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Agricultural landscape management in the tradition of Osing tribe in Banyuwangi, East Java, Indonesia

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Abstract

In managing agriculture, Osing tribe has unique patterns when it deals with spatial structuring environment as an adaptation strategy to survive. The uniqueness shows in their culture when they manage and make use of the natural resources and its environment. The research aims to examine the method in managing agricultural landscapes in Osing tribe. The research used qualitative and quantitave methods. The qualitative method used emic approach and the quantitative method used calculation of density value and species distribution to obtain the Importance Value Index (IVI). The result of the study showed that in their agricultural system known as four landscape units (yard, paddy field, garden, and field) and used different ways of management. The study of plant community structure in each landscape unit of three villages reflected the existing dominant species and every landscape unit had different structure, composition and vertical stratification. The calculation result of economic valuation of agricultural landscape resources used direct use values and market values towards seven plant species i.e. paddy *(Oryza sativa)*, coconut (*Cocos nucifera)*, banana (*Musa* sp.), durian (*Durio zibethinus*), mangosteen (*Garcinia mangostana*), bitter bean (*Parkia speciosa*), and avocado (*Persea americana*) is IDR 36,850,000/head of household/year or IDR 3,070,833/head of household/year. The amount had contribution towards the fulfillment of subsistence needs of Osing tribe.

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Introduction

The existence of ethnoecology study appears as a result of new paradigm perspective of ecology that is sustainability. The basic understanding of ethnoecology study is the accumulation among natural characteristic, culture and production aspect which are integral and inseparable. Thus, the direction of ethnoecology study tends to be the management process and utilization of biological natural resources with its environment, and here are the causes from local community activities which based on ecotechnology for sustainable living (Prasetyo, 2019).

Osing community has relatively much knowledge towards landscape units such as forest, garden, paddy field, field, yard, river, cemetery, mountain, kampong, and village (Prasetyo, 2019). The knowledge of other etnic societies nearby the forest is different from the ethnic group lives in dryland that depends on climate especially rainfall. The whole landscape unit known and managed by Osing community is multi-function ecosystem full of biolcultural diversity and a rural ecosystem that is an important platform for integrating biological and cultural diversity for human well-being (Alam and Furukawa, 2010, Agnoletti and Rotherham, 2015). Referring to the meaning of ecosystems as multi-functional, it is hoped that the ecological study of rural landscapes can be used as a reference base in understanding in detail the aspects related to the richness of living natural resources in it (Raynor and Kostka, 2003).

The existence of Osing tribe in Banyuwangi district cannot be separated from the history of Blambangan kingdom which is famous for its rice barn and soil fertility. Naturally, Osing community becomes qualified farmer in cultivating paddy (Prasetyo *et al*., 2018). Osing community lives in rapid growth of science and technology nowadays (Prasetyo, 2019). In ethnobiology context, the existence of Osing community has an interest to study due to its unique patterns of environment management in relation to it environment management as an adaptive strategy for survival of its life. The uniqueness shows in its culture when managing and utilizing biodiversity resources and environment. The research aims to describe the traditional knowledge of Osing tribe in managing landscape units produced in farming activities and to measure economic value of biodiversity resources grown in farming landscape units.

Material and method

Field Research

The research was conducted in Kemiren village, Taman Suruh village Glagah subdistrict, and Jambe Sari village, Giri subdistrict, Banyuwangi district (Fig. 1).

Topographically, the village of Kemiren is located on flat land, alluvial soil, black soil texture, dusty soil, located at an altitude of 187 meters above sea level, precisely at coordinates 5° 12' 2"S and 114° 19' 21" E. Kemiren Village has an area of 117.05 hectares, administratively consisting of 7 Rukun Warga, 28 Rukun Tetangga, this village also has two hamlets, namely Krajan Hamlet and Kedaleman Hamlet, and a total population of 2571 people.

Topographically, the village of Taman Suruh is located on flat land, alluvial soil, black soil texture, dusty soil, located at an altitude of 276 meters above sea level, precisely at coordinates 8° 11' 26" S and 114° 18' 3" E. Taman Suruh Village has an area of 512.17 hectares, administratively consisting of 11 Rukun Warga, 41 Rukun Tetangga, this village also has four hamlets namely Andong, Gadong, Krajan, and Manduluko, and a total population of 4047 people.

Topographically, the village of Jambe Sari is located on flat land, alluvial soil, grayish soil texture containing clay and dust, located at an altitude of 197 meters above sea level to be precise at the coordinates 8° 11' 49" S and 114° 19' 9" E. Jambe Sari Village has an area of 889 hectares, administratively consisting of 11 Rukun Warga, 38 Rukun Tetangga, this village also has five hamlets namely Delik I, Delik II, Jambran, Langring, and Mangu, and a total population of 3440 people.

Data Sampling

The research used qualitative (emic) and quantitative (ethic) methods (Rosa and Orey, 2012). Ethnobotany data was collected through unstructured interviews

with key informants and respondents (Silva and Andrade, 2006). Overall, of the three villages studied, there were 10 key informants and 396 respondents.

Data Analysis

Vegetation analysis in each landscape unit of Osing tribe was conducted by direct measuring in every area of landscape unit which became the research plot referred to the data of tax object in Land and Building Tax Payable-Tax Returns (SPPT-PBB) of 2015. The parameter measured included density and frequency to obtain Important Value Index (IVI) (Cox, 2002).

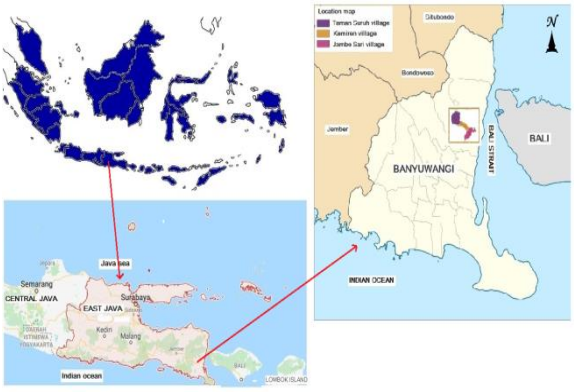

Fig. 1. Research location map in Banyuwangi district.

Result and discussion

Local knowledge and landscape management

The result of the research proved that Osing tribe in Kemiren village, Taman Suruh village, and Jambe Sari village in Banyuwangi district is a traditional community that has personality of maintaining the culture and traditional ritual of its ancestors. Most of the community life is based on farming activity. Its environment interaction is farming by making use of variety landscape units namely yard (*pelataran*) and residential, paddy field (*sabin*), garden (*kebonan*), and field (*tegalan*) (Prasetyo *et al.,* 2018). Each landscape unit shapes one type of ecosystem which has unique characteristics from the side of 1) vegetation cover, 2) designation 3) covering land, and 4) technology management.

The followings are overviews from each landscape unit including unique characteristics from the side of vegetation cover, designation, covering land, and management technology.

A. Yard (pelataran) and residential

Yard as a landscape unit is physically an area around the house and planted with various kinds of plants included survived wild plants. The planted plants have benefit values as vegetable, medicine, foodstuff, or other needs (Siriwattananon *et al*., 2010). Thus, sistemically a yard is an ecosystem and human and animal are parts of the unseparated integral part of the system (McConnell and Dharmapala, 1973, Soemarwoto, 1975, Pushpakumara, 2000, Iskandar and Iskandar, 2016).

In general, the characteristic of yard belongs to Osing tribe in three research locations is a dryland about 100 to 200 m², a building is on the area and also planted with various kinds of wild plants and animals are kept as pets (Alam and Furukawa, 2010). The dryland mentioned is an area which has not watered regularly like in paddy field. The watering of the plants in yard comes from rainfall or the house owner waters the plants (Prasetyo, 2019).

The pattern of yard area management in three research locations is not much different with the yard area of other tribes in Indonesia, there is a clear boundary in land ownership using living plants such as shrubs (*Acalypha sinensis*), hanjuang (*Pleomele fragrans*) as guardrail or big tree as the boundary and permanent building such as fence. Yard area of Osing tribe consists of front part of the house and called yard, while the right or left side of the house built for garbage dump or place to accomodate standing water and called *ledoan* (Prasetyo, 2019).

Several important elements become unique characteristic of an ecosystem in yard landscape, among others:

Vegetation cover

The relation between humans and yard landscape is closely related to the location around them and it makes the vegetation cover become very distinctive, its characteristic has function to fulfill various kinds of needs for humans to survive. In general, the yard in villages function as an area to cultivate various kinds of plants suitable to the interest and needs of the

owners, they also cultivate kinds of plants for daily needs such as foodstuff, herbal, vegetables, fruits, herbs, additional food, construction material, and firewood. Sometimes, the yard is cultivated with kinds of plants that is for human's favourite such as ornamental plants. The dominant vegetation cover of yard area in three villages is varied, for example in Kemiren and Taman Suruh villages are dominated by fruits, ornamental plants, and vegetables while in Jambe Sarei village is dominated by fruits, ornamental plants, and foodstuff plants. Thus, overall the vegetation cover of yard are is dominated by fruits, ornamental plants, vegetables, and plants that are foodstuffs (Iskandar and Iskandar, 2016).

Designation

Four landscape units as results of Osing tribe's interaction in three research villages have various area namely dry and wet land also combination of dry and wet land. Even in four landscape units are in different land contour as in yard, paddy field, and field are in flat and plain contour while garden tends to be in sloping land with the slope is about 15^{o} to 30^{o}. The condition of area and land contour in each landscape unit has influenced the various kinds of plants that cultivated despite the temperature, rainfall, light, and humidity.

As the condition of yard is a dry land and it exists in flat and plain land and the yard is also designated to cultivate perrenial plants such as fruit plants (manggo, rambutan, water apple, star fruit, guava, and soursop) and annual plants such as vegetables (spinach, eggplant, tommato, and long bean) and papaya. Often the owner's yard is planted with cultivate annual and perennial plants (Alam and Furukawa, 2010, Siriwattananon *et al.*, 2010).

Covering land

The understanding of Osing tribe in three research villages share towards the covering land in four landscape units that become their life supports show differencesYard is a dry land with an area ranging from 20 to 85 m^2, with a house building on it and located in flat contour. In general, the covering land of yards in three research location is not large due to the location which is on at the foot of Ijen mountains and makes it difficult to have flat land contour with extreme altitude. Other consideration is due to farming is the Osing tribe's skill and they prefer covering land of paddy field than yard.

Management technology

Cultivating land on yard area tends to be intensive (Alam and Furukawa, 2010) if it is compared with field and garden. It can be understood since the location of a yard integrated with the house of the owner and it makes the maintenance becomes more frequent. The maintenance of the yard is to prevent big puddle and the owner makes ditches (*kalenan*). For yard area which has slopy contour the owner makes a berm (*sengketan*) to avoid land erosion. Osing tribe in three research villages maintain their yard areas in order to kept them fertile by giving manure, compost, sometimes chemical fertilizer, ash, or organic waste. Meanwhile the water needs for the yard is obtained by watering the plants when the soil is dry or depending on rainfall. The management of system ability is in accordance with Dale *et al.* (2000) that to carry out the use and land management suitable with the regional natural potential and it requires the land owner to have understanding in location potential.

B. Paddy field (sabin)

In general, a paddy field in three research villages are wet land which located in permanent area and irrigated on schedule and regularly as a result the paddy grows well (Iskandar and Iskandar, 2016, Lestari *et al.*, 2019). In several cases, some paddy fields are managed intercropping system due to their location on high places. In such condition wet paddy field turns to be dry area and the kinds of planted plants are switched to be crops such as corn, soybean, peanut, cucumber, eggplant, and long bean (Iskandar and Iskandar, 2016, Prasetyo, 2019).

In social life of Osing tribe the ownership of paddy field takes contribution to their children's arranged marriage. As an example, the Osing tribe in Kemiren village is known as dilligent, resilient, and

workmanlike farmer and as a result it is comon that the understanding of the community towards the landscape unit place an honorable and special position in their lives. Even the status of the ownership of paddy field area of one person may influence the feasibility of the arranged marriage of their children (Prasetyo, 2019).

Several important elements become unique characteristic of an ecosystem in yard landscape, among others:

Vegetation cover

The characteristic of the plants in paddy fields in the research villages is paddy (*Oryza sativa*) with various cultivars such as IR64, etc. but there are coconut plant and several banana families planted by Osing tribe on paddy field embankment.

Designation

Paddy fields which tend to be wet land often planted with short-lived paddy sometimes the tribe also plant coconut or several banana families planted by Osing tribe on paddy field embankment. In dry season several paddy fields which are located far from water sources often planted by crops (annual plants) such as corn, soybean, peanut, eggplant, long bean, cassava, and sweet potato.

Covering land

Paddy is a piece of wet land with the width of 100 m^2 to 2 hectares and generally located on flat and plain land contour, the texture is loose, easily cultivated, have water supply from well managed irrigation system. As well as other lands like yard, garden, field, paddy field has ownership boundary in the form of live plants such as huge tree (durian, tamarind, or coconut trees) as hallmark or stakes from concrete.

Management technology

The paddy field which is cultivated continuously with paddy (*Oryza sativa*) makes difference with paddy field cultivated with crops as variation. The followings are the process in paddy field starting from initial step planting seeds to harvesting, first step is spread the seeds (*nyebar winih*), watering (*ngelep*), land cultivating (*macul*), plowing (*menyingkal*), harrowing (*menteter*), watering (*ngelep*), uprooting the seeds (*matun*), planting the seeds (*tandur*), fertilizing (*ngrabuk*), harvesting yellowing paddy (*manen pari*) (Yanti *et al*., 2019). The process of planting crops in paddy field starts with plowing (*menyingkal)*, levelling (*menteter*), planting seeds (tandur), few days after fertilizing with manure and chemical fertilizer, watering (*ngelep*) and the last is harvesting. After harvesting the paddy, the maintenance of the field in order to keep it fertile is by plowing using hoe thenit is fertilized it with manure and a small amount of chemical fertilizer and then left it for few days (*didayung/dilerem*) and finally plowed it again. With the sequence of the activities, the tribe hope that the paddy field that to be replanted will produce good and fertile paddy.

C. Garden (kebonan)

It is predicted that the garden formation owned by Osing tribe in early times came from the opening of wilderness which meant to avoid erosion or landslide in paddy fields. n general, the existence of garden in sloping land contour with the slope about 15^0 to 30^0 is in certain depth directly bordering with river flow and positioned to support the paddy field above it. The land character for garden is usually a dry land (Lestari *et al*., 2019) and settled in nature, water supply of the garden is from rainfall and water management is not intensive (Prasetyo, 2019). In general, the criteria for land used for gardening are dry land with a supply of water from the falling rain (Iskandar and Iskandar, 2016).

Several important elements become unique characteristic of an ecosystem in yard landscape, among others:

Vegetation cover

The plants species that dominated garden vegetation cover in three research villages are slightly varied as in Taman suruh village and Jambe Sari village are dominated by fruits, plants for construction and firewood while in Kemiren village is dominated by fruits, plants for construction and plants for traditional rituals.

Thus, in general the vegetation cover of garden is dominated by fruits, plants for construction, plants for traditional rituals, and firewood. In general, the types of plants that grow in the garden are used by the owner for firewood, yard fences, light or heavy construction, customary needs, the manufacture of household utensils, and the fruit is eaten, sold, and for vegetable processing (Perera and Rajapakse, 1991, Siriwattananon *et al.*, 2010).

Designation

Garden which considered as dry land and situated in sloping land contour is designated for perrenial plants such as durian (*Durio zibethinus*), areca palm (*Arecha catechu*), mangosteen (*Garcinia mangostana*), bitter bean (*Parkia speciosa*), fruit lute (*Sandoricum koetjape*), coconut (*Cocos nucifera*), bamboo (*Bambusa* sp.), etc. Sometimes, it can be found other annual plants like banana with its varied local cultivars such as gedang sobo, gedang kayu, gedang emas, gedang ketip, gedang lempeneng, and gedang berlin.

Covering land

The garden for the Osing tribe in the three research villages is a plot of dry land with a land area of around 500 m² to 1.5 ha, elongated in shape, most of which have land contours with a slope of 15° to 30°, and at the end of the lower or bottom garden land directly adjacent to a river or ditch while at the top it is directly adjacent to rice fields. So it can be said that the existence of garden land functions more as a buffer for the rice field landscape unit so that soil erosion or landslides do not occur.

Management technology

Garden is cultivated not intensively compared with field and yard. It can be understood since its location is relatively far from residential and mostly grown by annual tree with the thick canopy and makes the annual plants difficult in adapting well. In addition, the land contour with sloping becomes a problem for the owner to cultivate it. The maintenance of various kinds of plants in garden is conducted by Osing tribe by mowing or trimming the thick leaves and sometimes cutting the dead branches. To maintain the garden fertile is by piling dry leaves from several annual trees in order to get nutrition supply and sometimes weeding several weeds or plowing the land using hoe.

D. Field (tegalan)

The field is not quite long used by Osing tribe, it has been used for last 12 years, it is a dry land (Lestari *et al.*, 2019) which is temporary and from drying the paddy field nearby residential and designated for residence or other buildings. Water supply for plants in field mostly depends on rainfall and it makes the growth of the plants is not optimum (Prasetyo, 2019). This is also supported by the opinion of Iskandar and Skandar (2016) that the water demand for plants in the field is very much dependent on the amount of rain that falls.

Several important elements become unique characteristic of an ecosystem in yard landscape, among others:

Vegetation cover

Vegetation cover of field in Kemiren village is dominated by fruits, vegetables, and plants for traditional rituals. As for field in Taman Suruh and Jambe Sari villages are dominated by fruits, foodstuff, and vegetables. Thus, in general the fields in three research villages are dominated by fruits, foodstuff, vegetables, and plants for traditional rituals.

Designation

In general the field areas in three research villages are designated for temporary and mostly cultivated with annual plants such as crops, cassava, papaya, and perrenial plants (Iskandar and Iskandar, 2016).

Covering land

Osing tribe in three research villages define field as a piece of dry land with its width about 100 to 200 m² and a building on top of it. The field existence is designated for a house building or store but for sometime the owner could not afford to build it then the dry land is cultivated with several annual plants such as crops and fruits. As happened in garden areas, water supply in fields also comes from only rainfall.

Management technology

Field cultivation by Osing tribe in three research villages is almost similar to garden that is not routine compared to yard or paddy field cultivation. The maintenance of various kinds of plants in field is conducted by weeding or trimming the thick leaves and sometimes by cutting the dead branches. While land cultivating in garden aims to make it fertile and get nutrition supply is by piling the falling dry leaves from annual trees, weeding weeds or plowing with hoe and fertilizing with manure and chemical fertilizer.

Plant community structure in each landscape unit

The integration of residential and cultivated plants in each landscape unit has complexity in functions such as social economy, culture, and ecology (Garrity, 2004, Jumari *et al*., 2012). Social economy and culture functions are showed by the planted species and its benefit meaning while ecology function is implemented in measurement result of plant community structure in each landscape unit (Prasetyo, 2019).

The following is the calculation result of Importance Value Index from yard, paddy field, garden, and field landscape units.

Table 1. Plant species which have high IVI in yard landscape.

Local name	Scientific name	Average IVI value		
		K	TS	JS
Gedang lempeneng	*M. paradisiaca* triploid AAB	6.59	5.52	5.33
Gedang ketip	*Musa acuminata*	5.64	4.31	4.94
Rambutan	*Nephelium lappaceum*	5.26	5.12	6.06
Jambu air	*Syzygium aqueum*	5.07	4.17	4.75
Pelem	*Mangifera indica*	4.89	3.68	5.33
Kembyang pacar	*Impatiens platypetala*	4.88	3.68	3.63
Kembyang sore	*Mirabilis jalapa*	4.90	3.09	4.56
Kates	*Carica papaya*	3.94	2.91	4.75
Katuk	*Aalius androgyna*	4.50	3.77	2.73

Information: IVI: the Importance Value Index, K: Kemiren village, TS: Taman Suruh village, JS: Jambe Sari village.

Reffering to the ecosystem concept, the description of plant community structure in each landscape unit more reflects the existence and abundance of the species composition. Table 1 describes gedang lempeneng is the most important cultivated fruit and mostly cultivated by Osing community and it also happens to gedang ketip. Data from Table 1 and Fig. 2 show that gedang lempeneng in yard landscape becomes the most important cultivated fruit in three villages. In this yard landscape, the utilization and cultivation system of gedang lempeneng and gedang ketip is not different with the system in small to medium yard area.

In yard area the existence of rambutan (*Nephelium lappaceum*), mango (*Mangifera indica*), and water apple (*Syzygium aqueum*) are in seven large that have dominant value, the fruit species are cultivated purposefully in order to get economic value and also to fulfill fruit dailly needs of each family. This condition is in accordance with the opinion of Rukmana (2008), that yards in rural areas, apart from being a source of additional income for villagers, are also the main pillar of the household economy. The system for cultivating fruit trees in the yard has an important contribution in increasing farmers' income, improving nutrition for villagers, and growing local (household) industries. The three kinds of fruit are easily found in large yards with relatively big individual (Table 1). The condition is in accordance with Zakiyah *et al.* (2013) said that rambutan and mango are the dominant plant species which are in yard of Kemiren and Taman Suruh villages, followed by water apple and guava which are relatively little.

Kembyang pacar (*Impatiens platypetala*), kembyang sore (*Mirabilis jalapa*), papaya (*Carica papaya*), and katuk (*Sauropus androgynus*) are the species that have uneven distribution in yard with relatively small number of individuals. However, the existence of two flower species makes the yard owner care about aesthetic in cultivating plants.

Table 2 and Fig. 3 give an illustration that paddy field landscape with its paddy is the centre of staple food for Osing tribe in three villages. IVI of paddy (*Oryza sativa*) is very high compared to other species.

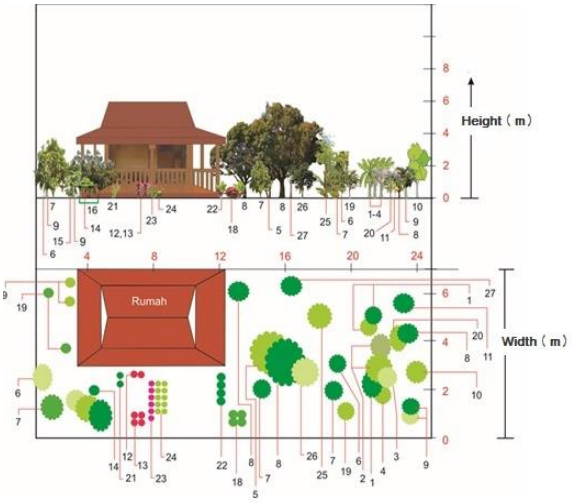

Fig. 2. Vertical and horizontal profile diagram of large yard vegetation (27.6 to 57.2) m² from one of the representative research plot example. 1. *Musa x paradisiaca* triploid AAB, 2. *Musa acuminata* diploid AA, 3. *Musa x paradisiaca* triploid ABB, 4. *Musa acuminata,* 5. *Nephelium lappaceum,* 6. *Psidium guajava,* 7. *Syzygium aqueum,* 8. *Mangifera indica,* 9. *Carica papaya,* 10. *Averrhoa bilimbi,* 11. *Averrhoa carambola,* 12. *Cordyline terminalis,* 13. *Pleomele fragrans*, 14. *Moringa oleifera,* 15. *Annona muricata,* 16. *Synedrella nodiflora,* 17. *Ageratum houstonianum,* 18. *Caladium hortulanum,* 19. *Citrus aurantifolia,* 20. *Spondias cytherea,* 21. *Ocimum basilicum,* 22. *Ixora coccinea,* 23. *Impatiens platypetala,* 24. *Mirabillis jalapa,* 25. *Parkia speciosa,* 26. *Cananga odorata*, 27. *Pterocarpus indicus*. Scale 1:10.000.

It means that the abundance and species distributiion of paddy are very high and even in three villages. The condition gives us information that farmers much depend on their agricultural product, they are expert and understand ins and outs of farming technique which prioritize unused natural products to be part of fertilizing paddy field although they also use chemical fertilizer.

It is well known in Banyuwangi that farmers from Kemiren village are famous for their skills in farming and cultivating and as a result their skills are often used by neighbours around the village to work on their paddy fields.

Table 2. Plant species which have high IVI in paddy field landscape.

Local name	Scientific name	Average IVI value		
		K	TS	JS
Pari	*Oryza sativa*	108.90	108.28	109.03
Gundo	*Cleome rutidosperma*	9.10	8.34	9.09
Kerambil	*Cocos nucifera*	9.10	8.34	9.09
Gedang sobo	*M. paradisiaca* triploid BBB	9.09	8.33	9.09
Gedang ketip	*Musa acuminata*	9.09	6.95	6.06
Suket teki	*Cyperus rotundus*	7.58	8.33	6.06
Gedang lempeneng	*M. paradisiaca* triploid AAB	4.55	8.33	9.09

Information: IVI: the Importance Value Index, K: Kemiren village, TS: Taman Suruh village, JS: Jambe Sari village.

Gundo (*Cleome rutidosperma*), coconut (*Cocos nucifera*), gedang sobo (*Musa x paradisiaca* triploid BBB), gedang ketip (*Musa acuminata*), suket teki (*Cyperus rotundus*), and gedang lempeneng (*Musa x paradisiaca* triploid AAB) are the plant group that have low IVI compared to IVI of paddy (Table 2). Gundo and suket teki are in the group plant called gulma but both have benefits for humans. In general, gundo is used by Osing community to make vegetable cuisine while suket teki which grows wildly on paddy field embankment is to support the embankment for footpath. Coconut, gedang sobo, gedang ketip, and gedang lempeneng are deliberately cultivated by the paddy field owner to fulfill the subsistence needs and optimize the paddy field use.

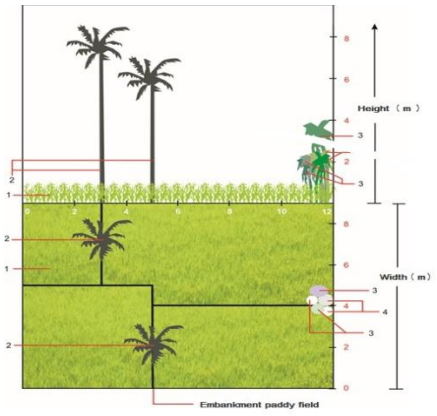

Fig. 3. Vertical and horizontal profile diagram of paddy field vegetation from one of the representative research plot example. 1. *Oryza sativa*, 2. *Cocos nucifera,* 3. *Musa x paradisiaca* triploid BBB, 4. *Musa acuminata*. Scale 1:10.000.

Table 3 and Fig. 4 gives a description about the plant species dominated garden landscape in Kemiren, Taman Suruh, and Jambe Sari villages. Gedang sobo (*Musa x paradisiaca* triploid BBB) is in the first place of IVI in garden of Kemiren village, followed by jajang benel (*Gigantochloa atter*), coconut (*Cocos nucifera*), durian (*Durio zibethinus*), sengon (*Albizia chinensis*), gedang lempeneng (*Musa x paradisiaca* triploid AAB), and coffee (*Coffea arabica*) (Table 3).

The high dominant value of gedang sobo is caused by fertiled soil with sufficient humidity, climate condition in Banyuwangi which is relatively dry, and supported by low monthly rainfall and makes gedang sobo thriving. The cultivation of gedang sobo by the garden owner in addition to vegetables (banana heart) also as traditional ritual needs such as leaves and the fruit itself needed for offering house renovation, house building, baby birth.

This is confirmed by the opinion of Hapsari *et al.* (2015) states that one of the benefits of the banana plant, the flower (banana cor) can be used for vegetable cooking, while Kennedy (2009) argues that banana leaves and fruit are often used for traditional rituals.

Table 3. Plant species which have high IVI in garden landscape.

Local name	Scientific name	Average IVI value		
		K	TS	JS
Gedang sobo	*M. paradisiaca* triploid BBB	7.02	5.71	3.93
Jajang benel	*Gigantochloa atter*	6.57	2.59	5.53
Kerambil	*Cocos nucifera*	6.40	5.76	6.33
Duren	*Durio zibethinus*	5.83	5.52	5.26
Sengon	*Albizia chinensis*	5.66	3.25	2.79
Gedang lempeneng	*M. paradisiaca* triploid AAB	5.20	4.35	5.90
Kopi	*Coffea arabica*	4.98	2.29	1.94
Jajang ori	*Bambusa arundinacea*	3.62	5.08	1.56
Langsat	*Lansium domesticum*	4.18	4.39	4.17
Pelem	*Mangifera indica*	1.97	4.35	1.61
Nongko	*Artocarpus heterophyllus*	2.88	2.49	4.73
Manggis	*Garcinia mangostana*	1.98	2.49	4.19

Information: IVI: the Importance Value Index, K: Kemiren village, TS: Taman Suruh village, JS: Jambe Sari village.

The second rank of IVI is jajang benel (Table 3). Most of various types of bamboo including jajang benel thrive along the river are deliberately functioned by the owner to avoid landslide of garden due to erosion from rainfall. Jajang benel is also used by the community to be construction materials. Coconut is in the third place of IVI species (Table 3). The utilizitation of coconut beside as cooking ingredient in the kitchen, coconut milk is also sold in order to support family economy. Durian is in the fourth place (Table 3) and it is only small amount that is consumed by the owner, most of them are sold. This is supported by the opinion of Zakiyah *et al.* (2013), that durian has an important contribution in increasing the income of villagers. The durian picking in Banyuwangi has characteristic that is durian is picked from the tree when it is ripe by binding the durian with raffia to the trunk in order not to fall and after it is ripe hang then picked.

Gedang lempeneng is widely grown in garden and is easily cultivated and rarely affected by plant disease. Coffee is grown by several societies to fulfill the family consumption sometimes it is for the needs of *kopi sewu* event which is one of the traditional agenda of Osing tribe in Kemiren village held once a year.

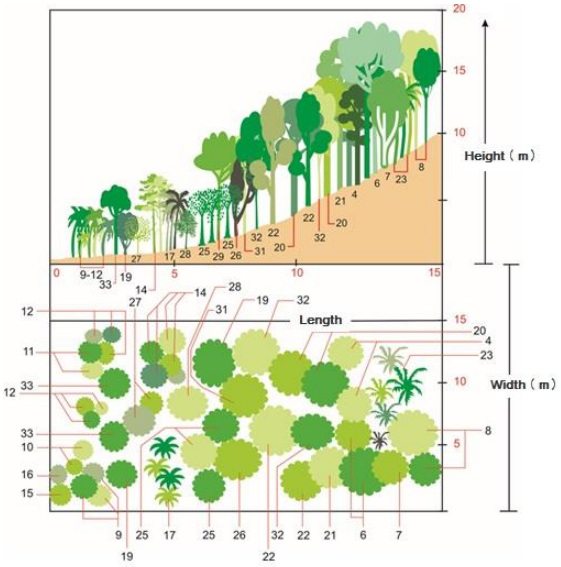

Fig. 4. Vertical and horizontal profile diagram of garden vegetation from one of the representative research plot example. 1. *Persea americana*, 2. *Synedrella nodiflora,* 3. *Ageratum houstonianum*, 4.

Mangifera foetida, 5. *Averrhoa carambola,* 6. *Artocarpus elasticus,* 7. *Ficus benjamina,* 8. *Durio zibethinus,* 9. *Musa acuminata,* 10. *Musa x paradisiaca* triploid ABB, 11. *Musa x paradisiaca* triploid AAB, 12. *Musa acuminata,* 13. *Syzygium polycephalum*, 14. *Anthocephalus cadamba,* 15. *Gigantochloa apus,* 16. *Gigantochloa atter,* 17. *Arecha catechu,* 18. *Syzygium aqueum,* 19. *Psidium guajava,* 20. *Pithecellobium lobatum,* 21. *Spondias cytherea,* 22. *Artocarpus camansi,* 23. *Cocos nucifera,* 24. *Coffea arabica,* 25. *Lansium domesticum,* 26. *Swietenia mahagoni*, 27. *Garcinia mangostana,* 28. *Melia azedarach*, 29. *Baccaurea racemosa,* 30. *Artocarpus heterophyllus*, 31. *Pangium edule*, 32. *Parkia speciosa,* 33. *Mangifera indica*. Scale 1:10.000.

The dominant species in garden area of Osing community in Taman Suruh villages from the first to the last rank are as follows coconut (*Cocos nucifera*), gedang sobo (*Musa x paradisiaca* triploid BBB), durian (*Durio zibethinus*), jajang ori (*Bambusa arundinacea*), langsat (*Lansium domesticum*), gedang lempeneng (*Musa x paradisiaca* triploid AAB), and mango (*Mangifera indica*) (Table 3). High dominant value of coconut is due to habitat condition, climate that is a little bit dry, and small amount of rainfall, aluvial land types with black texture and little damp, relatively few plant pests.

Gedang sobo, durian, jajang ori, langsat, gedang lempeneng, and mango are in the seven large that have high IVI, all of them have similar reasons with the reasons for the same plant species in Kemiren village. The sequence of dominant species grown in garden in Jambe Sari village from the highest to the lowest are as follows coconut, gedang lempeneng, jajang benel, durian, jack fruit, mangosteen, and langsat. The analysis result showed that in three villages found several species have high IVI with even distribution they are coconut, durian, and gedang lempeneng (Table 3).

Several reasons that are similar in Kemiren and Taman Suruh villages as the cause of high dominant value from similar various plant species among others conformity habitat for plant growth, climate factor which supports plant growth optimally, the plant species use for vegetables, fruits, and traditional rituals, fulfilling the economic needs of the family and land conservation needs (Table 3)

Table 4. Plant species which have high IVI in field landscape.

Local name	Scientific name	Average IVI value		
		K	TS	JS
Bayem	*Amaranthus hybridus*	7.51	5.88	5.11
Gedang sobo	*M. paradisiaca* triploid BBB	6.72	7.79	8.47
Gedang lempeneng	*M. paradisiaca* triploid AAB	6.40	5.65	6.37
Pegagan	*Centella asiatica*	6.40	5.15	0
Suket pait	*Axonopus compressus*	6.31	0	3.85
Lengkuas	*Alpinia galanga*	6.12	3.10	5.16
Babandotan	*Synedrella nodiflora*	6.09	1.85	5.78
Kemangi	*Ocimum basilicum*	4.67	5.74	4.28
Pandan Wangi	*Pandanus odoratissimus*	0	5.46	0
Gedang ketip	*Musa acuminata*	5.27	5.69	5.49
Meniran	*Phyllanthus urinaria*	5.52	5.88	6.37
Gedang emas	*M. acuminata* diploid AA	5.55	4.55	7.88
Jambu klutuk	*Psidium guajava*	4.98	4.32	7.00
Kates	*Carica papaya*	4.98	4.55	7.29
Katuk	*Sauropus androgynus*	4.95	4.28	6.33

Information: IVI: the Importance Value Index, K: Kemiren village, TS: Taman Suruh village, JS: Jambe Sari village.

Data distribution of IVI for plant species that grow in field landscape in research locations are shown in Table 4 and Fig. 5. The dominant species in three research villages showed different results but namun gedang sobo (*Musa x paradisiaca* triploid BBB) and gedang lempeneng (*Musa x paradisiaca* triploid AAB) have even distribution in three villages.

High value of IVI in both gedang is due to conformity habitat factor for plant growth and its benfit value. The different dominant distribution also described no arranged plan from the owner of the planted species because the designation of field is temporary and it can change function become building.

The existence of spinach (*Amaranthus hybridus*), galangal (*Alpinia galanga*), basil (*Ocimum*

basilicum), fragrant pandan (*Pandanus odoratissimus*), and katuk (*Sauropus androgynus*) in field are the species that give benefits for Osing tribe in order to fulfill the foodstuff as vegetables, salad, herbs and food flavoring. To fulfill the needs of fruit, the tribe tend to cultivate gedang ketip, gedang emas, guava, and papaya in their fields. The unwanted species (gulma) which thrive are as follows gotu kola (*Centella asiatica*), suket pait (*Axonopus compressus*), babandotan (*Synedrella nodiflora*), and meniran (*Phyllanthus urinaria*) (Table 4 & Fig. 5).

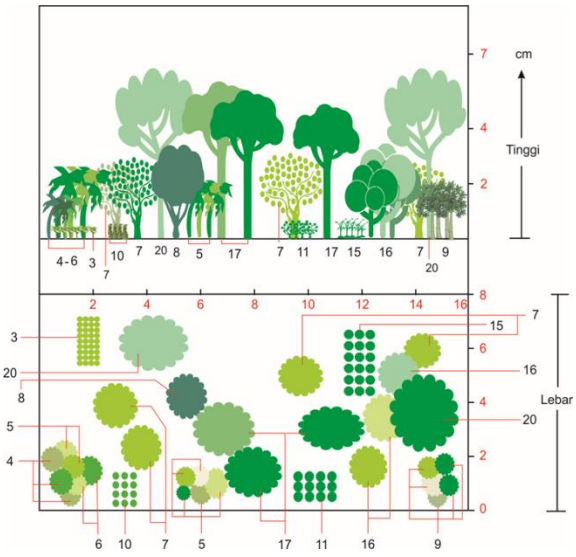

Fig. 5. Vertical and horizontal profile diagram of field from one of the representative research plot example. 1. *Synedrella nodiflora*, 2. *Ageratum houstonianum,* 3. *Amaranthus hybridus*, 4. *Musa x paradisiaca* triploid AAB*,* 5. *Musa x paradisiaca* triploid ABB*,* 6. *Musa acuminata* diploid AA*,* 7. *Syzygium aqueum,* 8. *Psidium guajava,* 9. *Carica papaya,* 10. *Vigna unguiculata,* 11. *Capsicum frustescens,* 12. *Ocimum basilicum,* 13. *Curcuma domestica*, 14. *Alpinia galanga,* 15. *Solanum melongena,* 16. *Pterocarpus indicus,* 17. *Mangifera indica,* 18. *Phyllanthus urinaria,* 19. *Euphorbia hirta,* 20. *Nephelium lappaceum*. Scale 1:10.000.

Economic value of farming landscape result

The dependency of Osing community towards biodiversity resources such as yard, paddy field, garden, and field is sufficiently high due to the majority of the community depend on farming and gardening (Prasetyo, 2019). To examine the direct contribution from each plant species in farming area which has economic value for life continuity of Osing community. The economic value calculation of farming resources is conducted through direct use value and market price approaches (Purwanto *et al.*, 2011).

Several plant species which have economic value and used by Osing community to fulfill the subsistence needs mainly harvested in its own farming such as paddy (*Oryza sativa*), coconut (*Cocos nucifera*), banana (*Musa* sp.), durian (*Durio zibethinus*), mangosteen (*Garcinia mangostana*), bitter bean (*Parkia speciosa*), and avocado (*Persea americana*). The plant species which have high contribution in fulfilling subsistence needs after paddy are coconut and banana. Several parameter can be used as economic value calculation of farming resources are the harvested amount per tree or per acre, harvest frequency in a year, and harvest total per head of family per plant species.

The following is a detailed calculation of the economic value of several plant species that contribute to the family economy in the Osing tribe community. Nowadays, the paddy variety mostly cultivated by Osing community is Inpari-32 and harvested in 98 days. The character of Inpari-32 is more durable towards high rainfall condition every year compared to Sintanur variety which tends to be durable towards dry season. In general, the community harvests Sintanur 100 days after planting it, Osing community can harvest the paddy four times in 1 year 1 month (Prasetyo, 2019). Not all Osing community in three villages have paddy field and the paddy fields are varied in sizes. There has been a paddy field sized more than 10 hectares but there is only 125 m^2 in size.

When the climate supports and pest prevention managed well then 1 hectare of paddy field can produce 50 sacks of dried grain. One dried grain is equal to 120 kg and it costs IDR 600,000. If it is counted on average per head of household who has and does not have paddy field, it is worth to IDR 3 to 4 million per harvest or 5 to 6.5 sacks of dried grain. In one year 1 month the household at least can earn IDR 16 million from the harvest.

Coconut is the third dependable contributor to the family needs after paddy because it can be harvested about 6 to 8 times per year. In one harvest of coconut tree, the community takes 2 bunches and is equal to 10 to 16 coconuts and worth of IDR 40,000. If it is counted on average per head of household who has and does not have coconut tree, the value is equivalent to IDR 1.6 million per harvest/year, or 40 coconut trees. In one year the household at least can earn IDR 9.6 million from the harvest.

Banana is the third dependable contributor to the family needs after coconut because in most of the farming (yard, paddy field, garden, and field) banana tree is easily found. If we see from the distribution of banana, it can be taken as the average that Osing community can harvest it every 15 year per tree and it equals to a bunch of banana. he price of banana per bunch in traditional market is varied and depends on its hand in one bunch. Generally, one bunch is worth of IDR 60,000 to 150,000. If it is counted on average per head of household who mostly has banana tree, it is worth to IDR 300,000 to 400,000 per harvest/15 days. In one year the household at least can earn IDR 7.3 million from the harvest.

Durian is a species that contributes the subsistence needs although its nominal value is not highThe price of each durian is varied and depends on the size and it is about IDR 10,000 to 25,000. Young durian tree which bears fruit at early time is worth of IDR 200,000, on the contrary for old tree aged more than 40 years, it is worth IDR 1.2 to 1.5 million. If it is counted on average per head of household who who has and does not have durian tree, it is worth to IDR 350,000 to 400,000 per harvest/year.

Mangosteen is a species that has small contribution to subsistence needs because mangosteen tree bears fruit when it is more than 15 years that is one of the reason that Osing community rarely cultivate it. Mangosteen tree which bears fruits at early time can produce about 1 quintal but for older tree it can produce about 2 quintals/tree. The price of mangosteen is relatively stable in traditional market that is about IDR 20,000 to 25,000/kg. If it is counted on average per head of household and it is not all of them has mangosteen tree, it is worth to IDR 1.5 to 2 million per harvest/year.

Bitter bean is very popular among Osing community due to its flavour when it is eaten as salad and with rice. Bitter bean harvest is conducted twice a year. One old bitter bean tree aged more than 30 year can produce about 50 bundles. Bitter bean sale in traditional market in one bundle (10 sticks) is IDR 15,000 or in one bundle (100 sticks) is IDR 150,000. The bitter bean tree distribution in three villages is quite a lot and if it is calculated on average per head of household who does not have bitter bean tree is equal to IDR 750,00 to 900,000/harvest. In one year the community harvested bitter bean about IDR 1.5 million.

Avocado is a fruit crop that has an uneven distribution in the three villages, however in several gardens and yards the Osing community still plant it. The Osing community tends to sell their avocado fruit to the market to help make ends meet. The price of avocado is varied and much more expensive in traditional market than in fruit middleman. Generally the price of avocado per kg in the market is IDR 25,000 while in middleman is only IDR 13,000. The price difference is as a compensation for the charateristic of fruit easily rotten. Each old avocado tree can produce and is worth about IDR 2 to 2.3 million. The avocado tree can only be harvested once a year. If it is counted on average per head of household who has avocado tree and does not have the tree, it is worth to IDR 600,000 to 700,000 per harvest/year.

Overall, the economic value of seven plant species have contribution in fulfilling subsistence needs of Osing community is IDR 36,850,000/head of household/year or IDR 3,070,833//head of household/month. The contribution is categorized as high in order to support and fulfill the sustainable development for Osing community in Banyuwangi.

Conclusion

The ethnoecology research of Osing tribe in following villages Kemiren, Taman Suruh, and Jambe Sari

showed that the ecology process created the shapes of landscape appearance with the characteristic of vegetation cover. Each landscape unit totally has its own value for the community life.

The study of plant community structure in every landscape unit in the three villages showed the existing dominant species and each landscape unit has different structure, composition and vertical stratification. The dominant species in yard landscape among others gedang lempeneng (*Musa x paradisiaca* triploid AAB), gedang ketip (*Musa acuminata*), rambutan (*Nephelium lappaceum*), and water apple/jambu air (*Syzygium aqueum*). Paddy field landscape is dominated by paddy (*Oryza sativa*), while species which dominated in garden landscape among others coconut (*Cocos nucifera*), duren (*Durio zibethinus*), gedang sobo (*Musa x paradisiaca* triploid BBB), and giant atter (*Gigantochloa atter*). The field landscape is dominated by gedang sobo (*Musa x paradisiaca* triploid BBB), spinach (*Amaranthus hybridus*), gedang lempeneng (*Musa x paradisiaca* triploid AAB), and gedang emas (*Musa acuminata* diploid AA).

The calculation result of economic valuation of agricultural landscape resources using direct use values and market values towards seven plant species i.e. paddy (*Oryza sativa*), coconut (*Cocos nucifera*), banana (*Musa* sp.), durian (*Durio zibethinus*), mangosteen (*Garcinia mangostana*), bitter bean (*Parkia speciosa*), and avocado (*Persea americana*) is IDR 36,850,000/head of household/year or IDR 3,070,833/ head of household/year. The amount had contribution towards the fulfillment of subsistence needs of Osing tribe.

In the ethnoecology landscape study proved that integrated ethnographic with ethnoscience in ethnology study has collaborated in order to dedicate the record in detail on community local knowledge towards landscapes and biologic organisms.

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