International Journal of Agricultural Technology 2017 Vol. 13(6):791-812
Available online http://www.ijat-aatsea.com
ISSN 2630-0192 (Online)

Pattern and Production of Durian in Saikhao Community, Kokpho District, Pattani Province

Radchanui, C.[1*] and Keawvongsri, P.[2]

[1]Tropical Agricultural Resource Management Programme, Faculty of Natural Resources, Prince of Songkla University, Hat Yai Campus, Songkla, Thailand ,90110; [2]Faculty of Natural Resources, Prince of Songkla University, Hat Yai Campus, Songkla, Thailand.

Radchanui, C. and Keawvongsri, P. (2017). Pattern and potential production of durian in Saikhao Community, Kokpho district, Pattani province. International Journal of Agricultural Technology 13(6):791-812.

Abstract The research on durian plantation in Saikhao Sub-district, Pattani was studied during in July, 2013 to July, 2015. Saikhao Sub-district is the area which famous in good taste durians of Pattani. There are several types of durians in the different plantations distributes in the forest, mountain plateau, walk way along canal near waterfall, hilly areas. After the announcing boundary of Saikhao Waterfall National Park impact to the areas of durian plantations was divided to the area inner - national park for 2,207 rai and outer national park for 838 rai. The total areas of durian plantations is 3,045 rai. Data used in this study were collected in the area inner and outer national park was found 4 patterns of durian plantations such as durian and forestry garden 2,207 rai 73%, durian and jungle fruits tree garden 293 rai 10%, durian and pararubber garden 73 rai 2% monoculture durian garden 472 rai 15%. The total of durians' potential productions is 1,744 tons/year. The net return of the pattern 1 is 10,275 baht/rai/year, pattern 2 is 24,550 baht/rai/year, pattern3 is 39,326 baht/rai/year, and pattern 4 is 58,688 baht/rai/year, durians'potential of the pattern 1, 2 and 3 was important to food security because there are wide variety of crops as subsistence agriculture in community and conservation of ecology especially water source and the structure of plants which crown cover more than 80 % of area.The different of canopy layers was decrease the impact of raindrops. The fallen leaves became decomposer, release mineral and protect the evaporation and made a slow water runoff. In the pattern 4 although the potential able to get more income but the cost for buy the good breeding branches of propagation, caring for weed and control water system in this garden is very high. Some of these gardens use pesticide. The management is privacy and have no quality control.The hamony of every pattern of durian gardeners able to make the way to the importance of self reliance society as a community in water source, available to the opportunities for contribute to The National Development Plan which agreeable to government policy in strong community, plant genetic conservation, biodiversity conservation especially pattern3 is able to applicative in pararubber planting aid fundamental in which occurrence direct and indirect benefit for the better life of agricultural and social.

Keywords: Durian, Pattern/Potential Production, Saikao Community, Pattani Province

[*] **Coressponding author:** Radchanui, C.; **Email:** charun-bio@hotmail.com

Introduction

Thailand has abundance of natural resource which composes of biodiversity in tropical rainforest. Nowadays, the occurrence of population decline in species and genetics, cause of land use and ecosystem degradation impact to food security and the base of agricultural productions in which an affect the quality of life of populations, loosing of genetic resources and biomass sources cause land use for power plants production and agricultural monoculture**.**Capitalist economy and material is concept flow made the environment treatment be a secondary issue. When agriculture economy for export are promoted. Including lack of knowledge in technology adoption and appropriately apply with local wisdom farmers. Therefore, it brings the negative effect on natural resources and the environment at Saikhao community, KhokPho District, Pattani Province, located on the upstream area, which is the location terrain of the SankalaKhiri Forest terrain and Saikhao Waterfall National Park, a source of the upstream forest. It is rich in tropical plants with high biodiversity (BCQY, 2013). The way of life of people in the community is characterized by natural resources. Local durian is a local fruit that has been cultivated in the community for at least 300 years. It has economic, social, cultural, and religious implications, and the tradition comes on continuously. When the farmer have received the land ownership document (Sor.Kor.1) (Department of Land, 1955). Some areas start growing local rubber tree and the propagative durian instead of the local durian, still remain wild mixed the rubber forest with local durian garden aggregate mixed with the other agroforestry crops, which is very relevant with the social and cultural dimensions in the southern of Thailand. For example, Somrom Garden or Dusong Garden (Some call "Granfather Garden" or "Ancient Garden"), The most legacy is inherited in grandparents, which can be found at the catchment area or plain. There are many plants in the Somrom Garden, such as traditional plants and later supplements planted which is a sustainable farming system in the border of southern provinces.There is a production system and co-operative management among relatives and community. By the management system, It is based on religious principles that emphasized the sharing and generosity of each other. Many kinds of plants, most of which are endemic species such as Durian (*Durio zibethinus*), Rambutan (*Nephelium lappaceum*) Mangosteen (*Garcinia mangostana*) Longong (*Lansium domesticum*) , Lamai(*Baccaurea motleyana*), Jampuling (*Baccaurea minor*), Sala (*Salaca zalaca*), Mahfai (*Baccaurea ramiflora*), langKae (*Baccaurea macrophylla*),Mahprang(*Bouea macrophylla*)Pepper(*Piper nigrum*),Stunk Bean(*Parkia speciosa*), Nieng(*Archidendron pauciflorum*),Betal Palm(*Areca catechu*),

Mamood(*Mangifera foetida*), coconut (*Cocos nucifera*), bamboo (*Bambusoideae* sp.), Banana(*Musa acuminate*), etc. And the lower plants naturally grow like natural ferns help cover the soil and moisturize the area in the garden. There are plenty of both wood and subsistence crops (Jintana, 2012). Land utilization according to the guidelines for protection and conservation of land to have the potential for agriculture together with the development of natural resources, restored and promoted values, Good culture and Lifestyle, consistent with The Convention on International Trade (CITES), the endangered species of wildlife and plants or threats, should be aware(Nair, 1993). Nowadays, the way of SaiKhao community related to the cultivation of the local durian has changed a lot.The benefits that the community has received from the durian folk forest (local durian) in the direct result is fresh durian and durian products. The indirect benefits are dimensions of biodiversity that support the abundance of water, wood, herbs, wild herbs, wildlife, Ecology, heredity, social path (Petmark, 1997). The SaiKhao community local durian forest studying should be one of the alternative models to communities' value awareness and the importance of genetic resources not to be destroyed. Provide sustainable replacement in productivity affected the social life of biodiverse organisms. Help conserve soil and water, Food security and immunity, Economic, social and environmental aspects, (Keawvongsri, 2005), according to Sufficiency Economy Philosophy and believe that this study can be used as a guide to improving the ecological system of agriculture in another area that is changing in the same way.

Study Objectives: To study the pattern of durian plantation and potential production in Saikhao Community, Kokpho District, Pattani Province.

Materials and methods

Researching scope

The scope of the study is three fold; The different patterns of durian plantations, the potential production of each pattern and the concerning to economic, social, lifestyle of Saikhao community and environment.

Research Facility

Operated at Khok Pho, Pattani, covering an area of about 50 square kilometers, located in the national park of SaiKhao Waterfall about 30 square kilometers and outside the national park area about 20 square kilometers according to the characteristics of land use, 6 villages of durian land, total area of durian plantation is 3,045 rai.

Population and sample group

Demographic sample collection consists of community leaders, philosopher villagers, Stakeholders, elderly people in the community and 84 durian growers apart from the total number of 120 durian growers by a specific random method.

Data Collection

An interview schedule and a questionnaire were designed to obtain primary and secondary data about the historical background of the community, its socio-economic aspect, environment, cultivation of durian, and biodiversity contributing to the production and revenue-generating systems. The data were collected at the points of sale of fresh durian harvested from the community plantations and randomly from the 20 meter x 40 meter durian plots from differing cultivating patterns, a total of 16 plots altogether. Data collection was conducted from July 2013 to July 2015 on the physical characteristics of the terrains, cultivation patterns, management, maintenance, harvesting, logistics, distribution of the products, morphological characteristics of durian fruit, agroforestry structure and local wisdom involved.

Data analysis

After collecting the data, then analyze it descriptively, about the structure of the plant with durian is the main plant according to the agroforestry system. Canopy covering, biodiversity, production potential and local naming of durians by the characteristics.

Research Equipment

The research instruments included Land Use Map, Manual for Identification of Morphological Characteristics of Local Durian, Interview Schedule and Questionnaire designed to obtain the required information.

Results

General information: Currently, Sai Khao community consists of 6 villages, forming a farming community engaged in growing crops and rice farming. The total area of rice farming is 3,342 rais (1,336.8 acres) and 11,506 rais (4,602.4 acres) of crop orchards. Key economic crops in the community were durian, coconut, and longkong. The average income per household was 124,757 baht/year (Community Development Office, 2011). There were 120

durian growers in the community. From 84 sample respondents in all six villages, age and education level of the growers were identified. The details are shown in Table 1, which shows that 70.24% of durian growers were males and 29.77% were females. Classified by the age group, 57.15% were between 31-40 years old, 23.81% were 41 years old and over and 19.05% were 20-30 years old. Based on educational level, the study found that 47.62% of durian growers attained the secondary education, followed by 39.29% of those who finished elementary education. Only 13.10% of durian growers graduated with a bachelor degree.

Table 1. General information of durian gardeners in Saikhao community, Kokpho,Pattani, 2015.

village	Sex			Age			Terms of Education		
	male	female	To tal	30-20 years	40-31 years	More than 41 years	Primary school	Secondary school	Bachelor degree
1.Banlamyong	4	2	6	-	5	1	2	4	-
2.Banloungjan	3	1	4	-	-	4	4	-	-
3.BanSaikao-oak	19	6	25	2	14	9	10	13	2
4.Bankounlungnga	5	3	8	3	5	-	2	4	2
5.BanSaikao-tok	17	6	23	7	12	4	9	9	5
6.Banlamaan	11	7	18	4	12	2	6	10	2
Total	**59**	**25**	**84**	**16**	**48**	**20**	**33**	**40**	**11**

Physical data of community

After collecting the data and conclude the analysis questionnaires was found the several in physical factors.

Geological features

In the area of Sai Khao community compose mainly limestone and granite. Soil composition is sandy clay, which has a high proportion of sandy soil (Royal Forest Department, 2012).

Topography characteristics

The community and agricultural ecology are located along the slopes on the hills and intermontane plateau. Some areas are located in Sai Khao Waterfalls National Park, from where the waterfalls originate and rivers and streams flow through the community. The water from these sources are used

for consumption and farming all year round. The upstream areas on the hills are utilized for fruit orchards and rubber plantations. Villagers build houses and shelters along the hillside. The highest peak is Nang Chan, about 1,500 meters above sea level.

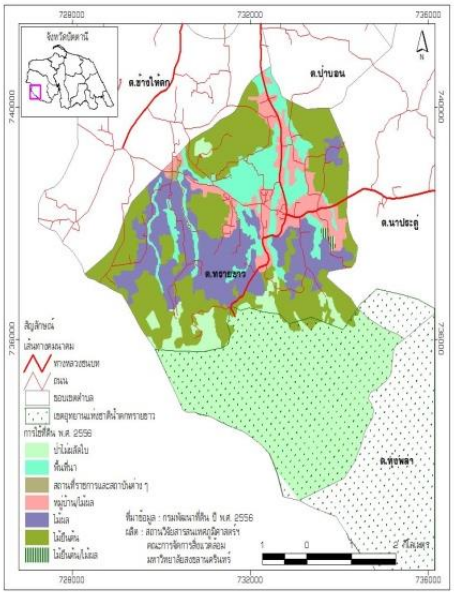

Figure 1. Land use in Saikhao Community
Source: Songkhla Lake Basin Knowledge Bank, 2013

Climate characteristics

The climate is hot and humid with the lowest temperature about 18 degrees Celsius. There are two seasons, the rainy season from September to December (heavy rain during October to November) and the summer season from February to June. The climate of the area has been influenced by the southwest monsoon in July, the northeast monsoon in November and from the local wind (sea breeze and land breeze) from the Gulf of Thailand (Thepa Bay and Pattani Bay). The weather is very humid and cool all year round. Average temperature is between 25 - 28 degrees Celsius.

Hydrological characteristics

It is influenced by the watersheds of the Sai Khao Waterfalls National Park in San Kala Khiri mountain ranges. Key watercourses in the community include: Sai Khao Creek or Sai Khao Waterfalls Canal, Lamyang Creek or

Laman Canal or Neua Canal, Ton Tapian Canal or Phan Nork Canal. There are also nearby watercourses, such as Klong Phai Creek, Puron Canal and Huay Ngok Canal. Details of the hydrological characteristics are shown in Table 2.

Table 2. Bringing the flow of water in SaiKhao community, KokPho ,Pattani.

Order	Community areas	Canal
1.	1,2,3,5	KlongLamAnn
2.	2	KlongSuanRian
3.	2,3	Klong Pan
4.	2,4	KlongpanYai and KlongTonPor
5.	5	KlongLamDinNeaw
6.	6	KlongLamYang

Economic and Social characteristics

Social ecosystem: Sai Khao Community lies to the north of San Kala Khiri mountain ranges. It is an agricultural community located in the rainforest ecosystem, where man lives harmoniously with the forest. Local villagers are engaged in farming in the lowland areas along the hillside. The community has a high potential for self-reliance. Most of rice farming is located the lowlands on foothills. Perennial fruit orchards and Para rubber plantations are found on the hills and hillside slopes.

Number of households and population: Sai Khao Community consists of 6 villages, of which Ban Sai Khao Ok having the largest number of population, with 157 households, whereas Ban Sai Khao Tok having the smallest population with 110 households (Table 3). The total population is 2,954 people, divided into people in the age groups of 50 and over (1,033-the elderly), people in the working group of 25-49 years old (1,313 people) and childhood population of 600 (Department of Community Development, 2011).

Table 3. The number of households and populationin 2011

No.	Village	The amount of population		Total	household
		Male	Female		
1	BanLamYong	262	298	560	143
2	BanLoungJan	211	211	422	123
3	BanSaikhao-Oak	253	269	522	157
4	BanKounLungNga	261	274	535	131
5	BanSaikao-Tok	169	212	381	110
6	BanLamAan	270	264	534	125
	Total	**1,426**	**1,528**	**2,954**	**789**

Durian Plantation in SaiKhao Community

Land utilization in Sai Khao Community has been changing due to the changes in social, economic and environmental factors. From the past to present, durian plantation areas are located on mountain slopes, plains along the banks of the creeks and the watercourses called "Huai" or "Trok" at about 40 - 500 meters MSL. The original fruit species *Durio zibethinus* has been grown in the area for more than 200 years ago. The species grown in Sai Khao is well known in the community and neighboring areas for its unique taste and flavor. Based on land ownership records issued in 1995, the total area for durian cultivation is 8,372 rai (3,348 acres). In 2008 when the area of Sai Khao Waterfalls National Park was officially declared by the Department of National Park, about 2,207 rai (882 acres) of original durian plantation areas were found to be located inside the park. However, durian growers in the overlapping areas have been allowed to harvest the fruits. At present, there are 838 rai (335 acres) of durian plantations outside the National Park. The total area of durian plantations both inside and outside the park is about 3,045 rai (1,218 acres). Currently there are 4 patterns of durian cultivation; 1) Durian and Forestry Plantation - 74% of the area, 2) Durian and Jungle Fruit Plantation - about 9% of the area, 3) Durian and Para rubber Plantation - about 2% and 4) Durian monoculture plantation (planting durian as a single crop) accounts about 15% of the total cultivation area.Total durian production in the community is approximately 1,744 metric tons per year. Four patterns of cultivation are shown in the following pictures:

Figure 2. The durian tree on the foothills **Figure 3.**The plenty of ripe durians were dropped

Pattern 1 Durian and Forestry Plantation

This type of cultivation has the longest history of farming practice in the community. Durian growers used local durian seeds to plant along the banks of the watercourses by putting 4-5 seeds in each pitch spaced about 10 -15 meters apart. Data collection revealed that an average number of durian trees were 13 plants per rai, about 79.2 cm DBH(Depth Breath Height), an average trunk height of 42.16 meters and the canopy crown cover of about 87.76%. Species of other subsistence crops or herbs are found in the space between the canopy such as Mahdoe(*Ficus cari*), Bontoa(*Hapaline benthamiana*), Fern(*Diplaziumes culentum*) Wan Nang Kroun(*Tacca chantrieri*)Por Kra Jong(*Minaliai vorensis*) Jig(*Arenga pinnat*),Wai(*Calamus caesius*) and so on. Durians are planted along the mountain slopes, valley and in the watershed areas.Tree space is not fixed with no planting rows.The planting method begins by clearing the land patches and native durian seeds buried in the ground. The declaration of the boundary of the National Park affected the way of life of native durian growers; certain plots were found to be inside the park and the overlapping areas were left unattended. The durian trees in these areas grew along with other wild plants. In the past, the yields from this area were transported to the community market by way of shoulder-carrying, on foot because of terrain difficulty.

Figure 4. Durian and Forestry Plantation in SaiKhao Waterfall, The National Park.

Pattern 2 Durian and Jungle Fruit Plantation

Most of the area is outside the boundary of the park. Initially, the method of planting employed the same procedures as those used in Pattern 1. Since durian growers of Pattern 1 were awarded land ownership rights, they were able to put their full efforts in maintaining the plantation. Jungle fruit or local fruit, such as Bitter Bea*(Parkia speciosa)*, Garcinia*(Garcinia atroviridis)*, Mahmood *(Mangifera foetida)*, NeingNok(*Archidendron jiringa*), Neing Yai

(*Archidendron pauciflorum*), Reing*(Parkia timoriana)*, Betalpalm(*Areca catechu*) were planted along with durian. Spaces between trees were not fixed. The data collected from 4 sampling plots showed an average 26 durian trees per rai, an average DBH of 31.66 cm, an average trunk height of 23.88 meters, and a canopy crown cover of about 91.53%.

Figure 5. Durian and Jungle Fruit Plantation

Pattern 3 Durian and Para rubber Plantation

Planting Pattern 2 has been modified by durian growers who received the financial support from the Office of Rubber Replanting Aid Fund (ORRAF) by felling existing local durian trees and other plants, in accordance with the regulations stipulated by ORRAF. However, some of the quality local durian trees were left intact and farmers expecting to harvest the yield for consumption or for sale; most of the protected durian trees were found along the plantation's rims.Before planting rubber trees, the area was cleared by getting rid of other unwanted plants.Pitches for planting rubbers were dug with the space of 3x7 m. between each tree. Data collection were found having the DBH of 54 cm. with an average of 8 rubber trees per rai, an average trunk height of 35 m. and a canopy crown cover of 98.50%.

Figure 6. A. the para rubber tree B.The local durian tree

Pattern 4 Durian monoculture plantation

The original was the gardener name Mr.Klay Intaraksa brought the good type of young breeding durian tree from BangKoonNon, Thonburi, Bangkok to plant instead of the old local durian in his garden at SaiKhao from 1963-1969. In the present, his durian garden was deliver to the Plant Genetic Conservation Project.The type of famous breeding and propagate durian was collected such as Chanee, Kanyao, Chaymafai, Koblebyeaw, Kobmaetao, etc.The conclude data from interview the gardener name "Uncle Reaw"at Nonthaburi province told that: In 1974, The people from SaiKhao brought the durian plants from Nonthaburi for planting. Those propagate durian as graft or plug the top branches height 50 cm. were packed in Tanoan Pot and carried by ship travel from King Rama1st Bridge to BanDon, SuratThani province and some of propagate durian were carried by train from BangKokNoi Station to NaPraDu Station, KokPho district, Pattani.(Uncle Reaw, 2014)After that, Mr.Mahdari the gardener in NaPraDu started to propagate durian by plug the top branches method for sale which made him famous in local. Almost gardener were interested to planted durian in garden like monoculture replacement the local durian in garden called " SaunSomRom "nearby canal by planting raised beds. The popular type is Chanee, Kanyao, Kob, E-Loung cause the famous durian production from SaiKhao. Later, Monthong durian variety was added to the plantations at Sai Khao and was well-accepted by durian lovers; Monthong's good taste always fetched a good price. (Interviewer the durian growers, 2014).

From data collected, the spacing of 8×5 meters was required for planting 32 plants per rai, with an average DBH of 40.7 centimeters, and an average trunk height of 14.69 meters. Durian monoculture in this Pattern felled existing perennial trees, leveling the ground and then plowing the earth to make blocks of raised beds. Durian growers then planted the variety needed by the market. Planted durian trees depended on mountain water supply and water pumped from watercourses or from ponds dug for durian cultivation purposes. Chemical herbicide was used to kill weed. Chemical fertilizer, organic fertilizer and manure were used for soil improvement in durian growing areas; others trees are not found in this monoculture cultivation, except a good durian variety. The canopy crown covers approximately 76.92% of the area. No effects of canopy crown of other trees and sunlight passes through the durian orchard areas easily. When the age of durian tree is about 20 years old and over, the yield decrease. The product is usually sold in the market in the village or through middlemen buying the products at a flat price at the orchards. This pattern of durian plantation has a high cost, with expenses derived from the preparation of quality young durian trees as well as caring of growing trees. However, the yield per unit was higher than that of native durians and durian growers earn more revenue.

A. B.

Figure 7. A.and B. The row of durian plot in garden Pattern 4

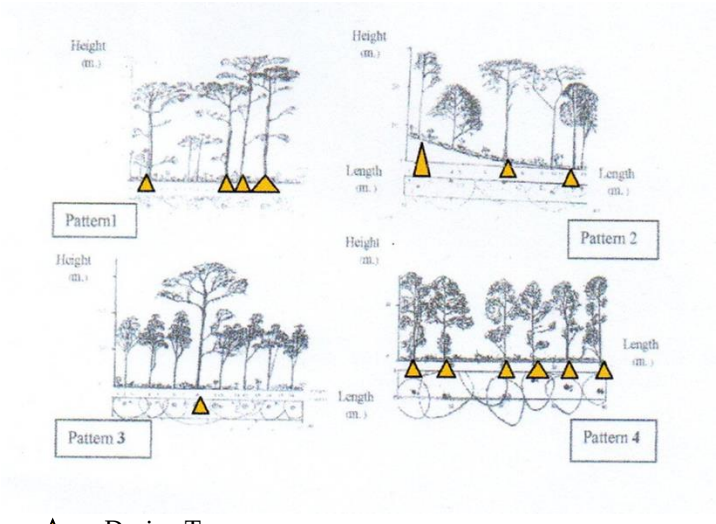

Figure 8. The Comparison of Profile and Horizontal cross 4 patterns of durian plantation: Pattern 1 Durian and Forestry Plantation, Pattern 2 Durian and Jungle Fruit Plantation, Pattern 3 Durian and Para rubber Plantation and Pattern 4 Durian monoculture plantation

The signature the local durian

There are several factors for naming convention of native durian in Sai Khao community. From field data observation, most of the fruits have been named in accordance with the external and internal characteristics or appearances, such spike shape, taste and color of pulp, trunk structure, geographical location, environment, name of grower, or name of the person who selected the stock species. Examples of naming characteristics are illustrated in the following:

Local durians are named after the differences in the shape of the fruit. 80% of the stock names are called after spherical or oval shape, whereas only 20% of the names are called after the ovate shape as in the following stocks: Namtao (pumpkin), Pruan (rambutan), Khanoon (jackfruit), Hoy Khong (apple snail), Khan Tong (golden bowl), Hua Chang (elephant's head), Look Hai (small jar), Lampong (loud speaker), Look Riew (oval shape), Look Yai (big fruit), Keepra (winter melon), Aiklom (round fruit), Aiklae, Jumbo.

Figure 9. The Fruit shape of local durian

Flesh colour: Local durians are also named after the color and texture of the flesh. 70% of the fruits are named after the creamy white color of the flesh, whereas 20% are named after the yellow flesh appearance and 10% after the grey color as in the following stocks: Kamin (turmeric), Khitao (ash), Nim (anteater - plenty of flesh), Kheedook (lack of flesh - not covering the seed).

Figure 10. Flesh colour

Seed shape : Seed shapes are used to describe native durians. 90% of the fruits are named after the oval, ovate shapes and 10% are named after the ellipsoid and oblong shapes as in the following nicknames: Khimaew (cat dropping) and Aaiklae(ovum shape).

Figure 11. Seed shap oval[Ai-kla]ellipsoid [Kemeaw]

Fruit spine shape: The characteristics of the spikes on the outer part are also used in durian naming. 90% of native durians are named after the sharp, pointed and concaved spikes and 10% after the small, sharp and short spikes, as in Ai-men (porcupine), Chang Thaeng (elephant's piercing), Khiew Lebyib (small spike), Nam Daeng (red spike), Daeng Dakdam Nam Khiaw (green spike), Ai-Leuang (yellow), Pahrai, Nam Khom (sharp spike), etc.

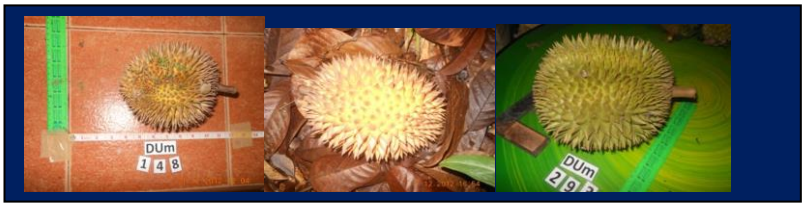

Figure12. The difference of Fruit spine shape of the local durian

Fruit stalk length: The difference in stalk length, short, medium and long, is used for naming native durian. Medium stalk length is found to represent 90% of the names, whereas short and long stalk is found to represent 10% of the names such as Wan San (short stalk), Wan Yao (long stalk).

Figure13. The difference of the stalk length short or long

Flesh taste: The taste characteristics are used for naming local durian, where 90% of the names are represented by sweet or slightly sweet taste, such

as I-tim (ice cream), and 10% represented by the bland taste as in Ai-jeud (bland tasteless), Ai-khaoyen (cold rice).

Figure14. The difference flesh taste

Tree growth habit and crown shape: These characteristics are used to name local durian such as Ton Khoo (double trunk structure), Song Pang (double branching), Sao Thong (flag pole), Mai Yang (rubber tree), Yod Hak (broken crown), Prong Lan (lizard's hole), Prong Musang(civetcat'shole) and Ai-MusangPeek(flying lemur).

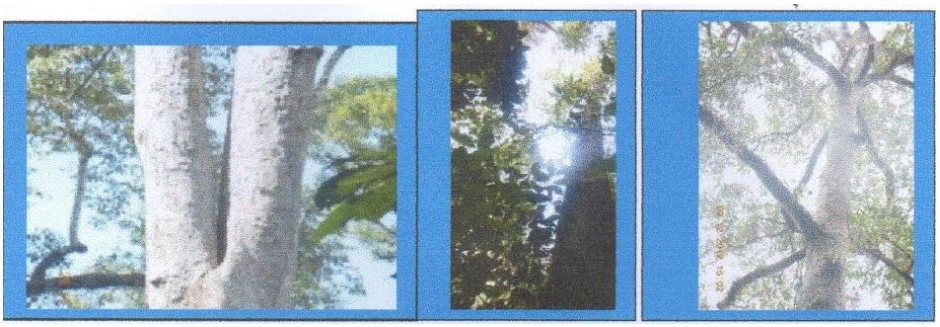

Figure 15. The difference of tree growth habit and crown shape

Environment: The position where native durian is grown with different ecological components can be used to name the durian stock. For example, Ai-Pluak (termite hill), Ai-Thungklong, Ai-Wao (the trunk is covered with climbing ferns, of which the dried leaves can be used to make kites), Yee-Rat, Ai-Rae, Ai-Keetaek(fruit ripen), Ai-Kheenon(have so much worms), Wan-Hak(stalk losen).

Figure16. The characteristics was found in environment for durian's signature

The Potential Production in Saikhao Community Kokpho district, Pattani

The Potential revenue of each patterns of the durian plantation

Potential revenue is calculated from productivity which can be valued and from non-estimable value not mentioned in this report but which is of great importance to the community in terms of the social ecology at the areal level. It involves many aspects of sustainability and security for food, local natural resources, and social and environmental aspects. Table 4 shows the potential of durian production in 4 patterns of durian plantation: monoculture and mixed crop planting, with details on values and benefits from other crops of varied biodiversity

Table 4. The potential productions of each patterns of then durian plantations in SaiKhao

Patterns of then durian plantations	**Amount of durian tree average/rai**	**Revenue [baht/rai/year]**				**Total [baht/rai/year]**
		from durian	**From jungle fruit**	**From subsistence crop**	**From para rubber**	
1. Durian and forestry	13	2,275	-	8,000	-	10,275
2. Durian and jungle fruit	26	4,550	14,000	6,000	-	24.550
3.durian and pararubber	8	1,400	-	-	37,926	39,326
4.Durian monoculture	32	58,688	-	-	-	58,688

The potential of durian monoculture productivity and local durian in SaiKhao community

There are 36,893 trees for local durians of Pattern 1, 2 and 3, with each tree producing 70 fruits, a total of 2,582,510 fruits. Each durian tree in these

patterns produces 70 fruits, 2 fruits weigh 1 kilogram, a total of 1,291,255 kilograms, or 1,291.25 tons of output per year. There are 15,104 durian trees for monoculture plantation, each of which bears 30 fruits, a total 453,120 fruits. On average, 1 fruit weighs 1 kg and the total production is 453,120 kg or 453.12 tons per year. The total production of all types of durian per year is 1,744 tons (Table 5, Figure 17).

Table 5. The assessment of potential output of durian monoculture ,local durian and para rubber monoculture in SaiKhao community

Potential	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Para rubber
Area[rai]	2207[73%]	293[10%]	73[2%]	472[15%]	10,563
Amount of tree whole	28,691	7,618	584	15,104	760,536
Amount of tree/rai	13	26	8	32	72
Estimate Revenue [baht/year]	5,020,925	1,333,150	102,200	27,700,736	134,081,439

The potential of food security

Various durians planted in Pattern 1 and 2 provide the varieties with good taste and nutritional value and the flesh can be processed for consumption with security in food production and safety from chemical contamination. Parts from fruits and leaves can be utilized as a food in the form of fresh or seasoned foods which are sustainable in terms of production and quality with less cost of production. The community is able to have access and participate in equitable sharing of benefits.

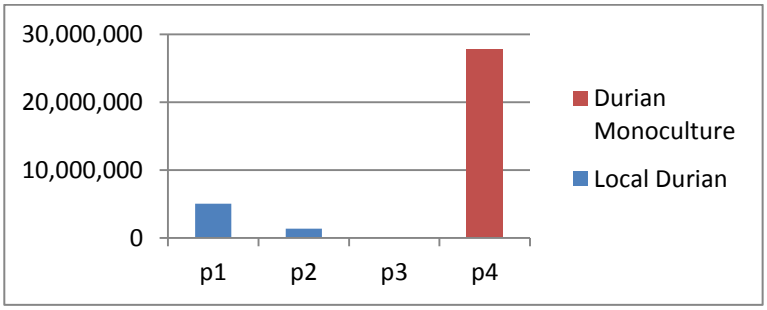

Figure 17. Comparison of potential revenue of the patterns of durian in SaiKhao community**,** p = pattern p^1 5,020,925, $p^2$1,333,150, p^3 102,200, p^4 27,770,736 baht/year

The potential of social and wisdom: The pattern of durian cultivation in Sai Khao Community has a history of social potentials as reflected in the terms of Suan Wa Reah or Suan Dusong, a co-cultivation of the crops by closed relatives whose practices have been carried on until the present. Members of the community have the potential to learn the coexistence between man and the forest, with emerging culture of sacrifice, sharing, unity and self-reliance, with further sustainable durian productivity and strong community in the transition period from the past to present.

The potential of environment: In addition to income generation, durian cultivation in Sai Khao Community in all 4 Patterns also creates an impact on the ecology and environment of the community. This is due to the fact that the structure of the agroforestry system of durian planting in combination with other plants of direct and indirect value is seen in in the following phenomena: structural differences of plants with crown cover canopy, root system and deep trunk in the soil directly affect the absorption and retention of rain water, preservation of soil moisture and prevention of soil erosion in sloping areas. These structural characteristics also help maintain the nature of a watershed for the community, an instrumental factor for the cultivation of economic crops.

Compliance to State Policy: The cultivation of durian in Sai Khao Community is characterized by the agroforestry, with an exception of Pattern 3 and 4, which are of monoculture characteristics. However, such a cultivation practice has brought about a high revenue potential, which is highly recognized by durian growers. The study found that agroforestry type of durian of Sai Khao Community is likely to decline while the government policy under the National Social Economic Development Plan emphasizes the protection of agricultural land and the increase of forest areas and the reduction of global warming. The goal of the government is to earn balanced incomes along with the sustainability of natural resources for agricultural production. It is a policy driven by an integrated durian agroforestry policy consistent with the policy of increasing forest areas and reducing global warming. Growing durian and Para rubber trees in monoculture cultivation only leads to lack of balance in biodiversity. By responding to the policy of reducing the number of single plants such as Para rubber and good stock durian varieties, local durian trees can be increased along with other varieties of plants in the planting area, while still maintaining their production and income potential with no impact on the economy, society and the environment of Sai Khao Community. It is feasible to comply with the replanting policy using Pattern 5 advocated by the Office of the Rubber Plantation Aid Fund (ORRAF) modified with Pattern 3 in planting durian along with Para rubber trees.

Discussion

Factors affecting the production potential of durian monoculture and local durian agroforestry compose of the following: number of durian trees in each area, quantity and quality of durian and Para rubber during specific period, utilization of biodiversity, attitudes of people in the community, forest policy of the National Park area and area based environmental potential (Radchanui., 2016).

The calculation of values derived from native fruits and subsistent crops in terms for food, environmental conservation and carbon credits shows the added values in the following: more than 10,275 baht/rai/year for Pattern 1, more than 24,550 baht/rai/year for Pattern 2, and more than 128,336 baht/rai/year for Pattern 3. There is no added value derived from Pattern 4. When the potential of durian is assessed, it is found that the revenue for the community is lower than that of the average household income. Therefore, the household is dependent on income from other economic crops. For this reason, durian should be planted with other economic crops, such as Para rubber and local fruit. Biodiversity should be conserved and utilized in accordance with the potential appropriate to the context of the area (Boonkerd, 1986; Preechapanya, 2011).

The results of the study show that production potential Pattern 1, 2 and 3 provides the revenue to the community for 704,670 baht/year, compared with the whole production area which can contribute the amount of 6,456,275 baht/year, with no visible production of 5,751,605 baht/year. Pattern 4 has the production potential of 27,700,736 baht/year but sales in the market value of 27,703,405 baht/year and the value more than production potential estimate 2,669 baht/year. The measures should be taken to maximize benefits of durian production and to avoid the conflict with the forestry management policy of the National Park (Agricultural Extension Office, 2012).

The study of the potential of durian cultivation on food security, social immunity, environmental wisdom and compliance to state policy can be reflected in the patterns of durian cultivation in Sai Khao Community: Pattern 4 durian monoculture cultivation focuses on the production of organic durian, reduction of production cost by self-reliance through irrigation, organic fertilizer with a quality control of durian fruit for consumer market. Pattern 1 cultivation of durian mixed with natural plants also promotes ecotourism in Sai Khao Waterfalls National Park, conserves genetics of local durians and maintains the original durian cultivation format, not leaving it at the mercy of nature. In Pattern 2, durian is planted along with jungle fruit trees, promoting community agroforestry, serving as a source of learning and folk wisdom of the

community and conserving local plant genetics. For Pattern 3, durian and Para rubber are planted in rows of fixed space. A number of durian trees are added to the plot to form ideal monoculture as recommended by ORRAF and avoiding planting rubber trees on the soil with the 45 degree slope and the sandy gravel soil, which is volatile for soil erosion.

The results of study reveal that before 1955, 8,372 rai of durians were found planted in Sai Khao Community area. After the declaration of Sai Khao Waterfalls as an area of the National Park, the planting area is approximately 838 rai outside and 2,207 rai inside the park boundary. At present, durian plantations cover the total area about 3,045 rais. Durian blooms from February to April and bear fruits from June to October. The overall yield is about 1,744 tons/year. The forest conservation efforts, forest management, promotion of monoculture and the attitude of the community have a direct and indirect effect on native durian plantation to the extent of the planting areas and native durian plant species being threatened. Currently, there are 4 patterns of durian and forestry plantation, durian and jungle fruit plantation, durian and Para rubber plantation and durian monoculture plantation, Total production potential of durian in the 4 pattern of cultivation, taken from the sample plots, reveals the amount of 10,275 baht/rai/year for Pattern 1; 24,550 baht/rai/year for Pattern 2; 39,326 baht/rai/year for Pattern 3 and 58,688 baht/rai/year for Pattern 4.The production potential, arranged in descending order, shows that Pattern 3 has the highest production, followed by Pattern 4, Pattern 2 and Pattern 1, respectively. Estimation based on durian production area only shows that durian cultivation in Pattern 1- 5,020,925 baht/year, Pattern 2 - 1,333,150 baht/year and Pattern 3 - 102,200 baht/year, Pattern 4 yields 27,700,736 baht/year respectively. Potential of durian production is due to variety of plant species planted with durian, and preservation of canopy plant covering more than 70% of area in agroforestry system. This helps reduce weed problems, conserve soil and water resources, reduce the evaporation of water and prevent the impact on soil from rain (Young, 1989). Planting of supplementary fruit trees, preserving the original state of the plants in the area and revenues earned will be the sustainability indicators for agriculture and a solution to social problems (Boonkerd, 1986). The lifestyle of the people in the community and the utilization of native plants should take into account of the conservation and restoration of natural resources. The promotion of agroforestry of durian plantation pattern is probably the key solution to land use of the upstream areas, providing a great benefit to plant genetic conservation through further research work. Local plant genetics should be preserved inside and propagated outside the planting areas in order to prevent loss of plant species. In response to the state policy, Pattern 3 cultivation probably can be served as a prototype of

planting in combination with ORRAF's Pattern 5 by planting mixed crops with Para rubbers in community forests in the upstream areas (ORRAF, 2016).

Acknowledgement

This research is supported by the department of Tropical Agricultural Resource Management, Faculty of Natural Resource Prince of Songkla University Hatyai Campus. The author highly acknowledge Ass.Prof.Dr. Pramote Keawvongsri for his the best suggestions to be completed Data Collection. The author is thankful to the kindness of curriculum team work and senior students from this department ,The stuff in Saikhao National park, The stuff in the department of Kokpho district, the committee of Plant Genetic Conservation Project and Saikhao community with the good accommodations all of the field works.

References

Agricultural Extension office. (2012). Famer registration database system. Department of Agricultural Extension office, Pattani. Retrieved from http://www.survey.doac.go.th/indexhome.php?=home./.

Biodiversity Center. (2013). In Commemoration of 72nd Anniversary Queen Sirikit. (BCQY). Yala Rajabhat University, Yala.

Boonkerd, S. (1986). Principles of agroforestry. Faculty of Forestry, Kesatsart.

Department of land. (1955). Land registion form (S.K.1), Documentation of land tenure and use, No. 2498/1064 Date 26 May 1955.

Interviewer the durian growers. (2014). Interview schedule and questionnaire designed to obtain the required information. Research instruments**;** Pattern and potential production of Durian in SaiKhao Community, Kokpho district, Pattani province, Prince of Songkla University, Hat Yai Campus, Songkla, Thailand.

Jintana, V. (2012). Introduction of agroforesty unit 1: Teaching document for agroforesty course. Department of Agricaltral Extension, Sukhothai Thammathirat Open University. Bangkok.

Keawvongsri, P. (2005). Teaching document for agroforesty course. Faculty of Natural Resource, Prince of Songkla University, Hatyai Campus, Songkla.

Nair, P. K. R. (1993). An introduction to agroforestry. United Kingdom: Springer Netherlands.

ORAF (2015). Operational policy of office of the rubber replanting aid fund. Retrieved from http://oraf-trang.tripod.com/html/activies.htm.

Petmark, P. (1997). Agroforesty; strategies to reduce risk to reforestation. Office of reforestation. Royal Forest Department.

Preechapanya, P. (2011). Durian and jungle fruit. Botanical Garden Organization, Chiangmai.

Radchanui, C. (2016). Biodiversity of *Durio zibethinus* in Saikao community, Khokpho district, Pattani province. Proceedings of the 3rd National Meeting on Biodiversity Management in Thailand, Biological and Cultural Diversity, Living in Harmony. pp. 228-237.

Royal Forest Department. (2012). Information center, information and planning department of information center. Retrieved from http://forestinfo.forest.go.th/55.

Rungpanit. N. (1985). Percent grown cover related to water and soil loses in mountains forest in Thailand. Soil Erosion and Conversation, Soil Conversation Society of American, Ankeny, Lowa.

Uncle Reaw. (2014). Interview schedule and questionnaire designed to obtain the required information. Research instruments**;** Pattern and potential production of Durian in SaiKhao community, Kokpho district, Pattani province, Prince of Songkla University, Hat Yai Campus, Songkla, Thailand.

Young, A. (1989). Agroforestry for soil conservation. International Council for Research in Agroforestry. Wallingfrond: Wheaton.

(Received: 4 July 2017, accepted: 30 October 2017)