

## TRADITIONAL ECOLOGICAL KNOWLEDGE FOR SUSTAINABLE LIVELIHOOD AMONG THE INDIGENOUS COMMUNITIES IN MALAYSIA AND INDONESIA

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### Abstract

Indigenous communities maintain a profound relationship with the natural world, rooted in a deep understanding of ecological systems and guided by generations of Traditional Ecological Knowledge (TEK). This knowledge is central to cultural identity and continuity and offers practical frameworks for sustainable living and biodiversity conservation. As modern development and environmental degradation intensify, recognising the role of TEK in shaping resilient, sustainable communities has become increasingly important. This study explores how TEK informs and sustains the livelihoods of two indigenous groups: the Baduy tribe of Indonesia and the Batek tribe of Malaysia. The purpose of the study is to examine the ways in which these communities apply TEK in daily practices and how they respond to the pressures of modernisation while striving to maintain cultural integrity. Using a qualitative phenomenological approach, data were collected through semi-structured interviews and non-participant observations with five key informants from both communities. The findings reveal that both groups rely heavily on TEK in areas such as agriculture, health, education, and governance.

However, they differ in their levels of adaptation—while the Baduy remain largely resistant to external influences, the Batek exhibit selective engagement with modern systems such as schooling and healthcare. The study concludes that TEK is essential to indigenous resilience and should be actively integrated into national sustainability and development strategies, with respect for local customs and governance structures.

**Keywords:** *Traditional Ecological Knowledge (TEK), indigenous communities, livelihood, sustainability, Baduy, Batek*

## INTRODUCTION

People who live on land and rely on its resources carry unique knowledge of their environment. Their understanding of natural ecosystems and the connection to their culture is deeply rooted in their relationship with the Earth (Stevenson, 1996). Indigenous communities around the world, whether they hunt, gather, or farm through traditional methods, possess a profound respect for the land. They recognise natural cycles and maintain a harmonious balance with nature. Turner et al. (2022) emphasise that these communities harvest and consume resources mindfully, ensuring they leave enough for both human and non-human life to thrive.

Sustainable living, guided by traditional ecological knowledge (TEK), promotes a holistic approach to align human activities with the environment. This knowledge, passed down through generations, offers a time-tested model for long-term balance between people and nature (Berkes et al., 2000). TEK, deeply embedded in cultural traditions and adaptive processes, reveals how communities have coexisted with nature in ways that safeguard both human well-being and the planet's health. By incorporating TEK into modern practices, society can gain valuable lessons from indigenous and local communities regarding sustainable resource management, conservation strategies, and resilience in the face of environmental challenges (Berkes et al., 2000). This is further echoed by El-Kassar and Singh (2019), who stated that it is necessary to balance economic development with environmental sustainability as the world's resources are depleted.

While the shift toward a market economy has threatened the preservation of traditional ecological knowledge, empirical evidence shows that TEK remains a vital guide for sustainable living (Gómez-Baggethun et al., 2010). As communities adapt to economic changes, TEK continues to offer a foundation for respectful and sustainable interactions with the environment. Its adaptive capacity allows it to remain relevant in today's rapidly changing world, helping communities navigate

new circumstances while holding their deep respect for nature (Gómez-Baggethun et al., 2010).

TEK holds an abundance of wisdom that can steer humanity toward more sustainable ways of living. By acknowledging the value of TEK in shaping conservation, agriculture, land management, and resilience strategies, societies can tap into generations of wisdom. Integrating TEK into contemporary practices fosters a stronger connection with nature, supports sustainable development, and promotes the well-being of both the people and the planet. This study explores how TEK and local wisdom help indigenous communities to sustain their livelihoods. The study focuses on the Baduy tribe of Indonesia and the Batek tribe of Malaysia. The Baduy are divided into two: Baduy Dalam (Inner Baduy) and Baduy Luar (Outer Baduy), while the Batek are from the Batek *Hep* (forest) tribe. Both tribes are still practising their traditional way of life, which has been passed down for generations, with minimal or non-existent outside influence.

## LITERATURE REVIEW

### **Traditional Ecological Knowledge (TEK)**

As global environmental changes intensify, the need to integrate traditional ecological knowledge into conservation efforts becomes more urgent (Gómez-Baggethun et al., 2013). Indigenous and local communities have developed a wealth of knowledge, beliefs, and practices over centuries. Their TEK offers valuable insights that can help us confront today's environmental challenges. When policymakers and researchers recognise the role of TEK in sustainable living, they can craft more effective strategies for conserving biodiversity and managing ecosystems (Gómez-Baggethun et al., 2013).

Incorporating TEK into public land management can significantly improve conservation outcomes (Souther et al., 2023). Through long-term observations of their ecosystems, local communities offer valuable insights that guide sustainable resource use and biodiversity protection. When scientific knowledge combines with traditional wisdom, land management strategies become more effective and culturally sensitive, benefiting both people and the environment (Souther et al., 2023).

TEK also plays a crucial role in agriculture by promoting sustainable practices and ensuring food security (Sumarwati, 2022). Communities draw on centuries-old practices related to land use, crop cultivation, and natural resource management, creating resilient agricultural systems adapted to local environments. Integrating TEK into modern farming supports sustainable food

production, while conserving biodiversity and preserving cultural heritage (Sumarwati, 2022).

Sustainability is central to TEK and is rooted in the belief that humans must coexist with nature to ensure the well-being of future generations (Fang et al., 2015). Communities practising sustainable management under TEK learn to respect and protect the environment while meeting their essential needs for food, shelter, and cultural practices (Fang et al., 2015). These principles help foster a more harmonious relationship with the natural world and build resilience in the face of environmental changes (Fang et al., 2015).

Indigenous knowledge systems offer a holistic understanding of the environment, blending ecological, cultural, social, and spiritual dimensions. Indigenous peoples perceive the interconnectedness of all aspects of life and the environment, allowing them to maintain a balanced relationship with nature (Ksenofontov & Petrov, 2024).

For example, the Batek tribe of Malaysia has lived in the Malaysian Peninsula for around twenty-five thousand years, relying on traditional ecological knowledge passed down through generations to sustain their livelihoods in the tropical rainforest. Similarly, the Baduy people of Indonesia have practised swidden farming for centuries, depending on the forest for survival. Guided by their customary laws or *adat*, the Baduy ensure sustainable forest conservation while protecting biodiversity, underscoring the importance of indigenous wisdom in environmental sustainability (Asteria et al., 2022). The Baduy actively involve their communities in sustainable forest management, promoting practices that preserve the forest for future generations (Asteria et al., 2022).

### **Baduy tribe of Indonesia**

The Baduy tribe is a unique indigenous community residing in the mountainous area of Kendeng, 900m above sea level in the western region of Java, Indonesia, in an area called Kanekes in the provinces of Luewidamar, in the Banten district. Renowned for their unwavering commitment to traditional customs and intentional isolation from modern influences, the Baduy have preserved their cultural heritage despite external pressures (Krisnadi, 2024). The tribe consists of approximately 11,699 members, divided into the Outer and Inner Baduy groups, each with distinct practices that set them apart from other communities (Asteria et al., 2022). As such, the current study examines the employment of TEK in both the Inner and Outer Baduy.

There are some distinct differences between the Inner and the Outer Baduy; the most obvious is how they dress. The Inner Baduy would only wear a white shirt and black pants, which the women of the tribe weave. In contrast, the Outer

Baduy would wear dark blue or black attire. However, they shared the beliefs that they are a part of nature, and it is their responsibility to sustain the resources of the planet (Sumarlina et al., 2022). Their deep connection to nature is evident in their sustainable practices, governed by customary laws that prioritise forest preservation and environmental conservation (Alfira & Uekita, 2023). Agriculture plays a central role in their lives, serving as a primary source of livelihood and illustrating their harmonious relationship with the land (Taryana et al., 2020).

However, the Baduy community faces ongoing challenges from modern influences, including the market economy and advancing technology. The Inner Baduy is steadfast in upholding their traditional beliefs, which has resulted in their refusal to use modern technologies. For example, they would rely on the traditional way of building their houses without the use of nails but using mortise, tenon and ropes made from rattan. However, the Outer Baduy are slowly embracing the influence of modernisation, which can be seen in the design of their houses and acceptance of modern technology. Nonetheless, they are still upholding their beliefs of keeping nature safe. The Outer Baduy has especially felt the impact of population growth and market interactions, leading to the introduction of commercial crops, such as robusta coffee (Iskandar et al., 2019; Kenedy & Deffinika, 2022). Despite these pressures, the Baduy have demonstrated resilience in preserving their cultural heritage, resisting changes threatening their values and traditions (Heriyanto, 2019). The economic resilience of the Baduy tribe, particularly in the face of challenges like the COVID-19 pandemic, has been attributed to their simple, frugal lifestyles, which align with cultural principles that emphasise happiness and healthy living (Amalia, 2023; Darmadi, 2023).

Education and cultural preservation also play key roles in the Baduy society. Family literacy fosters intergenerational learning and supports cultural and educational transformation within the community (Rosmilawati & Darmawan, 2020). This dedication to knowledge extends to integrating local wisdom into modern educational practices, including elementary school curricula (Kurniasih & Arisetyawan, 2019). Moreover, the distinct identity of the Baduy tribe has gained increasing visibility as individuals outside the community showcase Baduy culture on platforms like Instagram, contributing to its preservation and wider recognition (Amrullah, 2024).

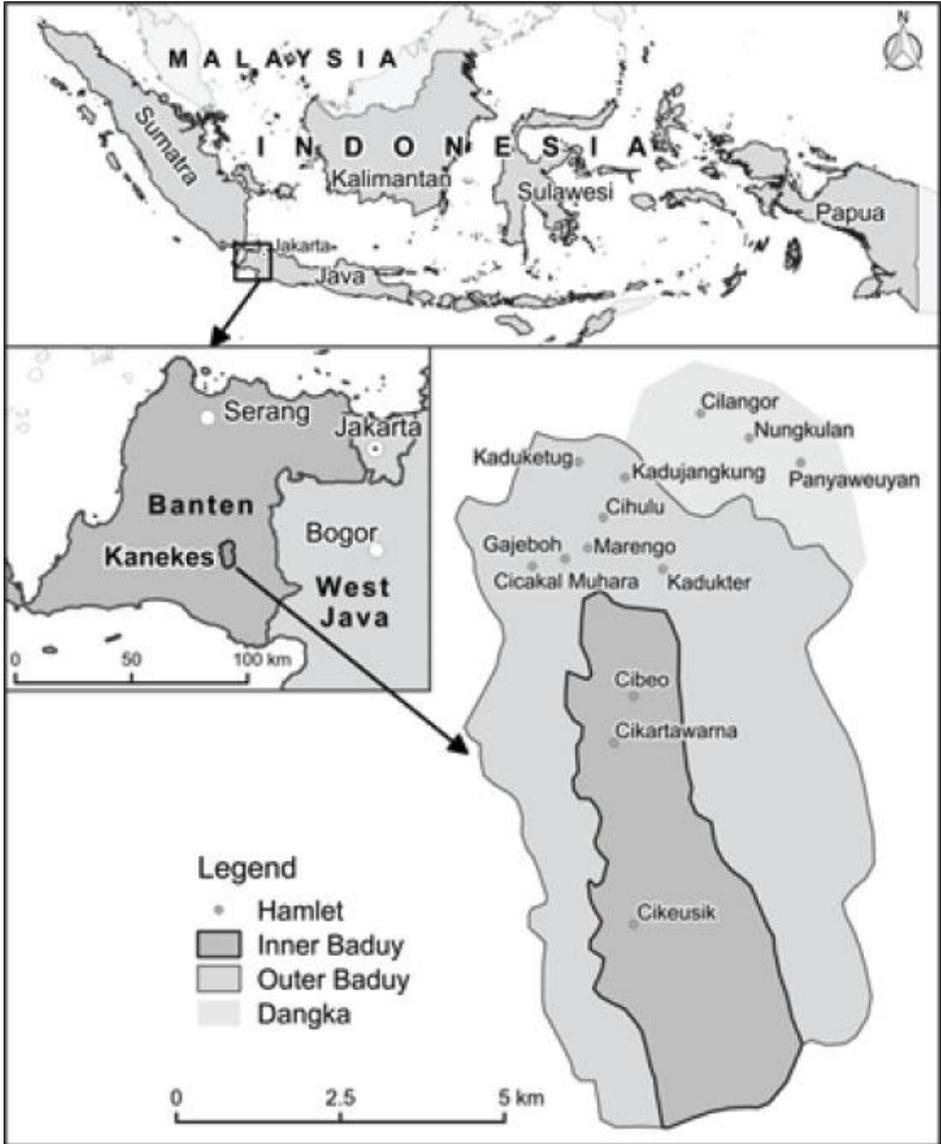


Figure 1: Location of Baduy villages in Kanekes, Indonesia  
(Source: Iskandar [2023].)

**Table 1: A general description of Baduy**

Baduy	Attire	Traditional beliefs	Work
Inner Baduy	The top is white (woven shirt) and black pants (See Pic 1 below)	Prohibited from using any modern tools or amenities Traditional houses made using mortise and tenon method House would only have one entrance/exit	Hill paddy planting ( <i>ngahuma</i> ) Trading local produce ( <i>Aren</i> sugar, honey and <i>Durian</i> )
Outer Baduy	Dark blue shirts or pants Black shirts or pants (See Pic 2 below)	Allowed to use modern tools (minimal) Houses are built using modern tools and design	Hill paddy planting ( <i>ngahuma</i> ) Souvenir stalls Trading local produce ( <i>Aren</i> sugar, honey and <i>Durian</i> )



**Figure 2:**  
A group of Inner Baduy men  
(Source: Fieldwork, 2024.)



**Figure 3**  
Outer Baduy teenagers

## Batek tribe of Malaysia

The Batek, one of Malaysia's eighteen indigenous tribes, belong to the Negrito subgroup. Their population remains small and dispersed across several regions in the states of Pahang, Kelantan, and Terengganu. As one of the last mobile hunter-gatherer societies in the Malaysian Peninsula, the Batek are closely tied to the lowland forests they call home (Lye, 2005). Within the Batek community, various subgroups exist, including the Batek Hep in Taman Negara, Pahang—where 'hep' signifies forest—along with the Batek De', Batek Nong, and Batek Tanum groups (Lye, 2000, 2005; Endicott, 1979, 1984; Tacey & Riboli, 2014). While these subgroups differ linguistically and culturally, their physical characteristics remain similar (Tacey & Riboli, 2014). For instance, the Batek in Taman Negara often remark on the difficulty of understanding the dialect spoken by their counterparts in Kelantan (Ahmad et al., 2024).

Batek society is notably egalitarian, with a strong emphasis on individual and collective autonomy. Their village headman, who holds no authoritative power within the group, primarily serves as a government-appointed representative (Endicott et al., 2016). Though traditionally semi-nomadic, Batek villages along the Tembeling River in Taman Negara have remained in place for over a decade. While the Batek still occasionally move to temporary forest camps (Endicott et al., 2016) or relocate between larger settlements (Rudge, 2021), their migration patterns have become more settled. The community no longer relocates in search of food but may shift only due to floods or elephant incursions (Ahmad et al., 2024).

Batek men continue to gather forest produce like rattan, agarwood, yams, and wild fruits, which they either consume or trade with local merchants. Additionally, they take on seasonal labour, such as land clearing and wood collecting, for local businesspeople or villagers (Lye, 2002; Ahmad et al., 2024). However, these activities often fail to provide a sustainable income. In recent years, the Department of Wildlife and National Parks (DWNP) has employed Batek men as contractual park rangers, recognising their deep knowledge of the forest and offering a more stable source of income (Ahmad, 2024). Batek women, on the other hand, create bangles and small handicrafts from rattan to sell to tourists, though these sales seldom generate sufficient earnings. The men are also skilled tree climbers (Endicott, 1979; Endicott & Endicott, 2008), hired by local traders to scale *petai* (*parkia speciosa*) trees and collect wild honey from the forest.



Figure 4: A typical Batek man in his hayaq (house)  
(Source: Fieldwork, 2024.)

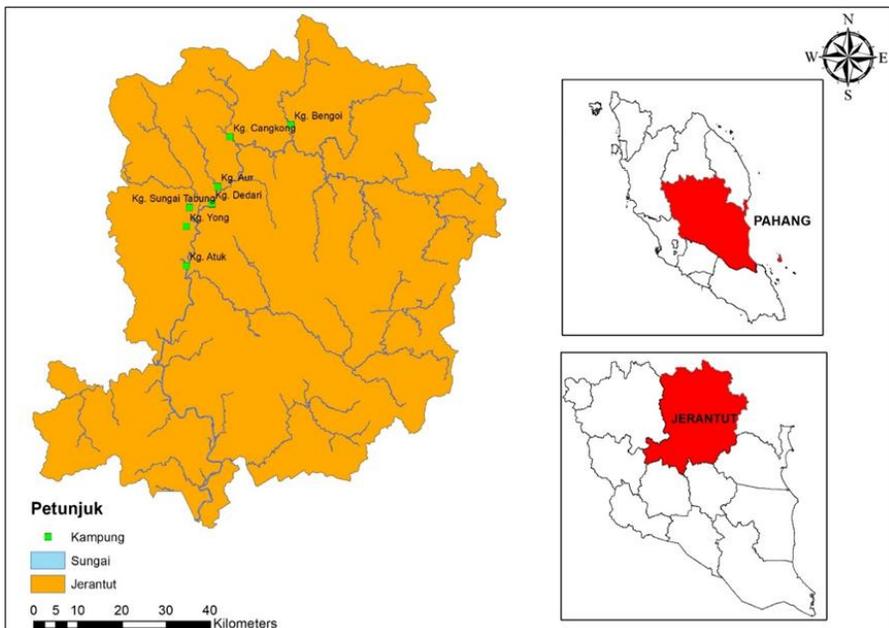


Figure 5: Location of Batek villages in Taman Negara, Pahang  
(Source: Ahmad et al. [2024].)

**Table 2: A general description of Batek’s lifestyle**

<b>Activities (Hunting/Foraging )</b>	<b>Work</b>	<b>Diet</b>
Small game such as monkeys Wild tubers, fruits, leaves, shoots, honey	Day labouring Tourist guide/ Demonstrators at show villagers Collection and trade of forest produce Contractual Park Rangers appointed by the DNWP	Wild tubers, fruits, leaves, shoots Rice, sugar, tobacco, tea (Lye 2005) Canned food

**Sources: Lye (2005), Ahmad et al. (2024).**

In conclusion, Traditional Ecological Knowledge (TEK) represents a vital resource for sustainable environmental management and conservation efforts. Integration of the insights and practices of indigenous communities, such as the Baduy and Batek tribes, can foster a more holistic understanding of ecological systems that respect cultural heritage and, at the same time addresses contemporary environmental challenges. The relationship these communities maintain with their natural surroundings highlights the importance of biodiversity and sustainable resource use. Recognising and valuing TEK enhances our conservation strategies and promotes resilience in the face of climate change. Collaboration between TEK systems and scientific approaches can pave the way for the benefit of the people and the planet, ensuring a sustainable future for generations to come.

## **METHODOLOGY**

This qualitative research employs the phenomenological approach. The phenomenological approach is seen as suitable for the study as it involves both a rich description of the lifeworld or lived experience (Finlay, 2009, p.8) as the aim of the study is to understand the experiences of the informants in using their TEK and adhering to their customary laws. Additionally, the phenomenological approach allows the researchers to get deeper into the lived experiences of the informants, hence providing better insights into the subject matter as can be seen in a research by Waluya et al. (2023) on the Baduy tribe.

Finlay (2009) highlights that within the phenomenological approach, it is essential to refrain from imposing external frameworks and instead suspend judgments about the reality of the phenomenon being studied (Finlay, 2009). Qualitative research, however, carries the risk of researcher bias when interpreting the phenomenon under investigation. To mitigate this, data triangulation and member checking were employed.

Semi-structured interviews are widely used in qualitative research due to their flexibility and ability to gather in-depth information on a range of topics (Fabiani et al., 2023). This method involves asking predetermined core questions on topics of interest, while allowing for the introduction of additional questions based on the participants' responses (Makanjuola et al., 2023). Semi-structured interviews are particularly suited to the phenomenological approach as they offer the flexibility needed to explore contexts and details, both explicit and implicit, within the participant's experience (Solarz, 2022). The open-ended interview questions allowed participants to freely share their perspectives, experiences, and insights. The interviews were conducted with indigenous community members who know their customary laws and environmental practices. These interviews served as the primary data collection method. The language used during the interviews with the indigenous Batek tribe is Bahasa Malaysia. They are generally fluent with the local dialect and they use this language for communication with the outsiders. Bahasa Sunda and Bahasa Indonesia were used during the interviews with the Inner and Outer Baduy as they are comfortable to communicate in both languages.

Non-participant observation was also employed as a secondary data collection method, as it allowed the researchers to observe and analyse social phenomena without actively participating in them (Pickersgill, 2011). The implementation of non-participant observation as one of the data collection methods would provide the researchers with insights into the dynamics of social interactions, behaviours, and practices that may not be apparent through other research methods (Oh, 2020; Shaby & Vedder-Weiss, 2019). Field notes from the observations were used for triangulation with the data received from semi structured interviews.

Five key informants were selected for the interviews. The informants were selected based on their knowledge of the tribe and their ability to communicate with the researchers (in the local language). This is to ensure that they were able to understand the question and relay the right information and also to prevent any issues in translating their words. Hence, the informants selected were the elderlies (head of village) and able to converse in the local language (Bahasa Sunda and Bahasa Melayu). The descriptions of the informants are explained below:

**Table 3: Description of informants**

Informant 1 (Batek elderly)	He is considered to be the spokesperson of his village. He is one of the eldest in the village which he set up a few years ago with his family. Currently, his village is being used as a 'show village' for tourists to experience living as a Batek. He is in his mid-forties.
Informant 2 (Batek elderly)	He is in his late fifties or early sixties and one of the eldest Batek in Taman Negara, and moved from one village to another depending on work or tasks that he has to do. His village is also being used as a 'show village' for local and international tourists. He used to be the chaperone for the children of his village when they go to school.
Informant 3 (Batek elderly)	He is in his sixties and is currently the head of the village ( <i>Tok Batin</i> ). His village is on the perimeter of the Taman Negara. He spends most of his time in the village and only go into the forest for hunting or gathering occasionally.
Informant 4 (Inner Baduy)	He is in his seventies and was the former head ( <i>Pu'un</i> ) of the main village ( <i>Cibeok</i> ) of the Baduy tribe, and he is well respected. Currently he is spending most of his time at home, doing simple chores befitting his age.
Informant 5 (Outer Baduy)	He was once a government appointed officer for the village of Kanekes (Outer Baduy village) and often the focal point for any interactions with the outer Baduy. He is in his early fifties and runs a souvenir shop near his house. He spends most of his time in the field, manning his hill paddy

Data analysis involves three main stages: data reduction, data display, and drawing conclusions (Williamson & Long, 2005). Data reduction and data displays are essential for organising, and transforming data to aid in inferences and conclusions (Verdinelli & Scagnoli, 2013). The data received were analysed accordingly until they reached a saturation point. Information that was not essential to the objectives of the study was eliminated. Emerging themes from the data are displayed and analysed according to the line of inquiry. Finally, conclusions that meet the objectives of this study are drawn. The research ethics for the research was acquired from the university and in order to ensure the privacy of the participants, they are referred to as Informants (1-5), and only brief descriptions were given.

## FINDINGS AND DISCUSSION

### The Baduy

#### *Food Security and Commerce*

The Baduy community is primarily based on agriculture, and their primary food source is hill paddy (*huma*) cultivated along the hills (*ngahuma*) of their village or boundaries. The Baduy do not sell the rice that they produce, instead, it is strictly for their own consumption and also for ritual ceremonies. They would take the amount that is needed to sustain the family, while the excess would be kept in storage for future use. This is to ensure that they would always have a constant supply of rice, regardless of the weather, disasters or calamities that may prevent them from harvesting their hill paddy. The hill paddy stored in a shed called '*leuit*' can last for decades. According to Informant 5, some of the paddy in storage is more than ten years old.

The old looking *leuit* would suggest that it is very old and the paddy that is stored in them is also old. Some are still new, maybe two or three years old. But some have been kept (paddy) for more than ten years. We need to make sure the next generation has something to eat. (Informant 5)

The tribe has come up with an indigenous way to prevent the paddy stored in *leuit* from being destroyed by pests or stolen by thieves. The pillar of the shed is designed with a circular ring at the top so as to prevent rodents from climbing into the shed. The thatched roof shed has no doors or windows but a small opening near the roof to allow the owners access to the stored paddy. In addition, the roofs are made from woven bamboo known as *sarigsig*, the frame of the shed is made from wood, and the walls are weaved from *mengkuang* (*pandanus artocarpus*) leaves, which allow for aeration. This design allows the paddy to be dry, has been in use for a long time, and has served the Baduy well by ensuring that they have a high level of food security that would serve the community well. Their dedication to upholding their agricultural practices aligns with the broader context of indigenous communities globally as they possess robust traditional ecological knowledge that enhances the sustainability of their farming systems (Iskandar et al., 2019). The *leuit* are normally constructed quite far from the village and arranged in clusters. This is to ensure the safety of the food, should anything happens to the village. According to Informant 5, in the case of fire in the village, the villagers' food storage would be far from it.

The *leuit* are normally built far from the village. This is because, if there is a fire, it will be quite difficult for us to put it out. Our houses are quite close to one another and chances of the fire spreading fast is quite high. The last time there was a fire in our village, many houses were burnt down. Luckily, we have our *leuit* far from our houses. We still have food. (Informant 5)

The figure below is one of the *leuit* in one of the Outer Baduy villages.



**Figure 6: Leuit/Storage shed for paddy  
(Source: Fieldwork, 2024.)**

The Baduy do not cut the hills into terraces; instead would utilise the contour of the hill when they plant the hill paddy. This is to ensure the maximum use of the land, without destroying the natural landscape. In addition, they would move from one section of the hill to another, allowing the land to ‘recuperate’ and maintain soil fertility. In addition, due to the nature of the hill, logs would be placed strategically along the paddy fields in order to prevent erosion or landslides should heavy rain occur. According to Informant 5, “The hills are cleared for planting but in the early days we place logs between the paddy. To

make sure that if it rains, the water will not flow too fast or caused landslide” (Informant 5). This can be seen in Figure 7 below.



**Figure 7: Logs placed in the hill paddy fields in Outer Baduy village  
(Source: Fieldwork, 2024.)**

The Baduy are involved in trading with people from the outside, especially the Outer Baduy. In one Outer Baduy village, located on the boundary of the Baduy land, the people of the village are involved in ecotourism, either as retailers or as guides. They opened up stores selling local produce such as honey, local Baduy textiles (cloth, traditionally hand woven shirts and hats) and handicrafts (small and medium size sling bags woven from bark of trees, bangles) to local and foreign tourists. Informant 5 is also involved in running a shop near his house in his village and the income from the sales of the products helps to provide him with a modest income. During fruit seasons, the Baduy is well known for its *durian* (*durio zibethinus*) and many local tourists can be seen during this time. Some of them also become tourist guides and take the tourists to the Inner Baduy villages, trekking the mountainous routes throughout the Outer Baduy villages.

### ***Health System and Diet***

The Baduy rely solely on natural remedies and do not use any modern medicine. For example, they would use lime for washing or bathing instead of soap. They would rely on traditional medicine for herbs and other materials from the forest. According to Informant 4, for health issues, they would consult their traditional healer or *Paraji*. He added that the sick would normally recover within a week under the *Paraji's* care. However, if this does not happen, the sick is left to either recover or worsen naturally.

We only use lime to wash our clothes or our bodies in the river. We do not go to see any doctors. If we are sick, we would go and see our *Paraji*. She will take care of us. If we do not get better in a week, then we would let nature take its course. (Informant 4)

The typical diet of the Inner Baduy includes rice, often accompanied by salted fish—the only product they purchase from the market outside their territory, fruits and greens from the forest. According to Informant 5, they would rear poultry but would only slaughter them for use during special rituals. He added that if he received guests, he would buy chicken from the nearest town instead of using his own poultry stock.

A setback of adhering to traditional medication, according to Informant 5, is that they would not be able to provide ample nutrition to the young ones. He said the Inner Baduy's refusal of modern medication has stopped them from using '*susu formula*' or formulated milk for babies, and this has resulted in the young ones being malnourished. Informant 5 added that the government of Indonesia is very concerned about this and has been trying to help tackle the issue of malnourishment among the Baduy.

### ***Education***

Due to their rejection of modernisation, the Baduy do not attend formal schooling for education. Formal schooling for education is considered a big taboo. The male children are taught by their fathers or elders the necessary skills they need to know to survive. These would include hill paddy planting and harvesting, farming skills, hunting and fishing. It was observed during data collection that the Baduy children spend their time at the paddy fields, either helping their fathers if they are old and strong enough or merely observing their parents work the field. The female children are taught the techniques for weaving cloth from a young age, and this has become a tradition among the Baduy women. However, they are also taught how to manage the hill paddy (*huma*) and help the family. The children are taught the skills they need to survive and sustain their living based on the knowledge passed down for generations.

### ***Governance and Adat among the Baduy***

The Baduy community, consisting of the Inner and Outer Baduy, adheres strongly to *adat*, and actively avoids modern influences. The *adat*, or customary laws, are fundamental to their way of life and governance systems. These laws encompass a broad spectrum of traditional practices and beliefs that guide various aspects of

life within Indigenous communities. The significance of *adat* and taboos in shaping social structures and relationships of the Indigenous communities cannot be overstated (Nordin & Man, 2023; Hidayat et al., 2018).

The Inner Baduy are more stringent in their adherence to *adat* than the Outer Baduy. They have deliberately insulated themselves from technology, formal education, foreign foods, contemporary medicine, and global news to preserve their traditional way of life based on their *adat*. With its unwritten codes, *adat* governs a wide range of behaviours within Indigenous communities, from family interactions to environmental stewardship, reflecting a holistic worldview (Robinson & Raven, 2019). These customary laws are integral to Indigenous peoples' identity and governance systems, offering frameworks for resolving disputes, managing resources sustainably, and preserving cultural heritage (Purnamawati, 2021). When rules are broken, the elders of the Inner Baduy, led by the headman called *Pu'un*, convene to determine punishments, which may include warnings, social ostracism, financial fines, or, in severe cases, expulsion from Inner Baduy villages to the Outer Baduy territory. The Outer Baduy are subjected to periodic inspections by Inner Baduy authorities to ensure compliance with *adat*. They are also restricted from attending formal schools, seeking medical care at clinics, or using modern communication devices. As Informant 5 recounted, "Sometimes you can see the Inner Baduy coming to our village or making rounds, sometimes at night. They do this once in a while, to make sure that we do not go against the customs of our people".

Adherence to *adat* in various rituals and ceremonies plays a crucial role in maintaining social cohesion and preserving cultural identity, spirituality, health, and community well-being (Nursanti et al., 2023; Jangga et al., 2023). Understanding and respecting these laws is vital not only for the well-being of Indigenous communities but also for promoting diversity, equity, and justice (Siregar et al., 2022). The Baduy's dedication to their traditional way of life through strict adherence to *adat* has allowed them to thrive over generations.

The Baduy engage in limited commerce through ecotourism and the sale of traditional crafts, which exposes them to the outside world while they remain committed to their customs. Their reliance on natural remedies and a diet based on self-produced food highlights their dedication to traditional health practices and environmental knowledge. Education within the Baduy community remains informal, focusing on the transmission of skills and knowledge from one generation to the next.

Despite their traditional stance, the Outer Baduy are gradually incorporating modern technology, influenced by interactions with tourists.

Younger members have started using smartphones and social media, although this technological integration is limited and mainly affects the younger generation.

Governance within the Baduy community is closely tied to their adherence to *adat*, with the Inner Baduy enforcing stricter regulations than the Outer Baduy. As modern influences gradually affect the Outer Baduy, particularly through tourism, they strive to balance modernisation with the preservation of their core identity.

The resilience of the Baduy, especially the Inner Baduy, in resisting external influences underscores their commitment to traditional ecological knowledge and *adat*. This has helped to ensure that despite the influx of modernisation on their doorstep, they would remain steadfast in maintaining their traditional way of life, which has allowed them to survive for many generations. Their lifestyle reflects a balance of sustainable agriculture, self-sufficient health practices, and a deep connection to their environment, demonstrating their commitment to self-reliance and resilience.

## **The Batek of Taman Negara**

### ***Food Security and Commerce***

The Batek of Taman Negara maintain a profound connection to their environment, relying on ancestral knowledge passed down through generations. While agriculture is not their primary livelihood, they engage in small-scale cultivation of fast-growing crops like chilli, mainly for personal consumption. The Batek's main subsistence comes from hunting, fishing, and foraging within the forests of Taman Negara. Their ability to thrive is deeply rooted in their understanding of the land, animal behaviours, and seasonal changes. Their survival is linked to the health of the forest ecosystem, which provides them with food, shelter, and medicine. Despite their deep knowledge and sustainable practices, food security is a significant challenge for the Batek. During periods of low hunting success or resource scarcity, they often rely on external support from NGOs and government agencies to meet their needs.

To complement their subsistence activities, the Batek engage in limited commerce, focusing on forest products. They harvest honey, bitter beans, and agarwood using traditional, sustainable methods to be sold to local traders (Ahmad et al., 2024). Informant 3 adds that they would be involved in gathering *durian* (*durio zibethinus*) and other fruits during the fruit season to be sold to the local traders: "If it is the fruit season, especially during the *durian* season, we will collect the fruit from the forest. It helps to supplement our income. Sometimes we also collect bitter beans (*parkia speciosa*) for the Malay traders."

Additionally, they produce traditional handicrafts such as blowpipes and bangles, which contribute modestly to their income. While limited, this commerce helps support their way of life while preserving their deep-rooted environmental practices.

### ***Health System and Diet***

The Batek of Taman Negara rely predominantly on traditional practices for their health care. Their diet primarily consists of small game hunting, though they now gather tubers less frequently than in the past. As Informant 2 recounted, "Now we do not go to get tubers like before. It is quite far from the village to get tubers."

Traditional medicine, including herbal remedies, is crucial to their health system. Despite their reliance on these practices, the Batek, according to Informant 3, are increasingly open to modern medical treatments, often seeking care from hospitals or mobile clinics that visit their villages. He adds that the younger generation does not know about all the medicinal herbs, but he keeps teaching them some basic herbs needed for simple remedies. This is to ensure that their traditional knowledge is kept alive with the young ones. Nonetheless, many children still experience malnutrition and dermatological issues, highlighting the challenges of integrating traditional health practices with contemporary medical needs. As Informant 3 recounted, "I still teach them about the herbs although not all of them are interested. I need to pass the knowledge to them. Hospitals are good but you still need to know the medicine from the forest. Hospitals are far and take time to get there."

### ***Education***

Traditionally, the Batek have learned essential survival skills from their elders, such as hunting, gathering, and forest navigation. This knowledge is fundamental to their identity and way of life. Recently, however, there has been a noticeable shift towards formal education. For example, Informant 2 has been actively involved in helping Batek children attend school, initially by chaperoning them from his village and now extending his support to children from another village. This initiative, supported by government efforts, represents a significant change in the community's approach to education (Abdullah et al., 2023). Informant 2, adds that currently, the children from his village are able to go to school without him as they are used to the idea of schooling. While the Batek continue to cherish their traditional knowledge, their increasing participation in formal schooling is helping to prepare the younger generation for the modern world, balancing the preservation of cultural heritage with new opportunities.

**Governance and Adat**

The Batek community is predominantly guided by their traditional customs, with elders playing a central role in providing advice and direction. Although the government has appointed a *Tok Batin* (headman) to represent the community, this role is largely symbolic, with real authority residing with the elders (Ahmad et al., 2024). They offer guidance based on ancestral knowledge and long-standing traditions.

The Batek's deep belief in the supernatural significantly shapes their governance and worldview. They hold that any harm to nature or violations of their rules will result in punishment from the spirits. This belief underpins their identity as "guardians of the forest," a role they take very seriously. They see it as their duty to protect and preserve the land for future generations. Informant 3, said that it is his duty to ensure that the future generation understands this, even though not to the full extent.

Their respect for nature and adherence to *adat* (traditional laws) are integral to their cultural identity. They are acutely aware that any wrongdoing affects their community and incurs the forest spirits' wrath. This belief instils a profound care for their environment, ensuring that they maintain a harmonious balance between themselves, the land, and the spirits.

**Table 4: Comparison of Baduy's and Batek's TEK**

TEK	Baduy	Batek
Food Security and Commerce	Good food security	No food security
	Trading local produce	Trading local produce
Health System and Diet	Traditional herbs and medicine	Traditional herbs and medicine
	Reject modern medication	Accept modern medication
Education	Traditional knowledge passed down through generations	Traditional knowledge passed down through generations
	No modern schooling	Accept modern schooling
Governance and <i>Adat</i>	Adhere to strict traditional rules and <i>adat</i>	Adhere to traditional rules and <i>adat</i>

## CONCLUSION AND RECOMMENDATIONS

The findings from this study underscore the vital role that traditional ecological knowledge (TEK) and customary laws (*adat*) play in the sustainability and survival of indigenous communities such as the Baduy and the Batek. Both communities have established practices, passed down through generations, that align closely with their natural environments. This adherence to tradition is evident across various aspects of their lives, including agriculture, food security, health, education, and governance.

For the Baduy, their rigorous adherence to *adat* enables them to practice sustainable agriculture that respects natural land contours, thus preventing environmental degradation. Their focus on self-sufficiency, particularly in food security, is demonstrated through careful planning and a reliable storage system for rice, ensuring food availability even in difficult times. Although their interactions with the modern world through small-scale trading and ecotourism have introduced new opportunities, they remain protective of their traditional way of life. Nonetheless, despite increasing malnutrition issues, their resistance to modern health systems presents a challenge, particularly concerning the well-being of the younger generations.

The Batek people similarly depend on their traditional knowledge of the forest for their subsistence as hunter-gatherers. Their understanding of the forest supports sustainable practices and is guided by a profound respect for the spirits they believe inhabit the land. Despite their traditional practices, the Batek face significant food security and health challenges, particularly during periods of resource scarcity. Unlike the Baduy, the Batek are more receptive to modern interventions, including formal education and healthcare. The increasing acceptance of formal schooling among the younger generation reflects their evolving approach, blending traditional knowledge with modern opportunities.

Both communities illustrate how TEK and customary laws contribute to resilience and sustainability. However, their experiences highlight the pressures and challenges of navigating modernity. The Baduy face a delicate balance between preserving their insular lifestyle and engaging with the outside world through commerce and tourism. The Batek, in contrast, are finding ways to integrate traditional practices with modern solutions in health and education.

The findings from the study may provide relevant insight for stakeholders and policymakers of the respective country in understanding TEK and the customary laws of the Batek and Baduy people. The integration of TEK and customary laws into any effort to enhance the quality of health and education of

these tribes would serve to show that the government takes into consideration these laws and knowledge.

Future research can further investigate the integration of modern commerce, entrepreneurship and mainstream education in the Baduy and Batek tribes. The Baduy depend on commerce as part of their sustainability through trade and business. The Batek, on the other hand, are slowly involving themselves in similar trade activities. Research could focus on enhancing and sustaining their knowledge of business and trades. In addition, research on education should also be given due consideration as both tribes face the digital future.

In conclusion, the Baduy and the Batek exemplify the strength and wisdom embedded in their traditional knowledge systems. Their future sustainability will depend on their ability to adapt to the evolving social, economic, and environmental landscape. Their commitment to traditional ways demonstrates that sustainability encompasses techniques and technology, values, relationships, and respect for the natural world.

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