**.** Despite the shift to mechanized methods, mustard oil remains a staple in Bhuiyan households, primarily used for cooking and food preparation.

Sorgi telo:
Common Name-Sal tree

Botanical Name of Plant -*Shorearobustagaertn*

Sal seed



The seeds of the Shal tree (Shorea robusta) are first dried thoroughly in the sun to reduce moisture and prepare them for processing. Once dried, the seeds are crushed and then boiled in water until they begin to release oil. As the oil rises to the surface, it is carefully collected using feathers—a traditional method that ensures gentle separation—and then stored for future use**.** Shal seed oil is traditionally used in the preparation of meat dishes and local foods such as chakoli**,** a traditional delicacy. This practice reflects the Bhuiyan community's deep knowledge of forest-based resources and their integration into everyday culinary culture.

Kusum Telo
Common name- Kusum tree
Botanical Name of Plant -*Schleicheraoleosa*

The seeds of the Kusum fruit (Schleichera oleosa) are first dried thoroughly in the sun**.** After drying, the seeds are roasted in a heated pot and then ground into a fine powder. This powder is tied in a sack and pressed under pressure using traditional oil extraction machines. In some cases, the seeds are taken to the market and processed using modern mechanical oil presses.

Kusum oil is not suitable for direct consumption or cooking, as it can cause vomiting if ingested without proper treatment. Traditionally, it must be burned or processed carefully to neutralize its toxic effects.

Despite its inedibility, Kusum oil holds significant medicinal value in the Bhuiyan community. It is commonly used for pain relief and to treat skin conditions such as itchiness**,** reflecting the community's deep knowledge of therapeutic forest resources.

Raikormonji telo
Common name- Black locust
Botanical Name of Plant -*Robiniapseudoacacia*

Raikormonji Tree



The Raikor fruit is first completely dried in the sun, after which the outer shell is peeled and the seeds are crushed to prepare them for oil extraction. The crushed seeds are then boiled in water until the oil begins to separate and float to the surface**.** This floating oil is gently collected using feathers**,** following traditional practices, and is stored

for future use**.** Raikor oil is traditionally used in cooking**,** particularly in the preparation of meat, vegetables, fish, and local rice cakes (pitha**)**. This reflects the Bhuiyan community's ability to make versatile culinary use of forest-based resources through sustainable and time-honored methods.

Karanja Tel
Common name-Indian Beech Tree
Botanical Name of Plant-*Pongamiapinnata*

The seeds of the Karanja fruit (Pongamia pinnata) are first thoroughly dried in the sun and then crushed using a traditional wooden crushing device known as a *Denki*. After this, water is boiled in a pot**,** and the crushed seeds are placed on a *jalhari handi* (a perforated container) above the boiling water, allowing the seeds to be steamed until thoroughly heated. Once sufficiently steamed, the material is wrapped in a cloth sack and then fed into a traditional wooden oil press called a *Gondi*. Using 5 to 6 weighted levers (pressurerac)**,** pressure is applied, and the oil slowly begins to leak from the lower section of the press, where it is collected and stored**.** Among the Bhuiyan community, this oil is known as "Koronjo Telo"**.** It holds significant traditional value and was once widely used in daily life. The oil is believed to have medicinal properties, particularly for relieving body pain, preventing infections, and providing relief from colds. Its use reflects the community's deep-rooted reliance on forest resources and indigenous health practices.

Valia Tel

Common name- Bhilwa
Botanical Name of Plant -*Semecarpusanacardium*

The seeds of this fruit are thoroughly dried, and oil is extracted using traditional methods by crushing the seed in stone hole. This oil is highly valued for its medicinal properties and is used in the preparation of various types of traditional remedies and treatments within the community.



Bhilwa Seed

Mirjha Tel

The creeping part of this plant is first beaten thoroughly and then dried**.** Once dried, it is pressed using a traditional wooden oil extraction machine to obtain the oil. This oil is

primarily used for cooking purposes, reflecting the community's use of diverse plant sources for edible and practical needs.

Neem Tel

Common name: Neem Oil
Botanical Name of Plant - *Azadirachta indica*

The raw fruits of the neem tree (Azadirachta indica) are first collected and dried under sunlight to reduce moisture. Once dried, the fruits are crushed using a traditional wooden device called a *Denki*. The crushed neem is then heated in a container and placed into a leafy structure—a traditional organic wrapping that helps retain heat and support pressing. Two to three such leaf-wrapped bundles are stacked together and placed between the arms of a wooden pressing structure. The bundles are then compressed using manual pressure, and the oil begins to extract slowly. Once collected, the oil is stored carefully and can be preserved for several years. Neem oil is traditionally used in the Bhuiyan community for its antiseptic and healing properties**.** It is commonly applied to treat skin itching, wounds, and other minor infections**,** demonstrating the community's deep reliance on plant-based traditional medicine **and** forest resources for healthcare.

Sishukatho Tel
Common name: Indian rosewood
Botanical Name of Plant- *Dalbergia sissoo*

After collecting dry wooden pieces—likely from specific medicinal tree species—the Bhuiyan community cuts them into smaller sections and boils them in water using a covered vessel (*handi***)**. This process involves a sealed steam extraction method: a small opening is



made in the vessel, into which a bamboo pipe is fitted. As the water boils, steam carrying the oil essence travels through the bamboo pipe and is condensed and collected as oil. This distilled oil is then stored for long periods, often lasting for several years without spoilage. Known for its antiseptic and therapeutic properties, this traditional wooden oil is used to treat skin conditions**,** particularly itching and wounds, demonstrating the community's deep ethno-medicinal knowledge and resourceful use of forest materials.

Indigenous oil-making machine

Results and discussion

Relationship with Forest Resources and Traditional Oil-Making Practices

The Paudi Bhuyan community has maintained a deep and enduring relationship with the forest**,** relying on it as a vital source of materials for every aspect of their lives. They possess an intimate knowledge of the benefits of different parts of trees and plants—including leaves, roots, seeds, and bark—and understand precisely which parts can be used to extract oils and the unique traditional methods required for each oil. The traditional processes of oil extraction have been carefully preserved and passed down through generations, with each oil having its own specific preparation technique that remains unchanged. The community practices sustainable harvesting, taking only what is needed without damaging the trees, thereby ensuring that forest resources are protected and preserved for future use.

The Paudi Bhuyans are not only knowledgeable about the oil-making techniques but also deeply understand the uses of different oils—some designated for cooking, others for medicinal purposes. These oils are stored after seasonal collection and are preserved to last throughout the year.

Despite the rise of modern market oils and mechanical extraction methods, many Paudi Bhuyans still prefer the traditional methods of oil making. However, the decline in the use of these traditional practices is linked to a decrease in the community's overall health and longevity**.**

This study highlights the importance of protecting and utilizing natural resources and recognizes that the Paudi Bhuyan community continues to hold invaluable ethno-ecological knowledge**.** Their expertise in oil extraction and preservation embodies a model of sustainable resource management.

Furthermore, the oils produced are not only central to culinary and daily uses but also hold significant medicinal value**.** They are employed in healing treatments for humans, animals, and birds**,** underscoring the multifaceted role these traditional oils play in the community's wellbeing.

Sustainability and Resource Management in Traditional Oil-Making Processes

Sustainability in traditional oil-making refers to using natural resources—such as seeds, fruits, and plant parts—in a way that meets present needs without compromising the ability of future generations to access and benefit from these resources. For indigenous communities like the Paudi Bhuyan, traditional oil extraction is not just a production method but a holistic practice embedded in their relationship with the environment. The Paudi Bhuiyan people of sample area collect only the necessary amount of seeds or fruits from the forest, ensuring that trees and plants are not harmed or depleted. This careful harvesting allows the forest to regenerate naturally. By relying on multiple plant species (e.g., mahua, kusum, neem, sal), traditional methods encourage biodiversity conservation, which supports ecosystem health and resilience. Traditional extraction methods use manual labor and simple, non-polluting tools instead of mechanized or chemical-intensive processes, minimizing environmental degradation and carbon footprint. The methods and ecological understanding are passed down orally through generations, sustaining cultural identity and ensuring long-term stewardship of resources. Oils are used not only for cooking but also for medicinal and ritualistic purposes, demonstrating an integrated approach to resource use that maximizes benefits without waste. Oil extraction aligns with seasonal cycles of fruiting and harvesting, which helps maintain ecological balance and prevents overexploitation. Decisions about resource use are often communal, ensuring collective responsibility for forest conservation and sustainable use.

Challenges to the Preservation of Traditional Oil-Making Practices

The traditional oil extraction methods of the Paudi Bhuyan community have been deeply ingrained and transmitted across generations**.** However, the younger generation is

increasingly disengaged from these practices. Continuous exposure to modern culture and conveniences has led many young people to perceive the traditional methods as time-consuming and labor-intensive**.** Consequently, they prefer to purchase oil from the market**,** which is seen as more convenient.

This shift has resulted in a decline in the use and transmission of traditional extraction knowledge**,** with fewer youths making regular trips to the forest to collect raw materials. Such distancing from ancestral practices risks eroding critical survival skills**.** Historically, this knowledge has been invaluable during periods of hardship, enabling the community to preserve food and oil for sustenance in difficult times**.**

As the community moves physically and culturally away from these traditional landscapes, their sustainable ecological knowledge is at risk of disappearing. This loss not only diminishes cultural heritage but also threatens the community's capacity for resilient resource management and self-reliance.

Conclusion

The Paudi Bhuiyans have long maintained a close, symbiotic relationship with the natural world, deeply engaging with the fruits, seeds, roots, and leaves of every tree around them. This innate and experiential knowledge is vital to their daily survival and livelihood, as they depend extensively on nature's offerings. Through continuous interaction with their environment, the community has developed an intimate understanding of the uses and qualities of various natural resources**,** especially medicinal plants. Over generations, the Paudi Bhuiyans have refined their ethno-medicinal knowledge by hands-on experimentation—applying different oils and plant parts to treat specific wounds and illnesses, thereby gaining profound insights into healing properties tailored to body ailments.

In recent times, although some households still use mahua oil for cooking, there has been a marked shift towards refined and mustard oils for everyday culinary purposes. The traditional oils once made from seeds and stems for food are now less common, while oils with medicinal properties are primarily obtained in small quantities from markets for therapeutic use.

Despite increasing interaction with modern, urbanized society, the Paudi Bhuiyans' dependence on nature remains strong. This evolving coexistence with modern civilization is impacting their traditional lifestyle and practices. Therefore, it is crucial to protect and sustainably use these natural resources**,** as the Paudi Bhuiyans continue to possess and

preserve valuable knowledge of oil-making and resource management. This knowledge is central to sustainable resource use and maintaining their cultural heritage in a rapidly changing world

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