

The Utilization of Traditional Conservation of Sumatran Tiger as a Potential Development of Biology Teaching Materials

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Abstract: Indigenous communities have long had an unwritten norm system that regulates the protection of forests and biodiversity inside. Customary law has the potential to be developed as a source of learning biology. Therefore, the purpose of this study is to find out the values of traditional conservation of the Sumatran tiger which can be used as a source of developing biology teaching materials based on local wisdom. The method used in this research is a systematic literature review. Based on the results of the study, obtained results regarding the identification of Sumatran tiger, threats, and forms of conservation in the natural habitat of the Sumatran tiger. Based on the Curriculum 2013, the relevance of this study is linked into basic competencies 3.2 and 4.2 regarding distribution, threat analysis, and conservation efforts of biodiversity for the grade of 10th of high school. The material is also included in the learning outcomes of the Merdeka Curriculum phase E regarding understanding and process skills analyzing interactions between ecosystem components and efforts to conserve biodiversity. These material resources can be developed into a module-based on local culture to be studied independently by students.

Keywords: Biology; Teaching Materials; Traditional Conservation

Introduction

Indonesia has more than 200 ethnic groups spread among 13,400 islands. These ethnic groups have their own language and culture. Culture with the coming of the necessary transformative dimension that ensures the sustainability of development processes as United Nations' 2030 Agenda for Sustainable Development (Rahmawati et al., 2023). Therefore, the learning process requires accommodation of various cultural aspects such as cultural identity or community diversification to support cultural sustainability (Laine, 2016). Thus, quality education will increasingly be able to promote the development of human resources as well as cultural and environmental sustainability.

Local wisdom-based education is actually a form of reflection and realization of Government Regulation Number 13 of 2015 on the second amendment of Government Regulation Number 19 of 2005 concerning National Education Standards, explaining that the curriculum structure for secondary education units, one of which consists of general

content developed for the education unit is adjusted to local potential and wisdom. With this decentralization of education, each region can develop its own potential and culture. But in fact, there are various research results that show that learning in schools does not pay attention to local culture (Adinugraha, 2019; Damayanti et al., 2017; Istiqomah et al., 2020; Masihu & Augustyn, 2021). In addition, there are several environmental problems that are not known by students, but have become important issues in the area, one of which is the threat of Sumatran tiger extinction.

Therefore, the appointment of local wisdom needs to be accommodated by teachers, especially if exploring local excellence in each respective region. Teachers need to utilize learning resources that are relevant and familiar to students. Local culture, such as typical foods, visual art, and social and ritualistic practices, known to students from their home life, strongly influences cultural identity related to students' daily lives (Rahmawati et al., 2023). By incorporating cultural values into the curriculum, teachers can create a supportive learning environment

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for students to directly learn their cultural identity with meaningful understanding (Kumar et al., 2018). With the gradual decline of the country's culture and traditions due to globalization, educational agents began to have to pay attention to cultural aspects in school learning, especially biology learning.

According to research conducted by Julca in 2000, the knowledge and experience learned from activities related to local communities such as habits, natural resources, images, and the use of objects will help develop meanings and concepts, thus contributing to effective learning (Vargas-Hernández & Vargas-González, 2022). However, culturally integrated biology learning has not been optimally developed. This causes students' ability to analyze community activities related to science is still low which has implications for low student learning outcomes (D. Fitriani, 2015). Therefore, as teachers who have professional competence must have the ability to identify various alternative methods and ways to develop the learning process in accordance with the characteristics and environment, including developing teaching materials to direct the teaching and learning process according to learning objectives (C. Fitriani et al., 2017).

Learning biology material that is linked to the local wisdom, is useful for making local wisdom known in the world of education that utilizes the environment or local areas as a source of learning (Safitri & Anas, 2023). One of the uses of the environment to learn biology is to examine the local wisdom that exists in the environment of students. The selection of teaching materials based on local wisdom is in accordance with biological characteristics, especially the relationship between nature and culture that converge in many ways that span values, beliefs and norms to practices, livelihoods, knowledge, and languages. Meanwhile, there are not many teaching materials that integrate local wisdom and potential owned by a region, while according to Parmin & Peniati (2012) states that integrating teaching materials with this contextual approach will be more easily learned by students.

Basically, local wisdom describes how people respond to distinctive changes in the natural or cultural environment which then become local knowledge and are inherited. Local communities have been protected their lands and waters in reciprocity with nature, often guided by deep connections to place, culture and ways of knowing for a long time (Diver et al., 2019). Local communities are very dependent on the existence of forests. Thus, community management of forests has many benefits. It can help to halt deforestation and preserve plant and wildlife diversity. Based on Regulation of Government Number 28 of 1985, one of the functions of the forest is a place for environmental preservation, for that the

forest wealth must be protected and maintained from human impacts that can damage the sustainability of living things in it. One of the forest areas with a large area is the island of Sumatra. Data from Department of Environment and Forestry of Bengkulu Province in 2020, the area of protected forest in Bengkulu province is 250,750 hectares wide and the area of nature reserves and nature conservation is 462,965 hectares wide. The extent of the forest area in Bengkulu Province indicates the potential for biodiversity, one of which is as a place to live for animal species, namely the Sumatran tiger (*Panthera tigris sumatrae*).

The Sumatran tiger (*Panthera tigris sumatrae*) is endemic to the island of Sumatra in Indonesia that has been able to survive up until now, after previously two sub-species, namely the Bali tiger (*Panthera tigris sondaica*) and the Javan tiger (*Panthera tigris javanica*) had previously been declared extinct (Goodrich et al., 2022). Current studies indicate the Sumatran tiger population continues to decline and its existence is increasingly difficult to find. One of the few causes of this can occur due to human activities and actions that are not beneficial to the environment (Suryanda et al., 2017). Decreasing of Sumatran tiger population are caused primarily by human activity that have excessively converted forest land into plantations or settlements.

The decline in tiger population due to the narrowing of forest area is supported by data that recorded in the period 1990-2010 (Margono et al., 2012), it was found that there was forest clearing with a large landscape on the island of Sumatra, namely with 70% conversion of forest area. Research by (Nahib & Suwarno, 2017), found that the rate of deforestation that occurred on the island of Sumatra was in the first place in Indonesia with a value of 0.78% higher than the island of Kalimantan. The main cause of the high rate of deforestation is agricultural expansion, especially the expansion of oil palm plantations and the expansion of industrial forest plantations for pulp and paper plantations (Margono et al., 2012).

Based on analysis of range contraction in the geographic range for 25 large carnivore in 2017. The Sumatran tiger is one of the large carnivores that experiences the greatest range contraction of 95% (Wolf & Ripple, 2017). This research is closely related to extinction risk individual populations and as a whole. Based on these findings, the massive degradation of the Sumatran tiger's natural habitat is a threat to the preservation of this animal. The forest of Sumatera is the only natural habitat where Sumatran tiger live. When a disruption to these key environmental conditions occurs, the species become homeless. This is called habitat loss. Based on data from the Ministry of Environment and Forestry in 2007, the estimated population of the Sumatran tiger

is critically endangered at around 250 individuals left (Soehartono et al., 2007). Thus, tiger conservation is critically important for Indonesia.

The importance of Sumatran tiger conservation is quite extensive from the standpoints of ecology, socio-cultural, economic and for scientific purposes (Haidir et al., 2017). From the socio-cultural aspect, indigenous people believe that the bad relationship is caused by the attitude of the man himself. Therefore, the awareness of this community forms the knowledge that bring up to a tradition. The tradition of respecting the Sumatran tiger has taken root for the people who live on the island of Sumatra. This tradition has coexisted from generation to generation which explains the rules of how to maintain a harmonious relationship between humans and tigers in local communities in Sumatra. Both are located along the *Barisan* Hills, from Lampung to Aceh, as well as along the east and west coasts of Sumatra.

The Elements of caring environment such as attitudes, beliefs, and values in preserving the environment can be used as material for environmental education that is able to foster an attitude of responsibility, character, and knowledge of available natural resources. This potential seems to be forgotten by many teachers, especially in Biology learning. Teachers tend to use the material in Biology textbooks that have been marketed so that the material used does not focus on the development of material by teachers related to the local wisdom of each region (Ardan et al., 2015). In fact, learning biology is closely related to all forms of life in the world that are familiar. It is important for teachers teach students to make connections between what they learn in the classroom and what they see in everyday life.

Learning biology is not only about mastering concepts, facts, or principles, but also involves a process of finding knowledge (Ramdiah et al., 2020). The process of finding this knowledge can be done by developing a curriculum based on the advantages of each area. By strategically embedding local wisdom of each region into those topics in biology curriculum may allow student to finding more information. Students can study biology material that is close to their lives. This can develop a habit of mind as well as knowledge of students. The cultural approaches in traditional conservation are highly contextual to the local situations because it results from the characteristics of the ecological system and the needs of the people in each region (Infield et al., 2018). Therefore, in utilizing local wisdom in learning, teachers must be responsive to symptoms found in the environment (nature).

Integrating traditional conservation concepts in biology learning as an effort to foster environmental literacy and awareness for students can be done with a contextual approach. Integrating traditional

conservation values as teaching materials is a conservation step that is very relevant to students. Research by Primack (2013) explains that the use of textbooks with local content and in local languages can contribute to high biodiversity conservation. Students can identify the content and learn the material well so that it has the potential long-term impact on shaping students' attitudes towards local biodiversity protection and sustainability attitudes in the future.

Based on the description of the importance of utilizing local wisdom into learning to accommodate the biological learning needs of students, this study carried out the processing of scientific literature on traditional Sumatran tiger conservation in accordance with the Basic Competence (BC) in Curriculum 2013 and Learning Achievement (LA) for Phase E in Curriculum Merdeka. As for the purpose of the study. This study aims to identify the traditional conservation values of Sumatran tigers as local wisdom that can be used as teaching material for biology lessons. The use of teaching materials based on local wisdom can help students develop awareness of cultural identity, meaningful learning, and self-knowledge towards local biodiversity and cultural sustainability.

Method

This study used a systematic literature review method (Suhartono, 2017). A systematic literature review is a means of identifying, evaluating, and interpreting all available and relevant research to answer a predefined question or particular research or phenomenon of interest (Kitchenham, 2004). According to Creswell & Creswell (2018), this literature study plays a role in finding and summarizing studies on a topic in three systematic stages, namely capture (find or collect), evaluate (evaluate), and summarize (summarize) the literature.

A number of search strings were constructed using relevant terms based on the research needs and the search was restricted to papers, journals, conference proceeding, or technical reports published between 1981 and the present day. Literature searches are carried out from electronic database, namely PubMed, PMC, Google Scholar, Mendeley, Semantic Scholar and the Publish or Perish. In addition, the literature review also compiles several books, government regulations or policies as well as news on online news portals.

The number of data sources were selected for review was 25. The keywords used to search for literature sources on those electronic databases are Local Wisdom, Traditional Conservation, Local Wisdom based Biology Learning, Sumatran Tiger, Community Perception and Knowledge of Sumatran Tigers, Teaching Materials, Basic Competencies of

Biology, Merdeka curriculum learning on biology material in phase E.

The results of the collection from the literature are then analyzed as research needs to find out how to utilize the values of local wisdom of Sumatran tigers as a potential development of biology teaching materials. Systematically the steps in this study are made in the form of a flow chart, as shown below (Figure 1).

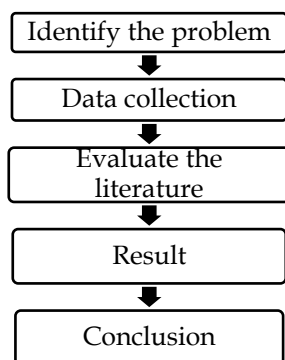


Figure 1. Flow Chart of Methodology

Result and Discussion

Etymology of the Sumatran Tiger (Panthera tigris sumatrae)

In the beginning of the tiger's real name was *tigris* or in English it was called tiger. The word *tiger* apparently comes from the Greek word *tigris*. The word *tigris* probably comes from Persian which means arrow (Thorley, 2017). The arrow symbolizes the incredible speed of the animal and the place where it first came from the Tigris River in Iraq. The word *tigris* was then absorbed into English into *tigress* which was first recorded in 1611. The tiger belongs to the cat family but is very large. This was stated by a scientist from Sweden, Carolus Linnaeus, who is known as the father of modern taxonomy (Mazak, 1981).

In the research of Carolus Linnaeus entitled *Systema Naturae* in the 18th century there is the naming of tigers. From these studies in simple scientific language, tiger or *panthera tigris* is also often thought to come from Greek which consists of two words *Pan Theron*. *Pan* means all and *Theron* means beast or wild animal (Matt & Holland, 2014). The naming of the Pantheron was a popular etymology at the time. In parts of East Asia, the naming of tigers appears as yellowish animal and whitish yellow. The name *harimau* itself was popularized in Malay and other languages such as *rimuëng* from Aceh Province and *maung* in Sunda Tribe.

In the Sumatran Islands, there are still many local communities who have inherited messages from their ancestors by applying customary law. The community is gathered at the village level. The community respects the Sumatran tiger as an mythical ancestor.

They believed that ancestor transformed into a tiger to serve as the community's guardian. The community's perception of the existence of this tiger has become a part of life in the communities of Aceh, Kerinci, North Sumatra, West Sumatra, and Bengkulu. These beliefs, values, concerns and attitudes that have lived for hundreds of years explain how the harmonious relationship between humans and tigers exists in communities in Sumatra, both those along the *Barisan* Hills, from Lampung to Aceh, as well as along the east and west coasts Sumatra.

Human philosophy or attitude towards tigers and other animals is also reflected in the Talang Tuwo Inscription. Wijaya, (2019) According to traditional leaders in Palembang, the King of the Sriwijaya Empire at that time mandated that this nature, which was symbolized through the Sriksetra Park, was intended for all living things, not only humans, including tigers in Sumatra as well. Before humans existed, tigers were the top carnivore in the forest. The ancestors in Sumatra viewed tigers as "*wong tuo*" who must be respected. This attitude then brings up into a tradition or culture which essentially protects the environment and tigers in the jungle.

Various regions in Sumatra call tigers with the same meaning. Research conducted by Maisaroh on 2021, four local names are often spoken by people in the North Sumatra area, namely *Datuk*, *Panglima*, *Belang*, and *Raja Hutan*. People believe that if they are talking about or intentionally calling a tiger by a common name then the tiger will enter the settlement. Naming the Sumatran tiger with this local name is the reason people give those names. This statement relates to local wisdom that has beliefs about the presence of tigers. If viewed from local wisdom by the community, local names appear for Sumatran tigers, people still believe in the term *pamali* as a prohibition to call *harimau* because if they are called, Sumatran tigers will enter settlements (Maisaroh, 2021). This is in accordance with (Septanti & Saptana, 2019) who states that local wisdom is a form of environmental wisdom that exists in social life in a place or area, therefore local wisdom is not the same in different places and times and in different tribes.

If in the mountainous areas of South Sumatra, such as in *Pasemah* the tiger is called "*niniak*" and on the coast it is called "*puyang*". In Aceh, it is believed that there are black and white tigers, whose function is to guard sacred tombs. Including the existence of a tiger (*rimueng*) guarding the tomb of a district chief named Teuku Cot Bada in Pidie Regency. In North Sumatra, the tiger is called "*ompung*" (grandfather), in West Sumatra it is called "*datuk*" (grandfather) or "*inyiak*" (grandmother), also in Kerinci "*hangtuo*"

(parent) and in Bengkulu as "setuo or setue" (parent) (S. Indonesia, 2021).

Even community groups recognize the existence of tiger man or weretiger. Both in North Sumatra, West Sumatra, Kerinci, Bengkulu, and South Sumatra. This tiger man is known as *Sumai* in South Sumatra, precisely in Pasemah (Pagar Alam, Lahat and Muara Enim), while in Kerinci it is called *Cindaku*. In Bengkulu Province, the incarnate tiger or tiger incarnate is respected as an ancestor. In *Sarang Macan Hills, Ladang Palembang Village, Lebong Regency, Bengkulu*, it is believed to be the place where reincarnated tigers or ancestral reincarnations meet in Lebong Regency (Hendry, 2017b). This hill is called *Tebo Sa'ang Imau* or *The Sarang Macan Hills* by the local communities.

Sumatran Tiger (Panthera tigris sumatrae)

Sumatran tiger (*Panthera tigris sumatrae*) is an endemic animal on the island of Sumatra. The distribution area is at an altitude of 0-2,000 above sea level (O'Brien et al., 2003), but sometimes it can also be found at an altitude of more than 2,400 above sea level (Linkie et al., 2003). The source of tiger food is an important factor supporting the sustainability of its population. The availability of these prey animals also plays an important role in determining the home range of individual tigers.

The Sumatran tiger (*Panthera tigris sumatrae*) has the smallest body compared to all tiger sub-species living today. Adult males can reach a height of up to 60 cm tall and a length from head to tail of up to 250 cm long and a weight of up to 140 kg. The female tiger has an average length of 198 cm and a weight of up to 91 kg. The Sumatran Tiger's skin color is the darkest of all tiger subspecies, ranging from reddish yellow to dark orange. They also have the narrowest black stripes of any tiger subspecies (W. C. S. Indonesia, 2021).

Sumatran tigers are carnivores. In their natural habitat, the Sumatran tiger preys on animals from the Cervidae and Suidae families such as the sambar deer (*Cervus unicolor*) and wild boar (*Sus scrofa*) as their main food. However, under certain conditions it can prey on other animals such as deer (*Muntiacus muntjac*), mouse deer (*Tragulid sp*), macaque (*Macaca nemestrina*), porcupine (*Hystrix brachyura*), and beyond (Ari & Aunurohim, 2012). A tiger needs about 6-7 kg more meat per a day. The amount of this need depends on whether the tiger is looking for food for herself or the tigress must feed her cubs.

Sumatran tigers are solitary animals, this is because most of their lives are solitary, except during the mating season or are raising children (Djoko et al., 2009). Home range of Sumatran tiger is around 50-70 km², while for a male tiger it is around 110 km². Currently, the Sumatran Tiger is critically endangered

or on the verge of extinction as released by *The International Union for Conservation of Nature's Red List of Threatened Species*. With fewer than 400 individuals remaining in the wild, this sub-species is of particularly high priority for keep its population in its natural habitat due to their critically endangered status (Parnell et al., 2014). Conservation efforts continue to be prioritized, especially in protected areas. Empowerment of people living in and around the Sumatran tiger habitat continues to be improved so that they can take part in the conservation of the Sumatran tiger (Goodrich et al., 2022).

Traditional Conservation Principles of Sumatran Tigers

Armed with the belief that the Sumatran tiger is a mythical ancestor or reincarnation of an ancestor, no one on the island of Sumatra dares to capture or kill a tiger (Gea et al., 2019). Disrupting the tiger's life is the same as killing an ancestor. If they kill an ancestor, then the indigenous people believe the payoff will be more dangerous for themselves. The local community do not feel bothered by the existence of tigers. So based on the story as their local wisdom, the responsibility arises to utilize natural resources efficiently.

Local communities already know that the Sumatran tiger is an animal fully protected by law (Suryanda et al., 2017). The community understands that the existence of forests will affect the behavior of the Sumatran tiger, one of which is that if the home range of the Sumatran tiger is getting narrower, it will result in the tiger's natural food being reduced. This causes the Sumatran tiger has forced towards human societies where they occasionally prey on livestock (Adu et al., 2019). Therefore, the level of public perception of the existence of the Sumatran tiger is good. To this day, people still respect the Sumatran tiger that prowls in the forest. This respect for tigers has maintained a promise for generations to protect the environment.

Forest protection efforts in local law are one way to prevent forest destruction that can disturb the balance of nature, including the presence of Sumatran tigers in this region. Therefore, each indigenous community, especially in Bengkulu Province, has its own local legal apparatus, which functions as a tool of social control related to the life of their community by complying with local forest rules that include material and formal local legal rules (Yamani, 2011). Yamani in his research also explained that the system of forest protection in local law is based on local legal rules in the form of taboos and prohibitions and is carried out through preventive measures in the form of rule formation, counseling and supervision, and repressive measures in the form of imposing customary sanctions.

The community understands the importance of the existence of forests for Sumatran tigers. One of

these forest hill areas in Bengkulu, namely The *Sarang Macan* Hills which is believed to be a place for Sumatran tigers to find prey. On this hill area, indigenous people also believe that destroying the forest environment will get traditional sanctions. So that the *Sarang Macan* Hills is free from destructive activities. There is a belief that considers the Sumatran tiger as a mythical ancestor, as well as awareness of forest sustainability, so on July 6, 2001 and August 30, 2002, residents and the village government agreed to designate The *Sarang Macan* Hills area as a forbidden forest or sacred groves. The community call it "*Hutan Larangan*". Furthermore, the agreement was stated in Village Regulation Number II concerning Village Protection Forests and Village Customary Forests dated September 30, 2003 (Hendry, 2017b).

The presence of the Sumatran tiger is also an indicator of the balance of the ecosystem. The Sumatran tiger as top carnivore plays a major role in maintaining the food chain. According to the traditional leader of Lebong Regency, Abdul Muis, the appearance of the Sumatran tiger in this settlement is a warning that environmental conditions are not good (Putro, 2017). Therefore, from generation to generation, local communities have tried to carry out conservation based on local wisdom, namely by implementing environmental management in the form of prohibitions or invitations.

The existence of regulations for prohibited acts based on the material content of customary laws on indigenous communities in the Bengkulu area, shows that indigenous communities have long had an unwritten norm system that regulates the protection of forests and biodiversity inside (Yamani, 2011). Traditional conservation carried out for generations by indigenous peoples is an effort to preserve biological natural resources and respect for ancestors (Mahirta, 2015). This knowledge system of indigenous people forms rules for utilizing limited natural resources (Suhartini, 2009). People's belief in taboos and supernatural powers has led to a way of appreciating the forest as a habitat for Sumatran tigers. Traditional forms of conservation that have been applied by the community in the *Sarang Macan* Hills area for a long time to natural resources are listed in Table 1.

Humans as part of the environment have a reciprocal relationship that is in harmony. The relationship displays balance and interaction between them. In their continuous interaction, humans gain experience of their environment. Such experiences generate a set of knowledge that influences human actions in treating the environment. One of the regulations in forest management in Bukit *Sarang Macan* is aimed at protecting Sumatran tigers which

are believed by the community to be the incarnation of ancestors.

Table 1. Traditional forms of conservation at The *Sarang Macan* Hills

Forms of Conservation	Forms of Customary Fines
Limits on taking forest products without destroying trees	<i>Serawo punjung</i> of chicken (Lebong Specialty Food), rice and money fines
Creating firebreak for forest burning in plantation areas	<i>Serawo punjung</i> of chicken (Lebong Specialty Food), rice, fine money
Prohibition of expanding the farm area to go into forbidden forest	<i>Serawo punjung</i> of goat (Lebong Specialty Food), rice, and money fines
obligation to plant trees in farm areas bordering or within forbidden forests	<i>Serawo punjung</i> of goat (Lebong Specialty Food), and rice
Utilization of non-timber forest products without damaging existing perennials	<i>Serawo punjung</i> of goat (Lebong Specialty Food), rice, and money fines

Sources: (Hendry, 2017a; Suminar, 2020; Yamani et al., 2014)

This knowledge forms rules such as the extraction of non-timber forest products such as fruits or vegetables taken by not participating in damaging timber forest products. While clearing a new field, the community must also obey customary rules. Old forests were cut down in January and young forests were cut down in March (Hanafi et al., 1980). Based on table 1, people who want to burn fields must make fire barriers (firebreaks) when *nyilap* or burning wood and branches that have been cut down before. The burning of this field is carried out in a controlled manner so that the fire does not spread to the surrounding land. Burning land to open agricultural fields is considered by the community to eliminate pests and fertilize the soil before planting.

Sanctions for those who violate these customary rules vary widely. People who do not make a fire block, for example, are sentenced to cook *Serawo punjung* of chicken (Lebong's special food), two cans of rice, plus a fine that will be used as social funds. One illustration of the shape of a firebreak made during the clearing of new agricultural land is as shown below (Figure 2).

To this day, the condition of The *Sarang Macan* Hills area has not been used for the commercial interests of the community. The imposition of customary sanctions is carried out as a form of repressive forest protection. There are two types of sanctions in the local law of the indigenous community of the Bengkulu region, the first is customary sanctions, apologies to fellow citizens of customary law communities, and to supernatural forces that are disturbed due to violations or prohibitions in customary rules. The concrete form of customary sanctions is an apology in the form of

punjung, goat or black chicken, black rice, and so on, which is paid in the customary institution session under the leadership of the head of the customary law community. Second, customary fines for planting replacement trees, applied to the prohibition on cutting trees without permits, clearing forests without permits, cutting trees in any location, cutting down rare trees with medicinal functions, and harvesting honey by cutting trees (Yamani, 2011).

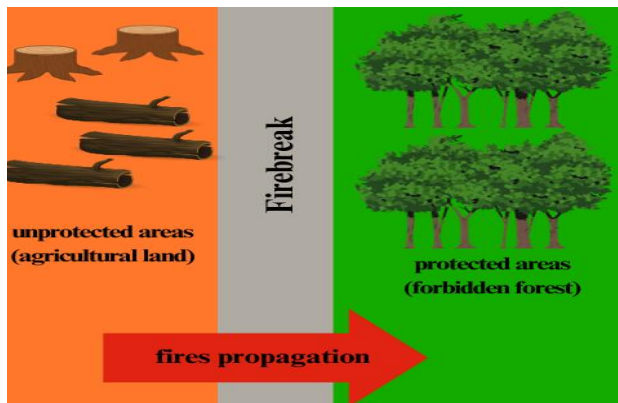


Figure 2. General Sketch of Firebreak

Based on Table 1, for utilization, residents may only take forest fruit, medicinal plants, and honey without damaging the trees. If violated, the perpetrator is subject to a customary fine in the form of *serawo punjung of goats*, two cans of rice, and a monetary fine equal to the price of wood that is cut or damaged. The community is also prohibited from converting it into farmland in the *Sarang Macan Hills* area. In addition, if people are gardening, they must plant trees to preserve forests to maintain their functions. If this is violated, it must comply with customary law, namely *serawo punjung kambing* (butchering a goat) and two cans of rice (Putro, 2017).

The management of forest resources is one of the conservation efforts for the existence of the Sumatran tiger. Local communities, especially in the *Sarang Macan Hills*, have various ways of environmental management to prevent the decline in the quality of natural resources including the biodiversity of flora and fauna in the forest. Local community together with The Natural Resources Conservation Agency (BKSDA) of Lampung and Bengkulu are also looking for and removing snares deliberately set by poachers in the roaming areas of the Sumatran tiger (Supardi, 2020). The management of the forest where the Sumatran tiger's natural habitat is, proves that the community is still trying to preserve this critically stated animal. Traditional conservation by the community for the Sumatran tiger in the hill with an area of approximately 20 hectares wide is still maintained. The strict prohibition on damaging the

Sarang Macan Hills areas can also be seen from the installation of warning boards as shown in Figure 3.



Figure 3. Warning Boards in The *Sarang Macan Hills*

Table 2. The Content of *Larangan Jurai*

<i>Larangan Jurai</i>	Meaning
<i>Ndang mangkak ulam</i>	Do not felling down young trees in the woods
<i>Jage tanah bebat gunung</i>	Land sloping land to be planted with useful trees with a sabuk system
<i>A tuan Jage "imbe larangan"</i>	Preservation and Management of The <i>Hutan Larangan</i> (forbidden forest)
<i>Kalu nak selamat, jangan sesekali me'usak hutan di pucuk. Makenye ku larang u'ang ni"</i>	Prohibition of land clearing in the <i>Ulu Tulung and Tulung</i> area (watersheds sacred to the community) to avoid flooding

Sources: (Hadiprashada et al., 2016; J.E.S et al., 2021)

The value of local wisdom which is divided into several forms of traditional conservation of the preservation of natural resources in the forest is also found in Kaur Regency. The form of conservation is such as prohibition, *pamali*, or invitation. The values of local wisdom in the Kaur community as a form of oral message used by people in the hilly area as an ancestral heritage to protect the forest. This ancestral message (*pesan-pesan njadika jagad*) is contained in the *larangan jurai* (Hadiprashada et al., 2016). The *Larangan Jurai* is believed by the local community to be a message from ancestors who have been passed down from generation to generation to protect nature The content of the *larangan jurai* can be seen in Table 2.

The *Larangan Jurai* is a mandate in living a life that is conveyed orally and down and down to the *jurai* which means descendant in the language of the Pasemah tribe in Kaur Regency (Hanafi et al., 1980). This hereditary prohibition is then referred to as the *Larangan jurai*. The *Larangan Jurai* is believed to ensure the sustainability and availability of their natural and cultural resources. Forest management in the customs and habits owned by the community is carried out to prevent the loss of forest functions that threaten water sources and the preservation of flora and fauna in the forest (Hadiprashada et al., 2016). This statement is in

accordance with the content in Table 2, that the things carried out by the community in maintaining and maintaining customary forests in the Kaur region aim to prevent the resources in them from being used carelessly.

According to data from The Central Bureau of Statistics of Kaur District in 2020, the majority of people in Kaur work land-based as farmers, do activities in the forest, or have arable land in the forest, so that the jurai message has been deeply rooted in the community. Basically, the forms of these messages include: (1) It is not allowed to felling down trees, (2). Not allowed to use forest products without the permission of *ninik mamak* (customary holder), (3) Not allowed to use forest products excessively, (4) Not allowed to sell forbidden forest products, (5) Not allowed to be arrogant while in the forest area, (6) Not allowed to hunt fauna in the forbidden forest, (7) May not do bad things in the forbidden forest, and (8) May not speak bad words in the forest (Undri, 2017).

Based on Table 2, the message of the first prohibition is a ban on cutting down young trees. This prohibition message has a history related to the marriage custom in the Kaur regarding the making of *lemang* (typical Food of Malay People in Sumatra). Lemang is sticky rice cooked inside bamboo used in wedding processions. The bamboo cutting process, also has its own time and pattern, the selection or cutting of bamboo must be a little old (not too young but not too old). The purpose of choosing bamboo is in accordance with the form of prohibition of jurai in the message *ndang mungkek ulam* which means do not cut young trees. Cutting bamboo starts from the base of the root, this is done so that the bamboo segments located on it become undamaged.

For the Kaur community, bamboo is a plant that is often used so that its existence must be maintained. The bamboo root system can absorb and store more water in the soil. Bamboo roots can also strengthen soil structure that prevents erosion. Therefore, bamboo is very suitable to be used as one of the plants for soil and water conservation (Mentari et al., 2018). The form of the prohibition message applied by the community is a step to preserve natural resources in the forest so that it remains sustainable.

The *larangan jurai* is a source of knowledge that is integrated with the understanding of the natives towards the surrounding nature and culture. Based on table 2 which has been shared above, there is poin of *larangan jurai* that is "*jage tanah bebat gunung*" which means that residents plant trees on sloping land in order to suppress soil erosion. The conservation message in table 2 also explains about forest management. There are many prohibitions on entering forest areas, one of which is the prohibition to disturb or enter the Sumatran tiger's roaming area. People are not allowed to hunt or take natural

products in forested areas that have high tiger intensity (J.E.S et al., 2021). People in the Sumatra region, especially the tribe in Kaur believe that tigers have cultural significance because they have mystical powers. This type of tiger is known as *Puyang*. The appearance of *Puyang* is interpreted as a bad omen. There are two meanings to the appearance. First, a sign of a violation of social norms. Second, warning of forest destruction. As a result, the people there can be wise towards nature.

Indigenous peoples in the Bengkulu area keep myths that contain messages from their ancestor form of invitations and prohibitions as well as customary laws that are still enforced today. The existence of the application of local wisdom values can control the community not to damage nature where various animals live, especially animals that are protected by law (*Panthera tigris sumatrae*). The various forms of application of customary law show that community attitudes towards tiger conservation are more shaped by local wisdom amid the community. People tend to fear and avoid conflict with Sumatran tigers who are believed to be ancestors. Tarrant et al. (1997) explained that people's attitudes towards the conservation and protection of wildlife species are formed indirectly from the knowledge they have gained over generations. This approach through culture could save the endangered Sumatran tiger population.

Relevance of Local Wisdom to Biology Content

Recovery of learning after post pandemic Covid-19 is carried out by the government by developing the *merdeka* curriculum well said independent curriculum. In its application, teachers are freed or given the freedom to develop their own learning content. Teachers have the flexibility to choose various teaching tools so that learning can be adapted to the learning needs and interests of students (Rizaldi & Fatimah, 2022). The local wisdom that is uniquely owned by an area is one of the potentials which can be used as learning content for development in the learning process. The values of local wisdom in the traditional conservation of Sumatran tigers by local communities can be applied in the learning process. The integration of the local wisdom of the Sumatran tiger into learning will provide a meaningful learning process.

Each region in the sector of education has the right to develop its own potential and culture. Teachers play an important role in providing learning materials that are relevant to the culture known in their respective regions. Local culture and local wisdom are tangible manifestation that can be found in everyday life and can be used for contextual learning. One of the factors that influence attitudes is knowledge, therefore as educators are expected to be more creative and innovative in compiling teaching

and learning resources by paying attention to local excellence to form a positive attitude towards Indonesian environmental sustainability (Mumpuni et al., 2014).

The implementation of biology learning that integrates local wisdom may be able to improve the ability to develop concepts and knowledge of cultural values. Learning biology that truly reveals the cultural reality around students is still rare so that the material taught also does not clog the culture and concept of the material well (Anjarwati et al., 2021). There is a solution in overcoming this problem is to start combining biology subject matter with local wisdom. Integrating local wisdom into biology learning indirectly, fostering positive attitudes in students, training students to care for the surrounding environment (Jena, 2012). This process can be applied at the secondary school level and needs more attention at the high school level in the context of learning biology because it is important to equip students before entering lectures of higher education.

Integrating traditional conservation values as teaching materials is a huge conservation step. One way to introduce biodiversity conservation to students is by exploring local content or languages. An explanation of the distribution of fauna in the western part of Indonesia, one of which is the Sumatran tiger, as well as the traditional conservation principles of indigenous peoples on forest management and the participatory steps of indigenous peoples in protecting the Sumatran tiger, can be used as biological content for the grade of 10th of high school on biodiversity. Based on the regulation on Core Competencies and Basic Competencies of Primary and Secondary Education number 37 of 2018, the local wisdom of Traditional Conservation of Sumatran tiger is included for the grade of 10th of high school on biodiversity material, in accordance with the basic competencies below:

Table 3. Basic Competence Learning according to The Topics

Basic Competence (Knowledge)	Basic Competence (Psychomotor)
3.2 Analyzing various levels of biodiversity in Indonesia and their threats and conservation,	4.2 Presenting the results of observations of various levels of biodiversity in Indonesia and proposed conservation efforts.

Biodiversity is material that discusses about definitions of biodiversity, species, habitats, ecosystems, conservation, and the relationships between them. Biodiversity also analyzes biodiversity threats, endangered species, and clear cases for one species or more to be saved from extinction. Biodiversity is intrinsically valuable and essential to

human survival because it also supplies indirect services to humans that are often taken for granted. The biodiversity material is a very broad learning material. This is because Indonesia has very abundant biodiversity throughout its territory (Dewi et al., 2020). However, the quality and quantity of biodiversity in a region may decrease or may even disappear. Therefore, in the learning process students can identify, explain, and analyze the benefits of preserving and threatening Indonesian biodiversity in Indonesia carefully and responsibly to maintain sustainability.

The value of local wisdom from the traditional conservation of Sumatran tigers can be developed into learning in phase E of the Merdeka Curriculum. Material elements that can be integrated are biodiversity and ecosystems. At the end of phase E, there are two elements of learning outcomes for students to achieve, namely understanding of biology and process skills. For understanding of biology, At the end of phase E, students have the ability to create solutions to problems based on local, national or global issues related to understanding the diversity of living things and their roles, viruses and their roles, biological technology innovations, ecosystem components and interactions between components and environmental changes. For the process skills element, the learning outcomes to be achieved consist of abilities in Observe; Questioning and predict; Plan and conduct an investigation; Processing and analyzing data and information; Evaluate and Reflecting; and Communicate results. At the end of phase E, learners have the ability to be responsive to global issues and play an active role in providing problem solving. Such efforts are directed towards sustainable development goals. The scope of material and the flow of learning objective can be seen in the table below:

Table 4. Flow of learning objective according to The Topics

The Scope of Material	Flow of Learning Objective
Ecosystem	Students analyze local wisdom that can prevent ecosystem imbalances by considering ecosystem components and interactions between components.
Benefits of biodiversity	Students identify the benefits of biodiversity by presenting data on the results of exposure to the benefits of certain species with various media
Biodiversity conservation	Students analyze conservation technologies that can be applied in the preservation of biodiversity, especially overcoming the scarcity of biodiversity by presenting a conservation model

The Scope of Material	Flow of Learning Objective
	chart from the results of the article review
Campaign against biodiversity erosion	Students Create solutions to the biodiversity around them through campaigns with various media

The existence of the Sumatran tiger as an endemic fauna in the western part (Wallace’s line) of Indonesia which has a critical status due to forest conversion and poaching can be used as an example of biodiversity and the threat of extinction of biodiversity as material according to Table 3 and 4 above. In addition, conservation efforts from the community customary law by managing forests to preserve the Sumatran tiger can be used as an example of material for preserving biodiversity conservation. This community participation is regulated in Law of The Republic of Indonesia Number 32 Year 2009 Concerning Protection and Management of Environment (PPLH), Chapter XI Article 70 paragraphs (1) to (3). Based on the law, the community has the same and widest possible rights and opportunities to play an active role in environmental protection and management. One of the objectives of this community participation is to increase awareness in environmental protection and management. Another goal is to develop and maintain local culture and wisdom in the context of preserving environmental functions.

This biology learning content can be developed into various forms of teaching materials. Biology learning will be successful if teachers are able to develop and use appropriate learning tools (Ramdiah et al., 2020). Teaching materials contain material descriptions of knowledge, experience, or theory on certain subjects according to the curriculum designed by the teacher to make it easier for students to understand the material (Kosasih, 2021). One form of developing teaching materials is a module. Furthermore, modules are teaching materials designed with a series of learning experiences for students so that they can be studied independently.

The purpose of developing the module is to provide teaching tools that can guide teachers to carry out learning. In accordance with the application of the Merdeka curriculum (independent curriculum), in the practice the teacher has the freedom to choose, modify or arrange their own teaching modules according to the characteristics of students. The module must have criteria that are interesting, meaningful, and challenging. In order to foster interest in learning and actively involve students in the learning process. A module based on local wisdom from the principle of

Sumatran tiger conservation can be developed according to the needs and interests of students.

To be able to help direct the learning process that completes learning outcomes, the teaching module can be designed with components in it by two learning activities and evaluation. The first learning activity can be discussed about the importance of biodiversity, the level of biodiversity and the distribution of biodiversity in the division of regions in Indonesia, including the types of fauna, which can include the Sumatran tiger as an example of the distribution of endemic fauna in western Indonesia. The second activity may contain threats and risk of biodiversity and educational activities for students, including activities to explore information regarding the traditional conservation of the Sumatran tiger based on the beliefs of the indigenous people in Sumatra region.

The integration of traditional conservation values as teaching materials in the form of modules is a very big conservation step to foster the enthusiasm and responsibility of students to participate in maintaining and conserving biodiversity in Indonesia. In addition, students can also analyze local wisdom that can prevent ecosystem imbalances by considering components and interactions of ecosystem. This learning experience with the development of teaching materials will have a positive impact on the next generation to cultivate a wise attitude for the future.

Conclusion

Based on the results of the literature review that has been studied, it was found that there are traditional conservation principles for the conservation of Sumatran tigers (*Panthera tigris sumatrae*) in the form of invitations and prohibitions and customary laws that can be developed into teaching materials for biology learning. This conservation principle has great potential to be developed as local wisdom-based learning content by teachers such as modules. The results of the content analysis stated that this material can be given to 10th high school students in the 2013 curriculum regarding biodiversity, threats, and conservation. The material is also included in the learning outcomes of the Merdeka Curriculum phase E regarding understanding and process skills analyzing interactions between ecosystem components and efforts to conserve biodiversity. In addition to assisting teachers in using local wisdom-based teaching media, some of the advantages of integrating learning with traditional conservation of Sumatran tigers are promoting students in the development of their own cultural identity, sustainability, and cultural capital. This result can be used as basis for further study in integrating

local wisdom of traditional conservation as learning resources in others relevant biological topic.

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The authors declare no conflict of interest.

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