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Indigenous Knowledge Systems and Practices (IKSPs), Livelihood Resources and Aspirations of the Matigsalog and Ata Tribes

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Abstract: The Philippines is an archipelagic country composed of different indigenous cultural communities (ICCs) spread across various islands. Indigenous peoples (IP) often face marginalization and lack access to the same resources available in lowland areas, creating inequality and barriers to their well-being and development. This study documents the indigenous knowledge systems and practices of the Matigsalog and Ata tribes in Davao City, focusing on their unique agricultural techniques, rituals, and conservation practices. Furthermore, we assessed their current livelihood options and explored opportunities for government support to improve their well-being. A focus group discussion was used to assess the knowledge and perception of participants from the Matigsalog tribe (N = 42) and Ata tribe (N = 15) of Davao City. Validation of the study took place separately through a brief presentation of the results before 15 members of the tribes and a hiking visit to their farmlands. The study determined the existing livelihoods in the two areas, which were mainly agricultural, farming of crops (rice, corn, cassava, sweet potato) and fruit trees (coconut, banana, durian, jackfruit, pomelo) and the community's resources as well as knowledge, systems, and practices with regard to agricultural crops including climate change. Their sustainable farming practices include intercropping, seed-saving, and exchange practices, preserving these crop varieties and ensuring their availability for future planting seasons, with no usage of chemical fertilizers and pesticides. In conclusion, the tribe's aspirations and the resulting recommendations are consolidated to facilitate and enhance governmental assistance in a more focused and efficient manner.

Keywords: Ata; crop management; farming practices; Matigsalog; sustainable agriculture



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1. Introduction

The Philippines is an archipelagic country consisting of 62 indigenous cultural communities (ICCs) spread across various islands. Recently, the established Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) highlighted the respect for and recognition of the indigenous and local ecological knowledge and its contribution to the sustainable use of biodiversity, ecosystems and conservation as part of its principles [1]. The promise of the indigenous knowledge systems and practices (IKSPs) are relevant to food security and crop management, such as food utilization, cultivation, and conservation practices, which have been poorly acknowledged or documented in the scientific community. IKSPs refer to the skills, beliefs, knowledge, and philosophies developed by societies with long histories of interaction with their natural environments. It

has been previously mentioned that IKSPs are beneficial in preserving the environment and the possible impact of their knowledge has many possible benefits towards generating new ideas. The IKSPs of indigenous tribes have long been considered a comprehensive concept designed to assist and enhance the knowledge about techniques in terms of agricultural aspects, particularly in upland areas. Their methods in terms of farming are environmentally friendly, causing no stress to agricultural areas and mountain ecosystems [2]. In addition, IKSPs have a role in monitoring and managing ecosystem practices and functions with special attention to ecological resilience [3,4]. The promotion of IKSPs in some areas has instigated communities to be productive in terms of income and their land producing alternative livelihood resources such as native products and other commodities [5]. This plays a crucial role in enhancing our knowledge in various aspects, particularly in terms of food security, crop management techniques, and conservation practices for our upland environment. Indigenous communities have developed a deep understanding of their local ecosystems over generations, which has led to the accumulation of valuable knowledge that can be harnessed for the benefit of society as a whole [6]. It is also useful to make efficient decisions regarding activities, such as agricultural and educational assistance, that are acceptable to the ways of living of ICCs [7]. Hence, the documentation of the IKSPs of the Matigsalog and Ata tribes will help create new information to develop sustainable solutions for a culturally acceptable livelihood [3,8]. Learning from the indigenous peoples' knowledge systems and practices, e.g., on farming, livestock raising, fishing, and conservation practices, will help enhance environmentally safe and sustainable farming practices for our lowland communities in general [9]. The cultivation and farming practices of indigenous tribes can be utilized to provide valuable information to promote and document the design of ecologically desirable farming production systems [10]. These practices come in various arrangements of crop management system practices, such as home gardens, crop combinations in fields and the management of crop utilization, and cultivation practices such as mixed fruit trees. This may not only refer to their traditional local ecological knowledge (TEK) about native farming practices but may also include their food production system [11]. Thus, the TEK of the tribes can be a good basis for agroforestry and crop practices that are sustainable and can be employed by many farmers. Crop production using their TEK can improve farm productivity due to its more conservative nature and therefore the ability to provide many ecosystem services [12]. However, there are currently very few existing agricultural practices that can be considered to have sound sustainable practices that can be attained through simultaneous enhancement of agroecosystem diversity and farm productivity as in agricultural systems [13]. Only a few studies in the Philippines have considered looking into the contribution of TEK, particularly concerning food security and crop management, to utilize agricultural sustainability and productivity [14] and address issues such as livelihood assessment, climate change, and the seasonality of crops [15]. The objective of this study was to record the indigenous knowledge systems and practices of the Matigsalog and Ata tribes in Davao City. Specifically, we documented their distinctive agricultural techniques, rituals, and practices pertaining to conservation, selection, and food utilization within the Davao Region. Additionally, we sought to evaluate their current livelihood options and explore ways in which the government can provide further support and assistance to enhance their well-being.

2. Materials and Methods

2.1. Study Area

Davao City is a highly urbanized city in the southern part of the Philippines, located on the island of Mindanao (see Figure 1). It is the largest city in the country in terms of land area, covering a total of 2444 km². Based on the PSA data of 2020, Davao City has a population of 1,792,195 people, making it the third most populous city in the Philippines after Quezon City and Manila [16]. The city is also known for its high literacy rate of 98.3%. It is home to various industries, including agriculture, mining, manufacturing, and services. The city is also a major gateway to the rest of Mindanao, with its international

airport serving as a major transportation hub. In terms of livelihood, the city is dependent on agricultural plantations for its food security, being the largest producer of fruits such as durian, pomelo, and banana in the Philippines and a major producer of rice, corn, and coconut. It is also home to a diverse range of industries including manufacturing enterprises specializing in food and beverages, textiles, and electronics. Moreover, there is a flourishing service sector, with a rising number of establishments catering to tourism, education, healthcare, and information technology. Moreover, Marilog District, Davao City, is situated at approximately 7.4846, 125.2527 (7°29' N, 125°15' E), with an elevation of 1218.2 m above sea level and a cold climate, while Paradise Embak, Paquibato District, Davao City, is situated at approximately 7.3495, 125.5287 (7°21' N, 125°32' E), with an elevation of 310.4 m above sea level. Paradise Embak has a tropical rainforest climate with little seasonal variation in temperature.

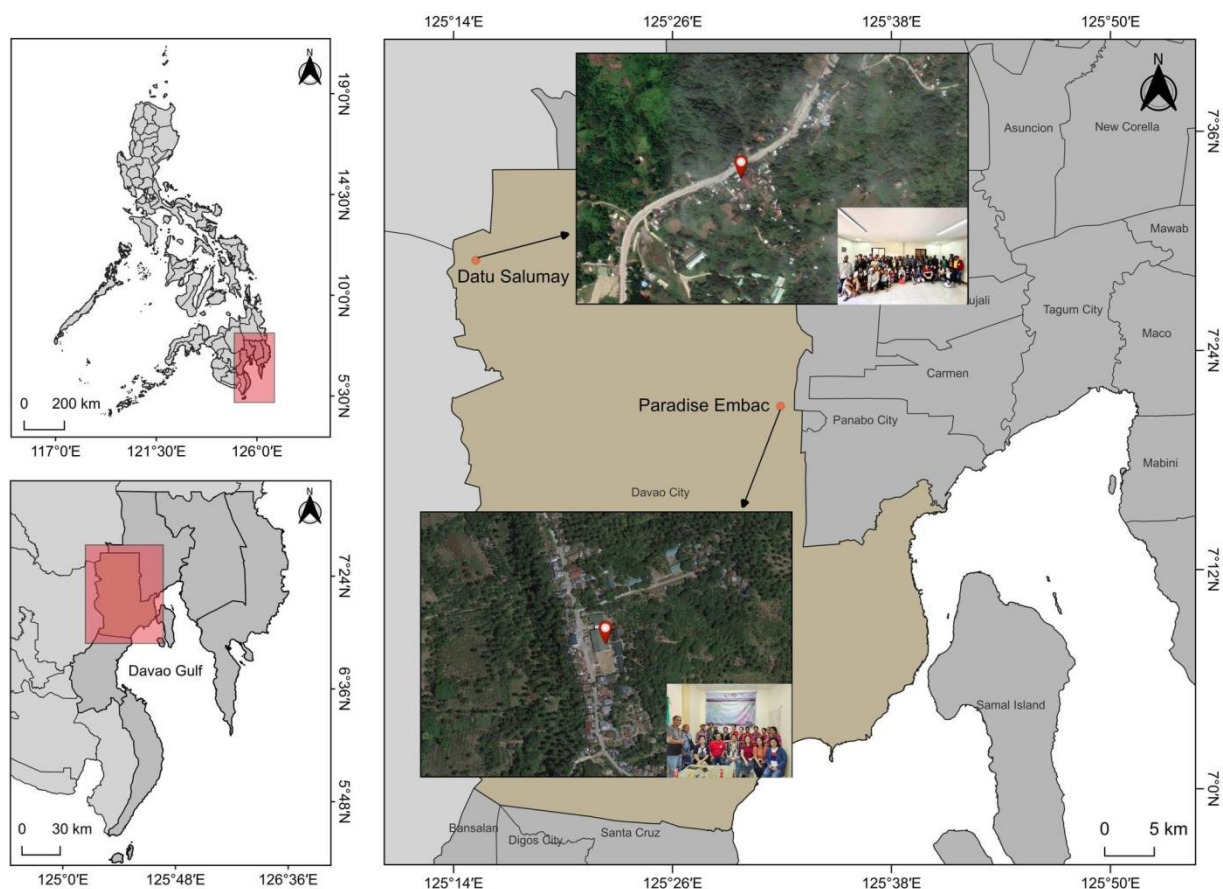


Figure 1. Site of study areas on IKSPs and livelihood mapping in barangay Datu Salunay, Marilog District, and barangay Paradise Embak, Paquibato District, Davao City.

2.2. The Matigsalog Tribe

The Matigsalog tribes are part of the indigenous cultural communities in Davao City, specifically in the mountainous areas of the city, such as in Marilog District. The Matigsalog people have a distinct culture and way of life, which centers on their traditional practices and beliefs, and have their own language as well as their own system of governance, which is based on a council of elders. Currently, the Matigsalog people have faced significant challenges in preserving their culture and way of life. They have been displaced from their ancestral lands due to the area's opening for tourism activities, mining and logging explorations and operations in their area, and the expansion of agricultural plantations, e.g., banana and pineapple. Despite these challenges, they remain resilient and have continued to fight for their rights and their cultural heritage. They formed their own

community organization called Matigsalog-Manobo Tribal People Council of Elders Davao Inc. (MAMATRIPCEDI), which will assist the tribe in gaining government-initiated projects.

2.3. The Ata Tribe

The Ata tribe is another indigenous group in Davao City, particularly in the Paquibato and Marilog districts in nearby areas of Davao del Norte and Bukidnon. Similar to the Matigsalog tribe, they belong to the indigenous cultural communities (ICCs), encompassing the diverse indigenous peoples of the Philippines. Within these communities, they uphold unique cultural beliefs, governance systems, and language, preserving their rich and distinct traditions. They have a rich history and folklore, which includes stories of their creation, beliefs about nature and the environment, and their agricultural practices. The Ata people have been in existence for centuries and have built their communities and livelihood resources using traditional methods that have sustained their way of living and their agricultural practices. According to Jorolan [17], the government has put programs in place for Mindanao's indigenous groups with the intention of raising their socioeconomic status. However, Ulindang [18] observes that concern for the indigenous people in Mindanao including the Ata tribe during modern times was mainly focused on the development projects that threaten to move them from their homeland. Like the Matigsalog tribe, the Ata people have faced significant challenges in preserving their culture and way of life. Despite these challenges, they also remained resilient and have continued to fight for their rights and their cultural heritage by forming their own community organizations and cooperatives to promote sustainable livelihoods and protect their lands from further encroachment. They call their community organization Lolopongan to mo Igbuyag to pog-uyan to Ingod (LIPI) Inc., which can help them gain government-initiated projects.

2.4. Approach of Study

This study made use of participatory research methods to assess the knowledge and perceptions of respondents regarding livelihood, resources, and aspirations in the community. It focused on prepared questions related to livelihood assessment, including existing livelihoods, resources, and recommendations. The farming knowledge components ask for their crops, how these are utilized, what has been planted in the last year, and if there were rituals involved. Other questions focused on the perception of climate change events and local adaptation strategies. The two study areas are Barangay Datu Salumay, which has a sizable population belonging to the Matigsalog tribe, and Barangay Paradise Embak, which has a sizable population belonging to the Ata tribe. These tribes are two of the five major tribes that are found in Davao City.

2.5. Focus Groups

Focus group discussion (FGD) is a qualitative methodology used to gain information from various stakeholders that are composed of small groups (>5) and those that are composed of 10–12 individuals per group [19,20]. It is effective to the degree that the facilitators are able to qualify the inclusion or exclusion of participants of the FGD and members of the group are freely able to discuss their ideas [21]. To gather information about farming and cultivation practices, the participants were divided into two groups. They were then questioned about their livelihood and aspirations as a whole. Before the focus group was conducted, a preliminary site visit was conducted in the two study areas to consult the leaders of the Matigsalog and the Ata tribes on whether the research project could be undertaken with their approval. Once this was approved by their tribal council, the research team prepared for the survey visit. Overall, there were 42 participants among the Matigsalog tribe during the FGD on 11 April and 15 participants from the Ata tribe on 13 April.

2.6. Validation

Enhancing data quality is essential to the success of research surveys. To make the results acceptable and ensure that the scientific method is robust, data quality issues must be addressed and data collected must be validated whenever possible [22]. Data validation was conducted in Marilog and Paquibato districts with regard to farming practices, crop utilization, and livelihood needs assessment on 26 April and 28 April. In total, 18 members from the Matigsalog tribe and 17 members from the Ata tribes participated. The conduct started by providing the participants with the written report from the previous discussions and showing them the results of the FGD from the two tribes. The researchers started to report on the results provided by the participants, verbally repeating what was written to them, and established in the Cebuano language whether they understood the results, whether they agreed on those points, and whether they wanted to add more information (Figures 2 and 3). Additional questions that were explored came out based on the narratives of the participants, for instance, on climate change impacts and on their rituals regarding their farming practices. Recording of the presentations during the FGD, writing notes, and photo documentation were also performed to collect information and insights from the participants.



Figure 2. Conduct of the focus group with the Matigsalog tribe of Marilog District, starting with a recollection of the previous answers of the participants on livelihood assessments (A), farming and crop practices (B), and gender (C), and a group photo of the research team together with the participants (D).



Figure 3. Conduct of the focus group with the Ata tribe of Paquibato district also started with a brief recall of the previous answers of the participants on livelihood assessments (A), farming and crop practices (B), and gender (C), and a group photo while discussing the way forward with the research team and the participants of the study (D).

2.7. Actual Farm Visit

After the validation meeting with the participants, the research team also visited one farm area from each tribe. The visit aimed to document and assess the areas planted with crops, vegetables, or fruit-bearing trees on the hillsides and slopes (Figure 4).



Figure 4. One of the elders of the Matigsalog tribe showing how planting rice occurs, with the man leading the way through making holes in the ground using a pointed stick and his wife following him (A). Common crops in the area include corn, rice, gabi, cassava (B), other crops available are banana, sweet potato, chayote (C), and different varieties of banana (D).

While the Matigsalog people are dependent on rain and cool weather, they also know their cropping calendars and point to the heavens to evaluate whether there is a specific crop that needs to be planted (Figure 5).



Figure 5. One of the key leaders of the Ata tribe showing his farm, which is filled with banana (A), the crops of which are often transported by using horses because of the steep hillside of their gardens and croplands (B). These are also planted with cacao, durian (C), and other lumber trees such as falcata or other trees such as coffee and lanzones in the area (D).

3. Results

3.1. Livelihood and Resources in the Area

The common livelihood in the two areas was mainly farming of rice in the Marilog District area and corn in the Paquibato area. Interspersed in the cornlands were coconuts, marang, rambutan, durian, cacao, abaca, and coffee for the Ata tribes. They also plant camote, *carling*, and squash. For the rice farming area of Bukidnon, which is a mountainous area, vegetable, abaca and banana farming (*binangay*, *cardaba*, *tundan*) is also practiced. They cultivate a wide range of rice varieties, including traditional native types such as denorado, pilit, and azucena as well as other varieties. In addition, they consistently grow a specific corn variety called sige-sige, which is considered a hybrid corn. It is cultivated annually, close to open-pollinated varieties in their area, but they wanted to replant their areas with native corn varieties such as Tiniguib. In both areas, they were highly affected by the decision of the Philippine Textile Research Institute (PTRI) to stop buying their native abaca varieties, which they have been cultivating for a long time now in the area, due to poor fiber quality. They were advised to change and plant the *tanggungan* abaca variety, an NSIC-registered variety (see Table 1).

Table 1. Livelihood resources, present skills, and aspirations for the Matigsalog tribe of Davao City.

Livelihood	Resources	Skills Present	Remarks/Suggestions
Livelihood present in the area			
Vegetable farming	Cold and warm season crops	yes	Need for fertilizers for vegetable farming, seeds for varieties planted, knapsack sprayer, tools
Corn farming	Sige-sige (yellow ug puti nga mais)	yes	
Rice farming	Dinurado, pilit, asuzena	yes	
Abaca farming	Native variety available		Need to plant the <i>tanggungan</i> variety because the native variety of abaca cannot be sold
Bead making		yes	Materials for bead making
Banana farming	cardaba, tundan, binangay	yes	Need for market connections
Livelihood aspired for			
Inland fisheries	Tilapia, Catfish	Very interested	Training on backyard pond raising and nets/and feed-making apparatuses for backyard ponds
Ornamental plants	Seeds, cuttings, plants available	Very interested	Training on propagation
Tribal dressmaking	Skilled women and stalls are available but without materials e.g., singer and electric sewing machines	The women's group was very interested	Sewing machines are needed (manual and electric); fabric/clothing materials are also needed
Livestock	Carabao, horses	Very interested	Livestock giveaways

The Matigsalog tribe aspires to establish dressmaking and bead-making cottage industries for their women's group. They seek sewing machines and fabric to start their business. Additionally, they desire training in backyard fish farming, ornamental plant cultivation, and provisions for horses and carabaos. Although they do not currently grow ornamental crops, they are inspired by their Bisaya neighbors and the favorable climate and diverse ornamental crops in the area. Similarly, in the Paquibato district, the Ata tribe focuses on fruit tree farming, livestock raising, and cultivating various crops. They request resources such as egglayers, dressmaking and beadmaking supplies, fishing implements, and a grinding and pelletizing machine for feed production (see Table 2).

Table 2. Livelihood resources and skills and aspirations of the Ata tribe of Davao City.

Livelihood	Resources	Skills	Remarks/Suggestions
Livelihood present in the area			
1. Brgy. Panyalum (Farming) Fruit plantations Livestock raising	Banana, durian, lansones, breadfruit, rambutan, coconut farms, abaca farms Goats, native pigs, poultry	Traditional way	Cycle of tending to harvesting takes a long time; cheap farm gate prices
2. Brgy. Mapula (Farming) Livestock raising	Abaca, cacao, banana, corn, coconut, peanut, Durian, coffee (robusta) native pigs, poultry	Traditional and modern farming methods (uses fertilizer) yes, present	
3. Brgy. Callayawan (Farming) Livestock raising	Banana (cardava, tundan), coffee, breadfruit, coconut, lansones Goats, ducks	yes, present Yes, present	
4. Brgy. Malabog (Farming)	Sweet potato farming, corn farming, squash farming, chayote (sayote), ube (karlang)	Modernized farming using fertilizers and pesticides	
5. Brgy. Salapawan (Farming) Livestock raising Traditional dresses (women)	Abaca, banana, cacao, coconut, corn Layer chicken Traditional and cultural	Yes, present Yes, present Yes, present	Abaca buyers stopped buying variety and farm gate prices of coconut copras are cheap Feeds and vitamins are expensive
Livelihood aspirations			
1. Farming of durian, rambutan, mangoesteen		yes	Sufficient seedlings of durian, and mangoesteen for planting Training on squash farming and market connections; seed materials of corn and fertilizers
2. Farming of vegetables, corn	Squash, corn	yes	Heads of free-range native chicken in addition to their layer chicken Sewing machines are needed (manual and electric); fabric/clothing materials are also needed
3. Raising native chicken			
4. Traditional dressmaking	Traditional and cultural	yes	Nets, drums, bamboo, and feed development for Tilapia and livestock Pilot oil processing plant
5. Inland lake floating cages	Tilapia/catfish	yes	Training on feed formulation using indigenous resources
6. Coconut oil processing	Coconuts are available	yes	
7. Feed processing	Raw materials are available		

3.2. Different Crops Available in Marilog District and Their Uses

Based on the focus groups, the following crops were mentioned as useful staple foods, root crops, or trade items for farmers: corn (*Zea mays*) has multiple uses. It can be ground and used as a daily food staple, its seeds can serve as chicken and fish feed, and the whole ear (pakaw) can be eaten by pigs. Corn silk can also be boiled and used as a tea for urinary tract infections. Sweet potato (*Ipomoea batatas*) or camote also has multiple uses. The young leaves (camote tops) can be used in vegetable salads, while the tuber can be boiled, grilled, or fried. The skin of the camote tuber can be used as feed for pigs, dogs, and tilapia fish. Camote tops can be boiled as food for anemic individuals. Furthermore, the farmers engage in the cultivation of cassava (*Manihot esculenta*). This crop serves various purposes, including being used as an ingredient for snack items such as cassava cake (suman), cassava-based sweets, and cassava flour. Additionally, the leaves of the cassava plant find utility as feed for horses, while they can also be utilized for hot steam inhalation (toub/suob). The root can be used to cure burns. Chayote (*Sechium edule*) has various uses. The young leaves are used in vegetable salads or stews. The fruit can be added to meat dishes or used as feed for pigs and chickens. Chayote fruit can also be used to lower blood pressure when juiced. Lettuce (*Lactuca sativa*) is a leafy vegetable that is eaten raw, used in salads, or included as part of other dishes. It can also be used as pig feed and is known for its stomach-cleansing properties. The stem can be used as a remedy for bruises. Pechay (*Brassica rapa*) is a leafy vegetable used in various cooked meals, boiled, steamed, as a side dish, or in stews. It can also be used as pig feed and as a remedy for heartburn. Carlang (*Xanthosoma sagittifolium*) is used in cooking, boiled, or added to boiled pork meat or stews. The root crop can also be used as pig feed. It is beneficial for those who are anemic. Upland rice is a staple food, and darak (rice milling byproduct) can be used as feed for pigs, chickens, and ducks. Yakon (*Smallanthus sonchifolius*) is a root crop that can be eaten fresh or pickled and can be used as pig feed, and its leaves can be used as fodder for goats. The ipil-ipil plant (*Leucaena leucocephala*) has leaves that serve as goat feed, and the seeds can be used as an antihelminth for animals.

3.3. Different Crops Available in Paquibato District and Their Uses

Corn (*Zea mays*) is also used by the Ata tribe as a staple food; the finely ground maize can be used to feed fish, chicken, and pigs, while the dukot can be used for steamed inhalation. It can also be sold for commercial purposes. Coconut (*Cocos nucifera*) is used in a variety of ways; it is sold as a copra, the juice can be drunk fresh, and the coconut shell can be used to make charcoal, which can be sold in the market. The coconut meat leftovers (sapal) after grinding it can be used as feed for pigs and chickens, while the coconut milk is often used in cooking and the oil can also be used for healing and massaging purposes. In addition, it can also be used as a coconut coffee, with the meat being used for this purpose. Banana (*Musa balbisiana*) is often used in a variety of ways, mainly as an additive in cooking pig stew, snacks such as banana cue or pinaypay, or fried banana as another snack variety, and its young banana leaves can be used for enhancing breastfeeding purposes or for wrapping bruised areas of the body. The fruit is often sold immediately in the market. Sweet potato (*Ipomoea batatas*) or camote, can be used as a vegetable salad together with tomato and green mango, while the tuber can be boiled, grilled, or fried as food. On the other hand, the skin of the camote tuber can be used as a medicine for stomach upset or LBM by using the camote skin. Meanwhile, the Guyabano fruit (*Annona muricata*) can be used as staple fruit because the tree can grow fast, and once it starts producing fruit, it keeps producing throughout the year. Its young leaves can be used to feed the pigs, and it can be boiled and made into a tea to be used for healing urinary tract infections. Cassava (*Manihot esculenta*) is a root crop that can be used as food for snacks to make cassava cake (suman), cassava sweets, or cassava flour, while the leaves of the plant are also used as feed for horses, and the leaves can be used for hot steam inhalation (tuob/suob). The root can also be used to cure burns. Karlang (*Xanthosoma sagittifolium*) is used in cooking, usually as part of boiled pork meats or stews; sometimes, the root crop can also be used as feed for pigs by first boiling it to make it soft. It is a good remedy for those who look pale, lack an appetite, and/or are anemic. Upland rice is usually used as a staple food; darak from rice milling can be used as feed for pigs, chickens, and ducks. Gabi (*Colocasia esculenta*), leaf, stem, and root tuber can be used as a food mixed with sardines or fish or with coconut milk. All parts of the plant can be cooked through boiling and used as feed for ducks, chickens, horses, pigs, and goats. Kangkong (*Ipomea aquatica*) is also used as a side dish and is often cooked as adobo. When chopped, it can also be used as feed for pigs. Oregano (*Oreganum vulgare*) leaves can be used as a spice for cooking and can also be used for deworming pigs and treating snake bites. Tomato (*Solanum lycopersicum*) fruit is used in cooking, and its leaves are used for treating wounds (Figure 6).

3.4. Seasonality and Farming Strategies of Important Crops

Upland rice is a special crop to both tribes, which involves four major crop production practices: *lampas*, *pugas*, *guna* and the harvest period. *Lampas* is carried out from January to March (clearing for land preparation), and *pugas* (sowing/planting) occurs around March to May while *guna* (weeding period) is from May to June. Harvest time occurs from July to October. Both males and females are involved during all phases, but *lampas* or clearing is usually carried out by males. In terms of off-farm activities such as hunting wild pigs, these are usually carried out around July for the Matigsalog tribe. During the summertime, they are involved in construction jobs (March to April), while from May to July, they are also working in the resorts. In the case of the Ata tribe, off-farm activities include the women making dresses and beads. They noted that the rainy season starts from May to July and the dry/drought period occurs from August to September, with disease and pest attacks usually occurring around May and June. The Ata tribe noted that the drought period occurs around March and April, with the rainy season occurring from May to July; rat infestation also occurs around the month of July. The harvest time is also around August to September. They have a post-harvesting practice known as “Linaplapan” that has significant effects on their food security. Corn is harvested at a specific stage, boiled while still covered in the corn husk, and then some of the outer parts are removed or “laplap” before the

corn is placed in sacks or containers and hung up for storage. The rice and corn in these special storage containers can be kept for consumption or for planting for the next season. The thick bark of the lauan tree, which, according to the respondents, is bitter to pests, is typically used to make the storage containers. Moreover, the Matigsalog and Ata tribes share rituals for major activities, reflecting shared values that continue to support their survival. The forest plays a significant role in their farming systems, with the Matigsalog tribe gathering special “sagbot” to use for “palina” and protect plants from diseases and pests. The Ata tribe, on the other hand, does not engage in off-farm activities such as construction or mountain resorts, as their produce is sufficient for their subsistence. They do not have the usual problems associated with conventional rice farming since they are knowledgeable in pest and disease management and do not need expensive fertilizers or irrigation. However, their cropping practices are vulnerable to soil infertility, pests, and diseases due to their reliance on conventional farming practices.

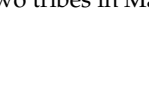
PLANTS		USES
Corn (Mais) <i>Zea mays</i>		- Staple food - Medicinal (Urinary tract infection)
Sweet potato (Camote) <i>Ipomoea batatas</i>		Anti-anemic
Cassava (Balanghoy) <i>Manihot esculenta</i>		- Staple food - Anti-burn
Chayote (Sayote) <i>Sechium edule</i>		- Stew - Medicinal (High blood pressure)
Lettuce (Letus) <i>Lactuca sativa</i>		- Raw/Salad - Feed for animals - Stomach cleanser
Petchay <i>Brassica rapa</i>		- Stew - Feed for animals - Anti-heartburn
Karlang <i>Xanthosoma sagittifolium</i>		- Used in boiled pork soup - Feed for animals
Yakon <i>Smallanthus sonchifolius</i>		- Raw/Salad - Medicinal (Diabetics)
Ipil-ipil <i>Leucaena leucocephala</i>		- Leaves (food for goats and pigs) - Deworming of animals
Coconut (Lubi) <i>Cocos nucifera</i>		- Juice, meat - Feed for pigs, chicken and duck
Banana (Saging) <i>Musa balbisiana</i>		Staple food
Guyabano <i>Annona muricata</i>		- Staple food - Anti-cancer
Gabi <i>Colocasia esculenta</i>		- Side dish, viand - Feed for animals
Water spinach (Kangkong) <i>Ipomea aquatica</i>		- Spices/side dish - Feed for animals
Oregano (Kalabo) <i>Oreganum vulgare</i>		- Spices - Deworming, anti-snakebite
Tomato (Kamatis) <i>Solanum lycopersicum</i>		- Spices - Anti-arthritis

Figure 6. Plants utilized by the two tribes in Marilog and Paquibato District of Davao City.

3.5. Perception of Climate Change Events

Climate change has significantly impacted the Matigsalog and Ata tribes in the past decade. In Marilog District, the Matigsalog tribe has experienced increased droughts and floods, affecting their harvest outcomes. In Paquibato District, the Ata tribe has experienced strong winds, prolonged wet seasons, and heatwaves in the years 2013 to 2015. Both tribes use the “Pandorawa” technique, which involves predicting weather and farming activities using moon and star formations. The Matigsalog tribe believes climate change is affecting their ability to accurately interpret the constellation of the moon and stars. For “pugas” or sowing, they said it was best to sow when the moon is bright, and for “lampas”, it was best to do so when they experienced sunny weather. Furthermore, the tribes have a ritual of shaking to start the planting process; they call this “kalayat” or the sounds of white-eared (alimokon) to begin sowing the seeds from their land. Climate change and weather conditions hinder their ability to accurately interpret the constellation of the moon and stars. Additionally, Paquibato District has experienced rat infestations between 2019 and 2021, which they attribute to cultural practices such as increased use of pesticides and fertilizers. These pest infestations have negatively impacted the quantity and quality of their harvest yields. The Matigsalog tribe claims that their ability to predict pest infestation timing was affected by climate change impacts.

3.6. Climate Change Impacts on Livelihood and Aspirations for Well-Being

Being one of the area’s main upland rice producers, the decrease in harvest yield has a strong effect on the Matigsalog’s livelihoods as well as their subsistence. Some of the FGD members have expressed a general feeling of exhaustion towards the increased efforts to uphold their crop production, while others have offered testimonies of their acceptance of the overall situation and their willingness to adapt and become more resilient in consideration of climate change. It has also been mentioned that the tribes have observed a decline in health because of climate change. The Ata tribe has called this a “fever”, where they are suffering from the sun’s heat during the day, which makes even the early hours of the morning seem like the sun is at its zenith.

In more technical terms, the members of the Matigsalog tribe shared their aspirations to receive more assistance from the government, especially in the field of the transportation of their products. Currently, they are delivering their harvest by foot over long distances through the mountainous area. In order to increase the efficiency of their trade and also minimize the physical exhaustion to their members, the tribe desires the supply of horses for the transportation of goods as well as the provision of technical tools for their farming activities. Previous government interventions in Paquibato District have been evaluated as inefficient by the local tribe. During an especially dry and hot period, the government wanted to provide the Ata IP with cacao seedlings. However, this support was not seen as an appropriate measure, as the Ata tribe felt a stronger need to purchase rice for subsistence at the time. On the other hand, the Ata tribes have complained about corruption regarding budget allocation to their community. According to their leader, their community was included in the budget but has not received the allocated funding. Nevertheless, Datu Boyson said they were enhancing their practices to maintain ecological balance for the sustainability of their environment just as their ancestors have done. There is a continued demand for help and assistance funds by the government, specifically the National Commission on Indigenous People (NCIP) as the authority to market their products so that they can manage their income independently and the earnings will not be lost to traders in Davao City and other investors.

3.7. Climate Change Adaptation Strategies

In Marilog District, the tribe members have developed several adaptation strategies in response to climate change, including intercropping, the alternation of planting crop species that are resilient to either rainy season or drought season, and the increased use of

fertilizer. Additionally, they grow “lagutmon” such as carlang, gabi, and gulay to avoid the rainy season because these crops can be harvested in just 45 days.

In Paquibato District, the first response to climate change was an adaptation of the daily rituals of the community’s farming practices. They perform more frequent prayers and rituals for protecting their environment and for sustained income on their farm. Moreover, they practice seed preservation and crop cultivation under forest rehabilitation and establish a massive nursery to restore their farmland, maintain their watershed protection areas and combat the impacts of climate change. The tribe has stationed 60 forest guards to secure their territory as well as the possession of a Certificate of the Ancestral Domain Title (CADT) and Ancestral Domain Sustainable Development and Protection Plan (ADSDP). In addition, the community has started deforestation programs for foreign species to rehabilitate endemic trees. Lastly, some members of the community have abandoned their farmland to look for alternative labor and income to support their families.

4. Discussion

4.1. Livelihood Aspirations

This study showed that the two tribes have contributed to farming cultivation and utilization in their communities. The abundance of their harvest through their farming efforts is essential to their daily survival and for other livelihood opportunities. It could be shown that indigenous knowledge can play a vital role in designing sustainable use of biodiversity and sustainable agricultural systems in which rural populations develop and maintain innovations and interventions through their experiences [10]. Some indigenous communities engage in small-scale agriculture as a source of income, which has been demonstrated by the two tribes. They may cultivate cash crops such as coffee, cacao, and bananas, which have market value. On the other hand, they may participate in local markets and engage in value-added activities such as processing and selling traditional food products or handicrafts made from agricultural materials. They primarily engage in cultivating small plots of land or working as laborers in farming or other low-paying occupations, earning minimal wages [23]. In most parts of their ecosystems in the past, as local farmers in their communities, they have been in perfect harmony with nature and have substantially contributed to conserving the richness of their agrobiodiversity. This unity includes growing diverse crops with livelihood and livestock using on-farm natural resources to enhance the fertility of soils and resist crop pests [24]. Regarding livelihood interventions, indigenous communities often have well-established practices prioritizing sustainability, cultural values, and community well-being [25].

Regarding additional farming crops and livelihood aspirations, the tribes requested technical training on proper banana propagation, proper abaca propagation, and proper fish culturing techniques and feed formulation using locally available raw materials. For traditional dressmaking, they need sewing machines and tools to finish bulk orders faster than stitching by hand. In order to pass this skillset through generations, they need to have a process of environmental interaction, and its continuity highly depends on its transmission and the ability of the young generation to acquire and practice it [26]. Furthermore, additional training such as on tailoring techniques and patternmaking is essential to enhance their competency and train young women in the tribe to develop their sewing artistry. Moreover, establish their cottage industry in their community and create a variety of accessories and high-quality beadwork, they also require a steady supply of input materials for bead making.

4.2. Crop Management and Utilization

The study showed that the two tribes have similarities in terms of plants that they utilized, especially rice and corn, and root crops such as cassava, sweet potato (camote), abaca and banana and inland fisheries. They are also using traditional methods of planting upland rice and corn and perform rituals for each production activity.

The two indigenous communities rely on the crops grown in their area for their food security and survival [27]. These crops provide essential nutrients and form the basis of their traditional diets. However, indigenous tribes have a vast knowledge of medicinal plants and herbs in their local environment. They utilize various crops for conventional medicinal purposes to treat common disorders and illnesses and maintain good health. During our validation, herbal remedies from plants in their community included guava leaves, lagundi, ginger, and turmeric.

On the other hand, crops play a significant role in the cultural and ritual practices of indigenous tribes. As they said, they are used in ceremonies, festivals, and significant life events. For instance, certain crops may be offered as part of ancestral rituals, weddings, or harvest celebrations, symbolizing attitude and respect for the land and nature [28]. Also, the two tribes showed that traditional crop varieties adapted well to local conditions over generations. They actively engage in seed-saving and exchange practices, preserving these crop varieties and ensuring their availability for future planting seasons. This helps maintain crop diversity and resilience in the face of changing environmental conditions [29]. During the site visit, the two tribes have shown their planted farms in Datu Salumay, Marilog District, and Paquibato District to be practicing sustainable farming techniques that promote soil health and biodiversity. They often employ traditional methods such as shifting cultivation, intercropping, and crop rotation. These techniques enhance soil fertility, reduce pest and disease pressures, and promote natural resource conservation [30].

4.3. Climate Change Adaptation Strategies

The importance of traditional practices for the development of adaptation strategies is high, as it is built from knowledge passed down through many generations [31]. The main examples of strategies that were mentioned during the study involved intercropping, alternation of more resilient crops according to the weather patterns, increased use of technical farming tools, and the diversification of income sources.

The two tribes recognize the importance of forests in regulating local climate patterns and mitigating the impacts of climate change and their restoration efforts help to preserve biodiversity and maintain ecosystem resilience [32]. Efforts to address climate change and support indigenous communities should consider their unique needs, rights, and aspirations [33].

4.4. Towards Sustainable Agriculture Practices

Considering that their traditional farming practices originally did not involve the use of chemical pesticides and insecticides, it is alarming that due to the increasing use thereof in surrounding areas, the tribes are pressured to abandon the use of organic substances. These substances are not only often biodegradable, less persistent, and less harmful to the environment and humans [34] but are also more readily available to the communities, which lessens the financial investment and dependence on external sources. The severity of the implications of commercial fertilizer use has become especially apparent during the recent price increase due to the COVID-19 pandemic and its restrictions on travel and shipping, as well as high fuel prices in the global market and the Russian–Ukrainian war [35].

5. Conclusions

In general, the traditional farming practices of the Matigsalog and Ata tribes are in balance with nature and provide long-term sustainability. Thereby, these practices offer an attractive alternative to the industrialized process of the over-exploitation of natural resources that is currently practiced in the lowlands of the Davao Region. A combination of both indigenous knowledge and scientific conservation practices is promising in providing more climate-resilient and low-emission management of future resources and enhanced food security for future generations. Lastly, this study has shown that ICCs provide a great source of knowledge on different aspects of farming practices, food utilization, and

food security. The inclusion of these communities and their TEK in regional planning and decision-making on farming practices could offer valuable assets in the adaptation of the agricultural sector to the changing climate of our future. Furthermore, future research demands encompass the comprehensive exploration of traditional farming practices, indigenous knowledge systems, and economic viability.

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