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Cultural Ecosystem Services of Rattan Garden: The Hidden Values

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Abstract
Ecosystem Services (ES) are services provided to local communities by natural resources. Cultural Ecosystem Services (CES) are the nonmaterial benefits that people obtain from ecosystems. ES, and particularly CES are often omitted from cost-benefit analyses associated with development plans in favour of a focus on maximizing economic benefits. Consequently, economic development can lead to the disappearance of cultural values such as local knowledge, and cultural identity. This research attempts to understand and analyze CES and benefits provided by rattan gardens for local communities in Tumbang Runen village in Indonesia. Information about CES was obtained through in-depth interviews with key informants, focus group discussions with farmers, and observations of daily activities of local people. This research revealed that residents of Tumbang Runen village attach strong cultural importance to their rattan gardens, including spiritual, heritage and local knowledge values. The spiritual aspects of CES include the use of some plant species in rituals and healing ceremonies. Local people consider rattan to be historically important, intimately linking people with their ancestors and their belief system. Rattan gardens and rattan cultivation also serve as cultural symbols, facilitating the maintenance of practices, beliefs, and knowledge across generations. The importance of rattan gardens to the local community should be communicated to policy makers and included in sustainable development strategies

Keywords: Cultural ecosystem services, rattan garden, local community, sustainable development

1. Introduction

This paper presents the cultural significance of cultivated rattan forests in Indonesia, examining how local communities value their rattan 'gardens' and the role of rattan cultivation in the preservation of local knowledge, wisdom and values. We consider how rattan gardens, and the management system used in rattan cultivation, contribute to cultural ecosystem services (CES) for local people. This paper focuses on CES with spiritual, heritage and traditional knowledge values. We discuss the relevance of CES in conservation initiatives and in the promotion of sustainable development.
Rattan is the name given to approximately 600 species of climbing palm found in tropical rainforests in many parts of the world. The stems (canes) of these plants are both strong and flexible, with diameters ranging between 2-10 mm. The canes can be bent and woven into products such as furniture, handicrafts and mats. The most popular rattan product is furniture. Additional rattan products include carpets, walking sticks, ropes, birdcages, matting, and basket Some communities utilize the fruits and leaves of rattan in traditional medicine (Dransfield, 2001; Meijaard, 2014; Renuka, 2001;). The resin from

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rattan fruits can also be used as a natural dye and as medicine (Dransfield, 2001).

In Indonesia, rattan is an important non-timber forest product and is harvested both from forests and from cultivated 'rattan gardens'. Rattan gardens include natural assemblages of rattan but with cultivated fruits and vegetables. Two species are cultivated: 'rotan sega' (*Calamus caesius*) and 'rotan init' (*Calamus trachycoleus*) (Bizard, 2013; Godoy, 1990; Matius, 2004; Belcher et al., 2004; Pambudi et al, 2004). The cultivation of rattan allows conservation of forest biodiversity including trees and shrubs. There are two methods by which rattan gardens are inherited among the children after parents pass away. First, a rattan garden may be divided equally among the children of a household. Each portion becomes fully owned by one sibling. Alternatively, the children may jointly manage the rattan garden belonging originally to a parent as a collective asset. The second option is preferred, because intact gardens managed as a collective are less likely to be sold or converted. This is because the approval of all members of the collective must be obtained prior to the sale of the land. This method also creates a bond among the heirs; they have something in common that links them to their parents. By managing the rattan garden collectively, they maintain their social bonds.

Rattan has been an important commercial product for the Tumbang Runen community since the1800s. During the 1980s the income generation from rattan was sufficient to cover all household expenses. In 2012 a fall in the price of rattan associated accompanying an export ban on rattan products was associated with conversion of many rattan gardens to oil palm plantations.

The Millennium Ecosystem Assessment (MA) defines ecosystem services as "the benefits people obtain from ecosystems". The MA also outlined four categories of ecosystem services: supporting, provisioning, regulating and cultural (MA, 2005). The MA further defines cultural ecosystem services (CES) as "nonmaterial benefits people obtain from ecosystems"; and considers such benefits to include "cultural diversity, spiritual and religious values, knowledge systems, educational value, inspiration, aesthetic values, social relation, sense of place, cultural heritage values, recreation and ecotourism" (MA, 2005, p.40). While this is a widely accepted definition of CES, it is considered a "coarse" definition (Chan et al., 2012, p. 745) because it does not characterise how other considerations in decision making (economic, livelihood, social interaction) could change the perceptions of non-material *benefits* (Chan et al., 2012; Lado, 2004). Emphasizing the psycho-social aspect of the connection between humans and nature, King (2012) redefined CES as "the way that humans use discourse to construct and communicate perceptions of nature (p. 358). Thus, CES derived from ecosystems includes intangible and subjective aspects such as memory and heritage value. CES are services that provide benefits with a contextual or relative value (Chan et al., 2012; Daniel et al., 2012; King 2012) which may depend on local cultures and social-economic backgrounds. For some communities, a forest may be a source of income, for others it could be a sacred place (Daniel et al., 2012; King 2012).

Policies related to natural resource management and development often neglect the importance of CES for local communities. While there is often a clear focus on maximizing economic benefits, the nonmaterial values of ecosystems for local people are often disregarded (Adekola and Mitchell 2011; Chan et al., 2012; Daw et al. 2011; de Groot et al. 2005; Hendee 2011). This oversight could lead to the disappearance of

cultural values such as local knowledge, sense of belonging and cultural identity that are all deeply embedded in the ecosystem. Unlike some other ecosystem services, CES, once lost, cannot be replaced by alternatives. For example, if a sacred place is destroyed, it cannot be replaced. In contrast, if a source of fresh water is destroyed, an alternative source of water can be found; and water can be brought in from elsewhere. In the latter example, it is the water, rather than the source, which is important. Infield and Morse-Jones (2014, p.5) characterize CES as "unique to their location and valued in ways that are specific to individuals, communities and cultures". The sense of belonging and sense of connectivity to a specific place cannot be substituted with another landscape (Brown and Neil 2011; Infield and Morse-Jones, 2014; Voora and Barg 2008). Communities often place a higher value on their CES when compared with provisioning services (e.g. food, fresh water, timber) (Brown and Neil 2011; MA, 2005; Voora and Barg 2008). Including CES in development plans is likely to enhance human wellbeing (Infield and Morse-Jones, 2014; Plieninger et al. 2015). An appreciation of CES can also support initiatives such as integrated conservation and payment for environmental services (PES) (Chan et al., 2012).

2. Methodology

2.1 Conceptual Framework

This research uses the CES concept developed by Infield, Morse-Jones and Anthem (2014) in a model known as Guidance for the Rapid Assessment of Cultural Ecosystem Services (GRACE). This model defines CES as "the environmental spaces (e.g. forests, deserts, seascapes, farmlands, gardens) and cultural practices (e.g. creating and expressing, producing and caring, playing and praying) that together give rise to the experience of valued material and non-material benefits" (Infield, Morse-Jones and Anthem, 2014, pg. 3). This interaction between environment, cultural practices and cultural ecosystem benefit is illustrated in the following diagram.

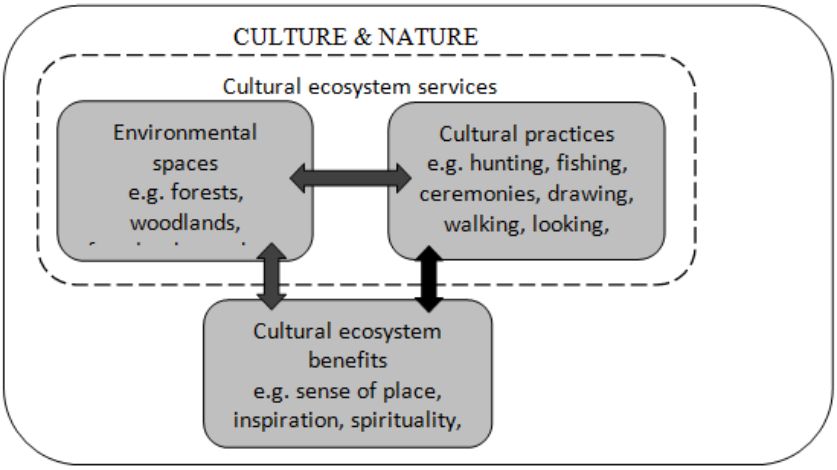

Figure 1. Cultural ecosystem services scheme (after Infield, Morse-Jones and Anthem, 2015)

2.2 Geography and Demography Overview

The Katingan river stretches approximately 650 km from the Muller-Schwaner mountains in the north of Kalimantan, Indonesia to the Java Sea in the south. Tumbang Runen village is located along the Katigan river, downstream of Katingan water catchment. The village covers an area of 11,400 ha of lowland with an average elevation above sea level less than 500 m. The area has a tropical humid climate with an annual average temperature of 31^0C and receives a monthly rainfall ranging from 27.72 mm to 378.77 mm (Statistics of Katingan Regency, 2015). Tumbang Runen is one of the oldest villages in the Katingan Regency. This village was officially established in 1884, under Dutch Colonial rule.

Figure 2. Map of study area

In 2016, at the time of the study, 349 adult people were living in Tumbang Runen: 182 males and 167 females. Typically, local people live in an extended family; grandparents live together in the same house with their children and grandchildren. Tumbang Runen comprises 92 households with an average of 3.8 adult people per household. Tumbang Runen village is relatively poor in terms of education and health facilities. The village has only one kindergarten and one elementary school; children have to go to *Baun Bango*, the capital city of Kamipang subdistrict, to continue their education to junior or senior high school level (Statistics of Katingan Regency, 2015).

2.3 Cultural Background

The general name for the major group of indigenous people who have inhabited the island of Borneo for more than 40,000 years is Dayak. Borneo is also occupied by

Javanese, Banjarese and Madurese people. Dayak means "people of the upstream" (Joshi, Wijaya, Sirait, & Mulyoutami, 2004) and the term was originally used by Europeans to distinguish the non-Malay inhabitants of Borneo island from Malay residents. The diversity among Dayak people is high, comprising more than 50 ethnics groups. Each ethnic group has its own culture, customs, territories, law and dialect (Baier, 2007). The high diversity of culture and dialects correlates with the diversity of ecological conditions, geography, and traditional knowledge (WWF, 2013). Geographical features, especially rivers, have shaped the cultures of most of the Dayak people, who typically identify themselves according to the name of their local river (Steckman, 2011).
The Ngaju Dayak ethnic group is the largest ethnic group in Central Kalimantan. This ethnic group inhabits large areas of the four main watersheds in Central Kalimantan: the Barito, the Kapuas, the Kahayan and the Mentaya watersheds. All communities classified in *Ngaju Dayak* speak the Ngaju language. In the local language, Dayak means *lewu te puna da'ak* or in English means "village with scarce people". Ngaju also means *ikey dumah bara ngaju dia bara ngawa*, or "we are coming from upstream, not from downstream." (Steckman, 2011),
Traditionally, the livelihoods of Dayak people have relied heavily on hunting and collecting forest products such as fruit, honey, latex, resin-scented wood and nuts. Some of these resources are still actively used by Dayak ethnic group. A long, interdependent relationship with nature, and a philosophy that holds nature with respect, means that many Dayak people have a detailed knowledge of the uses, functions and cultivation of plants. They know which plants are edible, which can be used as medicines, and which plants are harmful. They apply their knowledge to the simultaneous use and conservation of natural resources. Such knowledge It is arguably crucial to new approaches to sustainable management of natural resources too (Joshi et al., 2004).

2.4 Data Collection Method

We used a qualitative case study research design to examine the CES provided by cultivated rattan gardens in Tumbang Runen. Creswell (2007, pg. 73) defined case study research as "qualitative research in which the investigators explore a bounded system (a case) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving multiple sources of information (e.g. observations, interviews, audio-visual materials, and documents and reports), and report a case description and case-based themes". We used a case study approach to explore and understand the complexity and importance of cultural ecosystem services provided by rattan gardens in Tumbang Runen. Complexit was examined by capturing multiple perspectives from various respondents. The perceptions, thoughts, and feelings of local people with regard to rattan gardens were evaluated with in-depth interviews, focus group discussions (FGD), and personal observations. Gathering qualitative information from a natural setting was a key focus of this approach (Babbie, 2010).
In-depth interviews were designed to gather information about the function of rattan gardens in the spiritual and social lives of local people and to understand how local people view rattan gardens, and what kind of knowledge stems from the management of rattan gardens. FGD were undertaken to understand the historical importance of rattan gardens, land-use change due to depressed rattan prices, and alternative livelihoods (to

rattan cultivation). Observations of daily activities of local people included the collection of vegetables and medicinal plants from rattan gardens. Observations occasionally included active involvement in such activities, which facilitated additional context to the qualitative information provided.

In-depth interviews were conducted with 15 key informants (10 male and 5 female). Selection criteria for key informants included: those with extensive traditional and historic knowledge about rattan gardens, village history and cultural ceremonies and, rattan growers from families with two or three generations of rattan-growing experience in Tumbang Runen. Many of these key informants selected also had other occupations.

The first stage in selecting key informants involved consultations with the village leaders, who were well placed to recommend potential participants based on the selection criteria. Direct contact was then made with potential informants to gain consent from them with regard to their participation in the study. In-depth face to face interviews were conducted in the local language (*Dayak Ngaju*). Where permission was granted, some of the interviews were audio-recorded. Where key informants did not allow the interview to be recorded, detailed written notes were taken. Notes were taken in Bahasa Indonesia. Audio recordings were later translated into Bahasa Indonesian and then to English. Field notes were translated from Bahasa Indonesian to English.

We engaged three FGDs; two FGDs addressed the history and management of rattan gardens and one FGD addressed cultural aspects of rattan gardens. The latter involved five men and four women and included rattan farmers and village leaders, some of whom had also participated in the in-depth interviews. The FGD revealed additional information about CES (Babbie, 2010). In addition, observations of, and occasional participation in activities in rattan gardens facilitated contextual understanding and validation of the information obtained during interviews and FGD. For example, researchers directly observed the collection of vegetation from rattan gardens and the later use of these plants in traditional medicines or rituals.

Data were analyzed through inductive reasoning, moving "from the particular to general, from a set of specific information to the discovery of pattern of order among all the given event" (Babbie, 2010). Systematic classification and categorization of CES from rattan gardens followed the CES typology provided by Infield et al. (2014), with foci on spiritual, heritage and local knowledge values.

3. Results and Discussion

3.1 Rattan cultivation in Tumbang Ronen

Rattan gardens in Tumbang Runen are located along the river bank and all are located within 1km from the river's edge. This provides rattan plants with appropriate growing conditions and allows for transportation of raw harvested rattan by river. These areas are usually fertile due to annual floods that bring nutrient from the river, but are not so low-lying that they will be flooded for long periods.

3.2 Spiritual values of Rattan Gardenry

The spiritual value of rattan garden is defined as the contribution of rattan gardens to the mediation, maintenance and enhancement of the belief system or world

view of the local community in Tumbang Runen village (Infield et al., 2014; MA, 2005). Such spiritual value, as identified by local people, related mostly to rituals and traditional ceremonies. These spiritual practices are well maintained through rules and taboos in the customary laws or *adat*. In most parts of Kalimantan, the unwritten and informal documents of *adat* play an important role as a code of conduct that shapes behavior, social interactions and natural resource management.

The spiritual values that local people associated with rattan gardens related to their belief systems, which are strongly connected to the traditional religious practices and beliefs of the Dayak people. The traditional religion of the Dayak people is Kaharingan. This name has been used since 1945 to identify the traditional religion in Central Kalimantan. A fundamental belief of Kaharingan is that there exists a balance between humans, gods and nature. Kaharingan means "living" or "a source of life stemming from God" (Baier, 2007). Kaharingan is built on an understanding that human life is created and sustained only when people are living in harmony with the creator (*Ranying Hattala Langit*), the community and nature. The Dayak see themselves as a part of nature, and understand that what they do to nature will impact them. Their respect for nature is actualized in some rituals and ceremonies. For example, before they open an area of forest they will ask permission from *Raying Hattala Langit* and other spirits by giving an offering. Offerings also act as a symbols of replacement for what they take from nature (Baier, 2007).

Although the predominant religion of people currently living in Tumbang Runen is Islam, some villagers continue to practice rituals and traditional ceremonies that are derived from their ancient religion, Kaharingan. Some of the major rituals such as *Tiwah* (death ceremonies) and *Manyanggar* (village blessing and spiritual cleaning) are no longer performed but some minor rituals such as *palas bidan* (rituals of childbirth) and marriage and *balian* (a healing process) are still commonly practiced.

Rattan is used widely in almost every aspect of ritual ceremonies. For example, it is an essential component in Tiwah (traditional death ceremonies) where it is used as a tool to measure the length of the corpse and the dimensions of the tomb, to tie up the kangkurung (the coffin), to cover the sababulu (a jar containing holy water), and to bind sacrificial animals used in the ritual.

Spiritual aspects of CES attributed to rattan gardens also include the use of other plants which grow within the gardens. Such plants are used in ceremonies associated with important life events (births and weddings), crop cultivation (e.g. rice-growing) and healing process. Some species that are used in birth and wedding ceremonies include pilang *(Neolamarckia cadamba)*, Sawang bahandang and mamali. *Mamali* is a shrub that believed to have spiritual power to dissuade evil spirits from interfering in the life of a new baby or a new bride. This plant is also believed to mediate blessings from Ranying Hattala Langit (the creator). Usually mamali leaves are crushed and mixed with oil. This mixture is placed on the forehead of the baby. For wedding ceremonies and for blessing the bride, the *Damang* (customary leader) sprinkles mamali-infused oil on the bride.

Sari, 45 years old, household wife

"…. We are still practicing some of the traditional ceremonies that we have for centuries such as mamali and traditional wedding ceremony. However, we no longer conduct some important rituals such as tiwah and Manyanggar. These ceremonies contradict the principles of Islam. However, it is important to

perform traditional ceremonies for weddings, childbirth, building a new house, or to establish a rice crop in the forest. These ceremonies brings us peace of mind and a hope that what we do will bring us benefit."

The kajunjung, a large and strong tree, encouraged to grow in rattan gardens, is considered to bring blessings and fortune. For this reason, its timber is typically used as the main pillar in the construction of houses. Kanjunjung in Ngaju Dayak language means to be lifted up, or honoured. Use of kajunjung in the main pillar of the home is believed to improve the position of the household within the social structure of the community. In a society where vertical mobility is limited by blood and descent, legitimation from a supernatural force is expected. As the supernatural force cannot be directly observed, people symbolize its existence with metaphor. Hence, the kajunjung tree is not merely the main support for the house but it also represents the hopes, wishes, and good fortunes of the inhabitants.

Local people perceive other trees such as beringin (*Ficus benyamina*) as sacred places, where the gods and spirits of their ancestors reside. *Ficus* trees usually have a large and solid trunk, with branches that create a wide canopy. These physical characteristics promote the *Ficus* as a charismatic tree and a place where powerful spirits live. At significant times, for example when an epidemic disease has infected the village, people place offerings under the *Ficus benyamina* trees. From the perspective of local people, diseases can come from supernatural beings such as spirits. By giving offerings, they hope that evil spirits can be appeased such that disease is removed. Rattan farmers maintain these trees because of their important spiritual role. Local villagers believe that if someone cuts down a *Ficus* tree, the spirits that live there will become angry and bring bad luck to the village.

Arnus, 75 years old, Fishermen

"No one dares cut the beringin trees. Cutting them can bring you a curse. If you cut the tree you will be haunted by the spirit that lives in the tree, and you will become very sick. We believe that the beringin tree is the place where the spirit lives. The spirits love living in that tree because the tree is big, with a very thick canopy. We keep the beringin tree in our rattan garden no matter what. Sometimes we put offering under the tree such as lemang (cake from glutinous rice), eggs and rice. By giving the offering we hope the spirits living in the tree are happy and do not disturb our lives."

Offerings made to spirits are an example of the way in which local muslim people in Tumbang Runen maintain traditional practices based on their traditional (Kaharingan) belief system. Islam is practiced alongside the Kaharingan philosophy. Local people explained that Islam guides their relationship with God (Allah) and that, if they behave well, according to the syariat of Islam, they will secure a place in heaven. In daily social interactions among community members, and between people and with nature, however, some of the Kaharingan principles are often followed. Scharer (1963) found that in Dayak communities understandings of Islam religion the new religion is filtered through the lens of Kaharingan culture and perception.

Interviews with a customary Kaharingan leader in Baun Bango revealed that under Kaharingan principles, people do not differentiate between spiritual and physical materials; the secular aspect of life is as essential as the spiritual or religious aspect. One implication of this way of thinking is a belief that disturbances in the physical world are related to disturbances in the spiritual world. A Kaharingan worldview holds that spirits

reside in trees, rocks, and rivers. This belief influences people's interactions with nature. For example when a community disturbs a natural forest in order to establish a managed rattan garden, they seek permission and make an offering to encourage spirits inhabiting the area to move willingly to another place without interfering in the process.
The people of Tumbang Runen do not exploit natural resources for economic purposes without considering the effect of their actions on nature. They respect all life forms. Creating and maintaining harmonious relationships with nature is therefore key to their management of rattan garden and to their utilization of natural resources in general.

3.3 Heritage Value

Interviews with key informants revealed that they ascribed heritage and cultural identity value to rattan gardens. Local people consider rattan as historically important, intimately linking them with their ancestors and their belief system. Rattan gardens also serve as cultural symbols, where practices, beliefs, and knowledge are maintained through generations.
(Rano, 56 years old, rattan farmer,)
" …I obtained my rattan garden from my parents. Before giving the rattan garden to us, our parents warned us not to sell the rattan garden, instead manage it together. Anyone of us can harvest the rattan and sell it, or cut the tree or pick the fruit. We can do anything but sell it. So until today, even though rattan has no price anymore but we still keep the rattan garden. Even though it will become unmanaged jungle, we will never sell our rattan garden."
Rattan gardens also have heritage values linked to their economic and historical importance. Some respondents stated that they will never sell their rattan garden because it connects them to their parents or grandparents. Some trees evoke memories from the past, certain feelings and thoughts, images and experiences. Rattan gardens represent the journeys that their ancestors have made, creating a time portal for memories and event. The following citations give examples of the heritage value of rattan gardens.
Sumiarto, teacher, 45-years old
If you asked me if I would sell or alter my rattan garden for other purposes, my answer is always no. I will never sell my rattan garden because it is a legacy from my parent. It is part of my parent that is still with us today. Besides that, I have so many memories that reside in the rattan garden. I remember my grandparents planting that big asam tree at the corner of garden and we can still harvest the fruit today. Before my father died, he has a strong message for us to not sell the rattan garden. And until today I respect his message. I am afraid if I sell it I will get cursed. Instead of selling it, my parents wanted us to manage it collectively. By doing so my parents wished that we can help each other and prevent the rattan garden from being sold.
The rattan garden is considered to be a living shrine of memories, a legacy from previous generations. Many trees in rattan garden are planted by a villager's parents or grandparents. The rattan garden, comprising the rattan and its associated biodiversity, create a connection to previous generations. The existence of rattan gardens helps maintain memories from the past.
Ahmad, 40 years old, teacher
"I remember the big mango tree at the corner of my rattan garden was planted by my grandparents. The rattan garden reminds me of the past, when we worked together to open the forest, planting paddy and rattan. Each morning we worked in the rattan garden, cutting and dragging the old rattan and clearing

the vegetation around the rattan cluster. Around noon we would stop work and eat lunch prepared by our mother."

3.4 Traditional Knowledge

Traditional knowledge held by the Tumbang runen villagers is based on a long and intimate relationship with nature. In turn, traditional knowledge can contribute to social-ecological resilience and natural resource management and preservation of biodiversity (Agarwal 2001; Colding et al. 2003, Mishra et al. 2003, Berkes 2007, Grant and Berkes 2007, Rai 2007, Infield et al. 2014).

Rattan cultivation is an important source of traditional knowledge. Rattan gardens represent a way of living for people in Tumbang Runen, and requires knowledge regarding the use and conservation of natural resources. Cultural beliefs, skills, wisdom and knowledge are passed down from older generations. Uses such as medicine, food, and fuel are developed through ancestral linkages.

Interviews and observations revealed extensive traditional knowledge of ethnobotany and forest ecology. Traditional ecological knowledge facilitates prediction of favourable growing seasons, identification of suitable areas for cultivation, and prevention of forest fires. Ethnobotanical knowledge includes the understanding of the particular uses associated with certain plant species. Such uses may include materials for construction of buildings and boats and tools; sources of food, medicines, cosmetics, fuel and animal fodder and materials used in cooking, in traditional ceremonies and for handicrafts.

Traditional knowledge is more than just cognitive acquisition. Knowledge received from previous generations or older contemporaries is applied to manage and develop rattan gardens in particular and to conserve the natural environment more generally. Practical knowledge learned is developed through active engagement with the surroundings and applied directly in the management of rattan gardens.

The transmission of traditional knowledge in Tumbang Runen occurs between parents and children or from older to younger siblings. Children typically help theirs parents to collect rattan seed, harvest rattan, or clear up unwanted trees around rattan clusters. Knowledge is transferred by oral communication, observation and/or imitation. In Tumbang Runen, children begin helping their parents in rattan gardens from around 10 years of age. Younger children play in the forest and sometimes collect edible fruits while their parents work. Importantly, parents educate their children to distinguish poisonous from edible plants.

Martinus, 74 years old, rattan farmer

"I obtained my knowledge about rattan cultivation techniques and knowledge about soil, forest, vegetation, and season from my parents. I learnt this knowledge by going to the forest, helping my parent harvest or maintain rattan gardens. I remember the times when I would go with my father to the rattan garden, collecting fruits, vegetables or medicinal plants.

What I remember the most is when my father taught me how to predict the wet season by observing particular mushrooms, roots or flowers. When the yellow mushroom emerges from the soil it means the rainy season will soon come. Also if the flower of Muhur blooms, it also means that the rain season will come."

4. Conclusion

The local community of Tumbang Runen, particularly rattan growers, consider rattan gardens to be an important part of their culture and social system. Rattan gardens provide products for subsistence, but are also symbols of identify for local people, representing their belief systems and their way of life. Rattan gardens in Tumbang Runen inform and utilise villager's ethnobotanical knowledge and natural resource management strategies.

The cultural value of traditional garden systems, such as the cultivation of rattan, is often overlooked in modern development strategies, where the main goal is economic revenue. In Indonesia, where the ecological impact of forest development has been characterised by the development of large scale, monoculture oil palm plantations, with little to no ecological or cultural value, the role of traditional land-use systems in the cultural, economic and spiritual lives of local people is increasingly important. Herrmann (2006) found that the *pewen tree (Araucaria araucana)* in the Chilean Andes similarly play an important role the in economic and spiritual life of Mapuche Pewenche people. Similar to our findings, Gooner (2007) suggested that traditional land use practice among Benuag Dayak people presents a model for balancing sustainable livelihood with ecosystem function.

The CES provided to local people by their rattan gardens encourages conservation of local forests, maintaining other ecosystem services such as regulating services and provisioning services. However, compared with oil palm, rattan gardens have much lower economic utility. A recent restriction on raw rattan export by the Indonesian government has caused a large decrease in the price of rattan. Income from selling rattan is currently insufficient to meet the basic needs of villagers. Alternative sources of income are replacing rattan growing, including fishing, collection of other, non-timber forest products, raising cattle, artisanal mining and working at oil palm plantations. Yet the cultural value of rattan gardens including strong ancestral and spiritual connections encourages their conservation by local villagers.

Further loss of rattan gardens could trigger loss of CES including local ecological knowledge and heritage value. Traditional ecological knowledge is an important driver of natural resource conservation including the maintenance of biodiversity (Tang, 2013). Market mechanisms can accelerate change by introducing new commodities (e.g. oil palm) requiring more intensive cultivation resulting in the further loss of ecosystem services (Flora, 2014; Godoy et al. 1998; Reyes-Garcia 2007). For example, the policy of Indonesian government to develop extensive monoculture plantations such as oil palm, rubber and *Acacia* has a large impact on the cultural services important to the Dayak people (Joshi et al., 2004; Caniago and Siebert, 1998). A balance is required between economic development, and the maintenance of ecosystem services including cultural ecosystem services.

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