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Status, Threats and Conservation of Chiuri (*Diploknema butyracea*) in Kalika Municipality, Chitwan

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Abstract
Diploknema butyracea (Chiuri) is a multipurpose tree species with significant ecological, cultural, and economic importance for indigenous communities of Nepal, particularly the Chepang. This study assessed the population status, regeneration pattern, ethnobotanical importance, threats, and conservation needs of Chiuri in Kalika Municipality, Chitwan. Data were collected from 36 circular plots (500 m²) across an elevation range of 300-1100 m and through purposively selected 31 household surveys. The results showed a high density of seedlings (6389 ha^{-1}) but very low sapling density (144 ha^{-1}), indicating poor regeneration and low survival from seedling to sapling stages. . Ethnobotanical analysis recorded 214 use reports across nine categories, with seeds having the highest use value (UV = 4.967) and citation frequency (96.77%). However, declining traditional knowledge, market substitution, invasive species, and habitat disturbance threaten its sustainability. Promoting community awareness, improved processing technologies, and market access is essential for conservation and sustainable utilization of Chiuri.

Keywords: Ethnobotany, Regeneration status, Conservation**,** Livelihood and Chepang communities.

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Introduction
Diploknema butyracea (Roxb.) H. J. Lam, butter tree, locally known as Chiuri, is a medium to large- sized deciduous tree widely distributed on the south-facing slopes in the sub-Himalayan region from 200 m to 1800 m (Bhattarai et al., 2024; Bhattarai et al., 2025). The Chiuri tree is characterized by its robust growth, reaching heights of about 20 meters. The distribution of Chiuri extends beyond the borders of Nepal, encompassing regions in

India, Bhutan, and the Philippines (Subedi et al., 2022). The tree's geographical range spans from the western to the eastern regions of Nepal, covering districts such as Achham, Baitadi, Darchula, Kailali, Gorkha, Chitwan, Lamjung, Syangja, and many others (GoN-MoI/UNDP, 2014). It is geographically distributed in 58 districts (Bhattarai et al., 2024) of the country and has potential to produce 37,245 metric tons (MTs) Chiuri butter with market value of about NPR five billion (US$ 41.4 million) (Chikanbanjar et al., 2021). Various parts of Chiuri plant are used as food and medicine by diverse ethnic groups in Nepal (Devkota et al., 2019; Chikanbanjar et al., 2021). The Forest Resources Assessment 2015 identified 18 uses of Chiuri in the Chure region of Nepal, of which seven were nutritional (MSFP, 2016). Ethnobotanical use reports of Chiuri, used by 26 ethnic groups were recorded from 22 district (Bhattarai et al., 2024). According to a Resource analysis conducted by MEDEP (2020), there were over 5 million Chiuri fruiting trees documented across the country. Chiuri can play a significant role in carbon sequestration (Chikanbajar et al., 2021). Chiuri has an especially important religious and cultural value in Nepalese ethnic communities. Especially in the Chepang community, people give Chiuri plants as a dowry to their daughters, which indicates its significance in their livelihood (Shakya, 2000; Golay et al., 2021). The Chepang people are highly dependent on forest resources i.e., Chiuri, partly for their use and partly for barter and sale (Bhattarai, 1995; Chhetri et al., 1997). They are exceptionally good at weaving baskets, leaf umbrellas, and other handicrafts. Besides, they also know about wild plants and processing methods to detoxify wild foods (Bhattarai, 1995). Leaves of Chiuri are used as a fodder for livestock, the residue of leaves is also used as manure and stems are used as a source of alternative source of fuel (Thapa, 2019). Chiuri also has other indirect benefits such as carbon sequestration, food for wild animals like bats and birds, shelter for many birds, Chiuri seed cake is used as pesticides or for fishing, etc. (Chikanbajar et al., 2021). However, Chiuri trees have significant importance in the economic life of chepangs but they are yet to take advantage to the fullest potential. However, the information on diverse types of Chiuri found in Nepal is still limited such as elevation preference of several types, time to flowering, time to ripening, time to defoliation and size and weight of seeds (Chikanbajar et al., 2021).

Figure 1. Fruiting of Chiuri

Figure 2. Seeds of Chiuri

Diploknema butyracea (Roxb.) H. J. Lam is a multipurpose cultural keystone tree species of Nepal (Uprety & Asselin, 2023; Bhattarai et al., 2024; Bhattarai et al., 2025). Different ethnic groups of Nepal, India, Bhutan, and Tibet use Chiuri for various purposes (Adhikari-Devkota et al., 2023; Bhattarai et al., 2025). It is hailed for its multipurpose values as different parts/products such as bark, stem, leaf, nectar, fruit, butter, honey, oil cake, and gum are utilized (Bhattarai et al., 2024; Bhattarai et al., 2025).

Globally, it has been found that when cultural diversity is lost, biological diversity is also lost, as cultures and ecosystems are intricately linked (Preety et al., 2009). In Nepal, increased market access due to rural road expansion, outmigration, foreign employment, and land use changes have resulted in socio-economics changes, causing a loss of cultural practices over last 20 years (Bohora et al., 2018). The planting materials used for Chiuri plantation is seed–based and hence takes longer period (6−10 years) to bear fruits (Chikanbanjar et al., 2021). Chiuri has a variety of ethnobotanical uses within the Chepang community, making it a significant part of their culture. The seeds of this tree are extracted to produce "Chiuri butter" or "Phulwara butter," while the fruit is consumed fresh and also distilled for alcohol, and the tree and oilcakes serve as firewood and manure, respectively (Uprety et al., 2023; Tewari et al., 2015).

Materials and Methods

Study area

The areas that were studies during our research were within the radii of Shaktikhor and Siddi in the elevation range from 300 m to 1100 m along 3 wards: 9, 10 and 11 of Kalika municipality, Chitwan district, elites the higher relevance of Chiuri species majorly within the Chepang community. These locations are in the Mahabharat Range near the border of Chitwan National Park and Barandabar Corridor. These areas carry a major weightage of Chiuri (Diploknema butyracea) that imposes a higher usage index and value. Chiuri vegetation in Siddi and Shaktikhor areas of Kalika municipality include deciduous forests, shrubs, and agricultural lands. These areas fall within the hilly regions, and thus, vegetation is normally seen in the mid-hills of Nepal. The diversity in both vegetation and ethnicity contributes to the rich cultural and environmental tapestry of Kalika municipality. The forest area plays a key role in local livelihoods, especially the Chepang community in the region of Shaktikhor and Siddi.

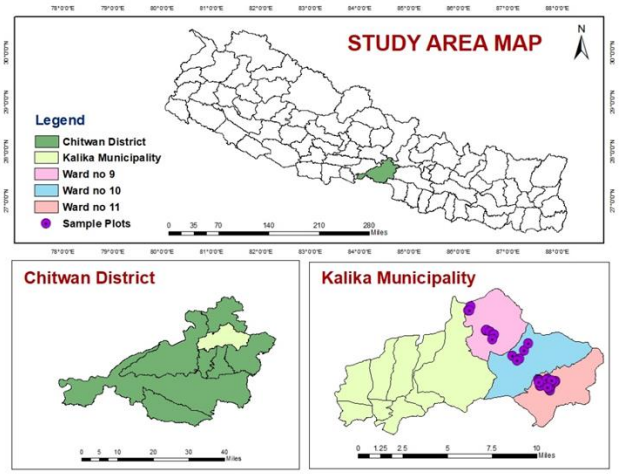

Figure 3. Study area

Data Collection and Analysis

We carried out a random sampling method using a circular plot of 500 m^2 during our research. A total of 36 plots were taken from different geographical structure. The plot showed different population structures depending on the site quality, aspect, elevation and biological disturbance. Similarly, 31 random households were surveyed to collect the socio-demographic information of the study area. Both qualitative and quantitative data were analyzed using standard techniques and applicable tools with MS Excel for data entry, MS Word for report writing, and

Ethnobotany R software for computing statistical analysis of data.

Distribution of Chiuri has been analyzed under the criteria; Seedlings (H<1m), Saplings (1-5 m and DBH<10 cm), Pole (DBH=10-30 cm), Young (DBH=30-60 cm), Adult (60-90 cm), Mature (DBH=90-120 cm), and old (DBH=>120 cm) (Kumar and Saikia, 2020), (Figure 6).

As per the CF Inventory Guidelines, 2061 (DOF, 2004) cited below, the status of seedlings was determined (Table 1).

The following ethnobotanical indices were calculated to analyze the quantitative ethnobotany using R Studio (version 2025.05.1).

Use Reports (URs)

It is the total uses for the part/product by all participants within each use category for that part/product. It is an account of the number of participants who mention each use-category NC for the part/product and the sum of all uses in each use category (Phillips et al., 1994).

$$URs = \sum_{u=u1}^{uNc} \sum_{i=i1}^{iN} JRui$$

The Use Value (UV)

The use value or importance of Chiuri was assessed using the methodology described by (Phillips and Gentry, 1993, Phillips et al., 1994) as –

$$UV = (\sum UVi)/N$$

Where, UVi represents the use value of the species for a single informant obtained as the sum of the number of different uses mentioned by informant i and where N is the total number of informants.

Frequency of Citation (FC)

It is the sum of participants that cites a use for the part/product (Tardio & Pardo-de-Santayana, 2008).

$$FC = \sum_{i=i1}^{iN} URi$$

The data of seedlings, saplings, poles and trees recorded at each plot were graphed at an elevation difference of 200 m. The figure shows the maximum number of seedlings at an elevation ranging from 500-700 m followed by 300-500 m that indicates the good rate of germination but the number of saplings seems to be decreasing.

A total of 9 use categories were designed, and the data were entered according to specific use categories. If respondents have recorded the use of any parts/products, then it was written as 1; if not, it has been recorded as 0. A total of 214 URs is calculated from 31 households.

Results

Socio-demographic Information

The respondents of the study area varied in different aspects such as age, ethnicity, education, gender, etc. The household survey data reflect that there were 16 male and 15 female respondents, out of which 14 individuals were literate and 17 individuals were illiterate. The majority of the respondents belonged to the indigenous nationalities(28), while Dalit, Newar and Brahmin were represented by 1 respondent each. Based on the age class distribution, there were 7 respondents from (40-50) and (50-60) age group, followed by 5 respondents from (20-30) and (60-70) age group, 4 respondents from age class 70 above as well as 3 respondents from (30-40) age group (Table.2).

Distribution pattern of Chiuri along the elevational gradient

Within the study area, regeneration of chiuri tends to decline from the elevation of 700-900 m, which indicates that the chiuri is less abundant above 700 meters. Similarly, there is no abundance of saplings at elevation ranges of 900-1100 m. The population status of adult trees is appreciable at the elevation range from 500-700 m, which shows a high survival rate of chiuri in this elevation range (Figure 4).

Table 1. Regeneration status

Plant Type	No. per hectare		
Seedling	>5,000	2,000-5,000	<2,000
Sapling	>2,000	800-2,000	<800
Condition of Forest	Good	Medium	Poor

Table 2. Socio-demographic status

Feature	Categories of Respondents	No. of Respondents
Age group	20-30	5
	30-40	3
	40-50	7
	50-60	7
	60-70	5
	70-above	4
Gender	Male	16
	Female	15
Education	Illiterate	17
	Literate	14
Ethnicity	Indigenous Nationality	28
	Dalit	1
	Newar	1
	Brahmin	1

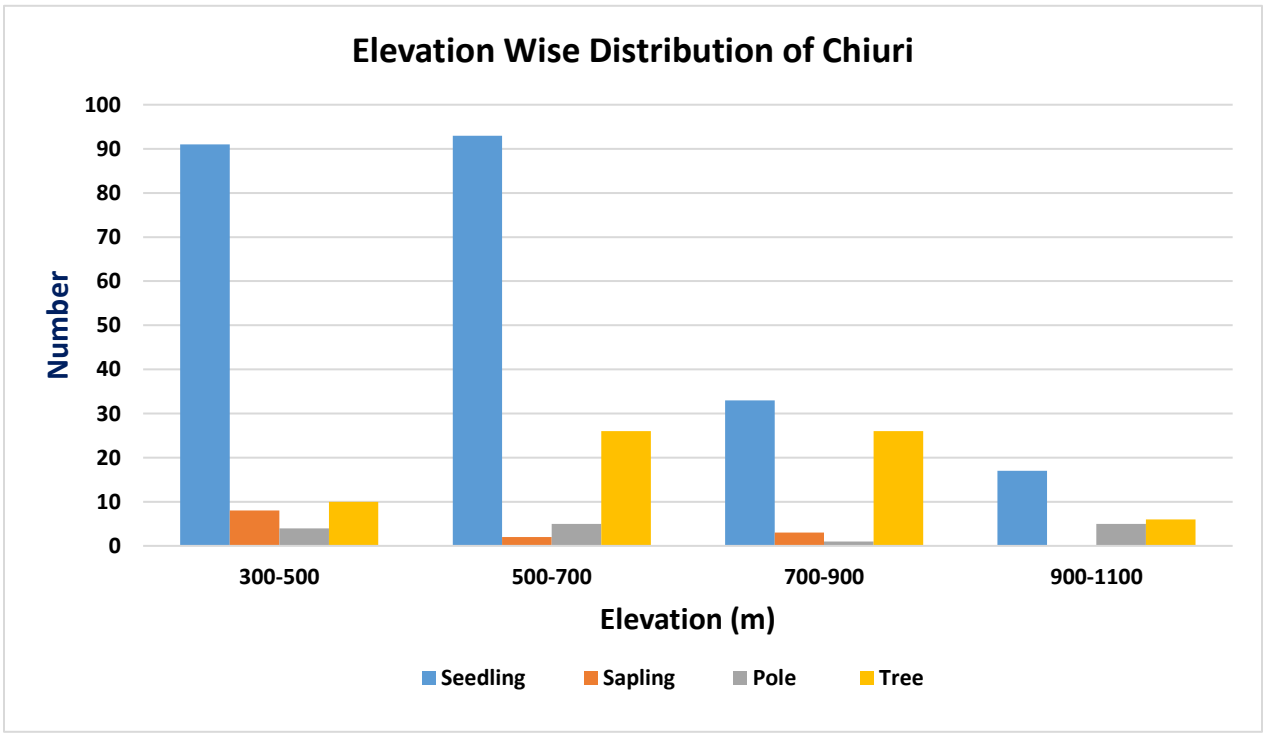

Figure 3. Elevation-wise Distribution of Chiuri

Population structure based on height and size classes

We found that the maximum number of Chiuri are of height class less than 5 m, which includes the count of seedlings and saplings that showing the dominance of younger Chiuri, while the minimum numbers of Chiuri are found above 20 m, which indicates the matured trees are fewer in number (figure 5).

We have found that there are good numbers of seedlings with lower survival rates, or only a few seedlings that have grown into saplings and poles due to various factors such as invasive species, and most of the chiuri are grown on rocky surfaces (Figure 6). The graph also demonstrates that there is a good population of young trees with the minimum number of mature ones.

Regeneration status

The analysis shows the area has approximately 6389 seedlings per hectare in each plot. Likewise, the area has approx. 144 saplings per hectare in each plot. This indicates that the survival rate of saplings is quite low despite having higher germination capacity. From the analysis above, we concluded that there is a good condition of forest in terms of seedlings, but the condition becomes poor when it comes to the status of saplings, as only few number of seedlings grow into the sapling stage indicating poor regeneration (Table 1).

Usefulness of Chiuri and its parts

In our research, seeds were reported as the highest use reports, i.e., 149, followed by fruits with a Use Report value of 23. Similarly, seed carries the highest use value (4.967) among all parts, which shows that seed is widely mentioned and used by the informants, followed by fruits (0.767). Bark has the lowest use value (0), which means it is not used by any of the informants who were surveyed during the research period.

Among all the parts/products mentioned above, seed has been cited by the maximum number of informants (96.77%), followed by fruits (71.19%), flowers (58.06%), and bark has not been cited by any of the informants, which shows its value to be 0% (Table 3).

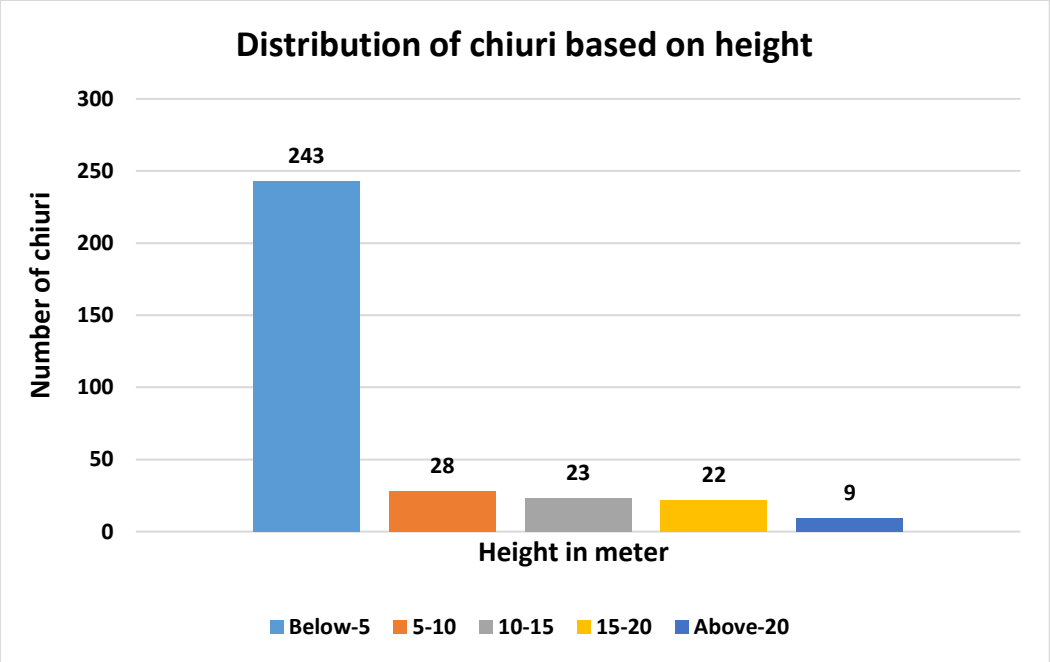

Figure 4. Distribution of Chiuri based on height

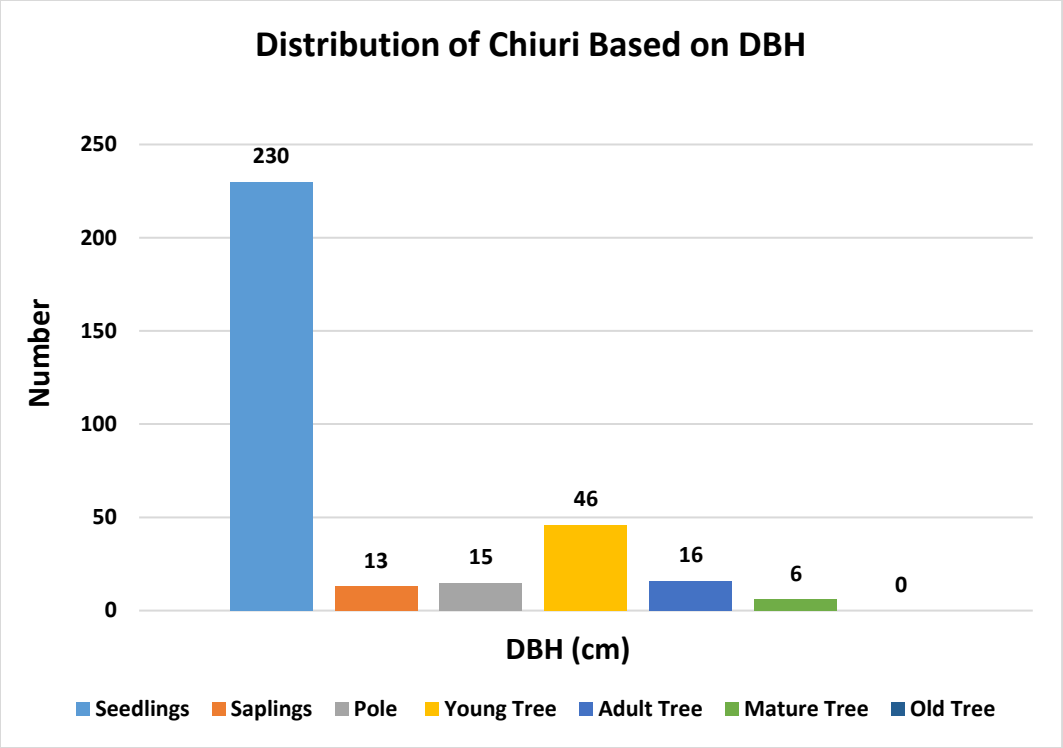

Figure 5. Distribution of Chiuri based on DBH

Table 3. Ethnobotanical Data

Parts/Product	URs	UVs	FCs(%)	Use Category
Seed	149	4.967	96.77	Medicinal
				Religious
				Butter
				Oil cake
				Subsistence
				Cultural
Fruits	23	0.767	74.19	Food
Flower	18	0.6	58.06	Honey
Leaf	15	0.5	48.38	Fodder
				Religious
				Cultural
Whole tree	6	0.2	19.35	Cultural
Stem	3	0.1	9.67	Fuelwood
Bark	0	0	0	

The chord diagram shows the versatility of different plant parts that give different use categories, such as ethnobotanical use, utilization patterns, traditional usage dependency, and so on (Figure 7). Remarkably, the subsistence (29 citations), medicinal (27 citations), and oil cake (25 citations) are those categories that are frequently cited across the research area. This demonstrates the key role in the livelihood of different local ethnic people throughout the community. Likewise, burning (3 citations), fish poisoning and economic use (2 citations), and wine (1 citation) are being followed, showing less dependency on these use categories. Also, it can be understood that those components are almost negotiable in one's life, which barely impacts the day-to-day life of individuals.

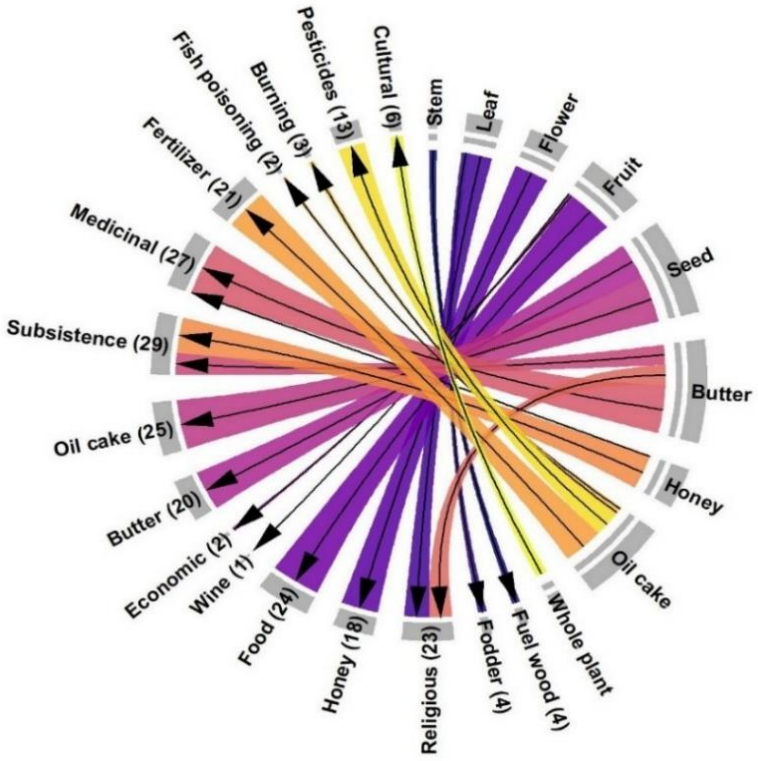

Figure 6. Chord diagram representing different uses of Chiuri

Conservation and Management

The production and the utilization of Chiuri-based products have declined significantly. The older generation does not have the courage to collect the Chiuri fruits, as they grow in the difficult topography, while the younger generation is less concerned about the use of Chiuri and Chiuri-based products. Due to the modernization and the easy access to market-based products, people are showing less interest in the traditional use of Chiuri. Farmers have introduced the hybrid breed of honeybee near the Chiuri plots for the commercial production of honey, which reduces the pollination capacity of Chiuri, ultimately decreasing the production of Chiuri. Advanced technologies have not been introduced to the communities for manufacturing the various Chiuri-based products, so people are not paying more attention.

To encourage local communities towards their conservation, various awareness programs should be conducted at the community level, focusing on the younger generation. Local and central governments should prioritize Chiuri-

based products, and farmers should be provided with modern interventions for manufacturing Chiuri-based products at the community level. Involving different NGOs and INGOs for scientific research on Chiuri will provide more authentic information that further facilitates its conservation. Easy market access to Chiuri-based products, such as butter, honey, and leaf plates, will support local communities economically. Nowadays, haphazard development, such as road construction, has degraded the potential of Chiuri to regenerate and grow further. So, such activities should be designed with proper planning. Widespread expansion of invasive species has affected regeneration capacity as well as the growth of young seedlings by increasing competition. So, more focus should be on reducing the negative impact of the invasion.

Paradigm Shift in Chiuri Utilization

As time has progressed, the traditional uses of Chiuri have gradually been replaced by various market-based products. In the past, items such as leaf plates, oil cake, ghee, and honey obtained from Chiuri fulfilled the daily needs and demands of local communities. However, nowadays, these same needs are met by commercially manufactured goods, which have created significant risks to both the livelihoods of indigenous communities and the conservation of this important ethnobotanical plant. Different products of Chiuri, which have their own traditional use, have been replaced by market-based products shown in Table 4

Table 4. Paradigm shift of Chiuri

Product	Traditional Use	Replaced by:
Leaf plate	a. For religious purposes b. Income for livelihood	a. Plastic/Paper plate
Oilcake	a. As a fertilizer to kill pests and insects in paddy field b. For fishing purposes	a. Chemical Fertilizers
Ghee	a. For religious purposes b. Household purposes (e.g., cooking) c. To treat burning and wounds	a. Packaging oil (e.g., Commercial oil) c. Different types of medicines
Flower juice	a. For honey production	a. Other honey (e.g., hybrid)

Discussion

Diploknema butyracea(Chiuri), a multipurpose tree species, grows profusely in south-facing slopes as patches in mixed broadleaved forest and in riverine habitats or as sparse populations in wastelands, transition lands, or agricultural lands. It is distributed in 75% of districts of Nepal, being particularly abundant and frequently used in Central and Western Siwalik and mid-hills (Bhattarai et al., 2024). Most of the Chiuri trees of Kalika Municipality are found to be grown on sloping areas, among which naturally regenerated trees grow better than those cultivated artificially. It is found that those trees that are less cut during the early days give early fruiting. Interestingly, seeds dispersed by bats show high germination capacity and good regeneration that ultimately supports higher production. The trees that germinated naturally also tend to produce better quality fruits than the plantation, indicating a healthy ecological relationship between Chiuri, Chamero (bats), and the Chepang community that sustains both biodiversity and livelihoods.

Chiuri is widely distributed from 200 m to 1800 m (Bhattarai et al., 2025), and we found that the abundance of Chiuri is at an elevation of 500 m to 700 m in the Kalika municipality of Chitwan district. The regeneration rate of Chiuri in the lower central region of Nepal is poor (Bhattarai et al., 2025). The Chiuri tree, known for its dense canopy and thick, leathery leaves, follows a unique ecological cycle, shedding leaves and fruit synchronously. However, this coordinated dispersal is hindered by ecological barriers such as shade intolerance and a 2-3 days short seed viability (Jackson et al., 1994; Acharya et al., 2023). Despite its dense canopy and leathery leaves on the surface, we found that there was good germination of seed with a lower rate of survival, which ultimately indicates the poor regeneration status of the species in the study area.

The application of Chiuri plant parts and products has been versatile—ranging from dowry to food, agriculture, and medicine—demonstrating its potential for cultural preservation and biodiversity maintenance (Bhattarai et al., 2025). The positive correlation between Chiuri use and household size, as well as livestock ownership, suggests that larger families and those with more livestock rely more on Chiuri due to increased economic demands and the need for diverse resources (Chinsembu et al., 2014). Conversely, the negative correlation with land ownership implies that households with smaller landholdings depend more heavily on Chiuri, as they have limited agricultural resources and rely on communal forests for food, medicine, and economic needs (Reddy and Chakravarty, 1999). But, due to the lack of interest of the young generation towards the utilization and commercialization of Chiuri and easy access to supplemental market-based products, the people of Kalika municipality have been relying less on cultivation of Chiuri and are more directed towards agriculture-based products. Also, those people depend upon different fodder species such as Kabro (*Ficus lacor*), Sindure (*Mallotus philippensis*), Koiralo (*Bauhinia variegata*), Bakaino (*Melia azedarach*), Badahar (*Artocarpus lakoocha*), Ipil-ipil (*Leucaena leucocephala*), etc., rather than Chiuri to fulfill the fodder and nutritional requirements of their livestock. The Chiuri products, such as leaf plate, oilcake, Ghee, flower juice, etc., that were previously used by chepang communities for various religious, economic, and subsistence purposes have been replaced by different commercially manufactured market-based products that reflect the decreasing trend of Chiuri utilization. Along with the diverse useful features of this species, its utilization is going on decreasing, which may lead to the extinction of this species.

Historically, Chiuri oil seeds were harvested for cooking purposes and marketed (Marketing, 1984). However, modernization and globalization have shifted consumer preference towards mustard oil and promoted modern honey production methods (Requier et al., 2019). Consequently, the status of native *Apis cerena* is expected to decline, with exotic bee introductions posing threats to wild pollinators (Poudel et al., 2024). This change in market forces, coupled with an inappropriate access to markets and diminished youth appeal—occasioned partly by the bitter flavor of Chiuri butter—has seen Chiuri collection drop continuously. Honey bees mainly support pollination; however, the introduction of hybrid bees has negatively affected flowering and fruiting patterns. Previously, coordination between local governments and cooperatives supported the empowerment of Chiuri collection and production by introducing programs such as oil extraction, honey bee distribution, market access, and other economic upliftment activities.

One remarkable initiative, “Chiuri, Chepang, and Chamero,” strengthened community participation and fostered

conservation-based livelihoods. But nowadays such initiatives are no longer in operation, which leads to a decrease in interest of local people towards their utilization and conservation.

Butter made from Chiuri is rich in polyunsaturated fatty acid and vitamin (A,E) that helps to hydrates, nourishes our skin, repair hair and shine (Dahal et al., 2021). Chiuri is mainly used to cure different allergic infections, gastritis, burns, wounds, mud affections, pain relief as well as for different skin care purposes. Traditionally it is also believed that oil/butter is used to cure the pain of people suffering from the demonic spirit (daibya sakti) when those people had defecated or urinated in areas like temples, forests, and other religious sites.

Chiuri not only provides medicinal benefits but also provides economic benefits that support the livelihood of local communities. Chiuri plant can give fruits from 12 years to 70 years (Dahal et al., 2021) and according to the respondents of our study area, healthy grown Chiuri can give production up to 100 years. Economic production gets affected by the age of Chiuri, as older the tree becomes, the smaller the size and lower the quantity of the fruits produced. Also, Chiuri supports honey production. A single hive can produce up to 10 kg of honey annually only if the flowers have flowered sufficiently. Looking after a single household, we have found that people can generate an average income of worth NRS 5,000 from the selling of honey (NRS 1000 per kg), NRS 400-500 per kg (Bhattarai et al., 2024). We also came to know that 250 gm of oil costs NRS 300 or 3.2 kg of grains as per traditional practice-(1 pathi), NRS 400-600 per kg (Bhattarai et al., 2024). Still, local people can easily consume butter for 6 months from good seed collection in a season. Alcohol production from Chiuri can also be a good source of income for the local people. There is no strong scientific evidence, but according to the response of local communities, we came to know that Chiuri is of different types classified based on the size of the leaf, size of fruit, and flowering season. On the basis of size of leaf, Chiuri is of two types, small-sized and large-sized. Also, Chiuri can be distinguished as small-sized fruit (Britiyo), Large-sized fruit (Bhantayo), Circular-shaped fruit and Elongated-shaped fruit on the basis of size of fruits. Similarly, based on the season of flowering, Chiuri is categorized as, Mangsire, Poushe, Maghe, and Falgune.

Figure 7. Butter extracted from Chiuri

Figure 8. Beehive in local households

Conclusion

From our research, we concluded that the traditional use of Chiuri has been decreasing. Local ethnic groups have been passively involved in activities like production, collection, and extraction, among which the young generation has been seen higher to get less influenced by the traditional usage practice of Chiuri. Due to this, there is a decreasing trend of Chiuri-based utilization. Despite this, there is a greater possibility of getting benefited by the products of Chiuri if the local ethnic group, along with the local government, shows greater efforts on traditional as well as commercial utilization of Chiuri. In conclusion, Chiuri is one of the highly valued tree species for ecological, cultural, and economic importance, particularly among the rural and indigenous communities. Local government, followed by central government, should formulate plans and strategies for the collection, production, and conservation of Chiuri. Different modern technologies regarding the extraction of different products from Chiuri must be brought into operation to support the economic status of local people. Further research should be conducted on the geographic, botanical, and climatic context in the area.

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