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The Global Challenges on The Development and  
The Education of Mathematics and Science

Faculty of Mathematics and Science  
Yogyakarta State University

# 3<sup>rd</sup> ICRIEMS : The Global Challenges on The Development and The Education of Mathematics and Science

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## Preface

Bless upon God Almighty such that this proceeding on 3<sup>rd</sup> International Conference on Research, Implementation, and Education of Mathematics and Sciences (ICRIEMS) may be compiled according to the schedule provided by the organizing committee. All of the articles in this proceeding are obtained by selection process by the reviewer team and have already been presented in the Conference on 16 – 17 May 2016 in the Faculty of Mathematics and Natural Sciences, Yogyakarta State University. This proceeding comprises 9 fields, that is mathematics, mathematics education, physics, physics education, chemistry, chemistry education, biology, biology education, and science education.

The theme of this 3<sup>rd</sup> ICRIEMS is '*The Global Challenges on The Development and The Education of Mathematics and Science*'. The main articles in this conference are given by six keynote speakers, which are Prof. Allen Price, Ph.D (Emmanuel College Boston USA), Ana R. Otero, Ph.D (Emmanuel College Boston USA), Dr. Michiel Doorman (Utrecht University, Netherlands), Prof. Dr. Marsigit, M.A (Yogyakarta State University), Asst. Prof. Dr. Warakorn Limbut (Prince of Songkla University, Thailand), and Prof. Dr. Rosly Jaafar (Universiti Pendidikan Sutan Idris, Malaysia). Besides the keynote and invited speakers, there are also parallel articles that presented the latest research results in the field of mathematics and sciences, and the education. These parallel session speakers come from researchers from Indonesia and abroad.

Hopefully, this proceeding may contribute in disseminating research results and studies in the field of Mathematics and Sciences and the Education such that they are accessible by many people and useful for the Nation Building.

Yogyakarta, May 2016

The Editor Team

# THE BIODIVERSITY OF HOMEGARDEN AS A FAMILY SURVIVAL AND A BASIS OF TOURISM DEVELOPMENT

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**Abstract** — Indonesia is a megadiversity country because of the plants and animals biodiversity. The Changes in socio-economic conditions have affected the community orientation from subsistence to commercial, so that it affected to the type of crops cultivated in home gardens (Arifin, et al., 2012; Mohri et al., 2013). This research aims to understand the role of biodiversity in home gardens in sustaining family life and developing tourism. The research was conducted in Manggungsari, Wonokerto, Turi and Ketingan, Tirtoadi, Mlati, Sleman, where are each of villages had taken 20 respondents randomly. The methods to collect data were through observation, questionnaires and in-depth interviewing with respondents and community leaders, and identifying the diversity of cultivated plants and husbandry animals. Data were analyzed with vegetations analysis about the important values and the Shannon-Wiener diversity index, cross-tabulations, and descriptive analysis. The results showed that in Manggungsari, Turi, the plant that has the highest important value is *Sallaca edulis* (58.81%) with 1.89 for the Shannon-Wiener plant species diversity index. It is due to the dominance of *Sallaca edulis* has become major income sources for people in Manggungsari, Turi. In Ketingan, Mlati, *Musa acuminata balbisiana* Colla (6.42%) has the highest important value with 4.58 for the Shannon-Wiener plant species diversity index, including high-value category ( $1 < 4,58 < 3$ ). The highest important value for Fauna in Manggungsari, Turi, is *chicken* (46.5%) with 2.46 for the Shannon-Wiener animal species diversity index. In Ketingan, Mlati, *Egretta alba* (89.91%) has the highest important value with 1.19 for the Shannon-Wiener animal species diversity index. It is due to the dominance of *Egretta alba* there. This value included in the medium category approach low (the low-approach-medium category) or the ecosystem condition is adequate (still quite) balanced but unsteady. Their excellence plant made Manggungsari, Turi, known as an agro-tourism of *Sallaca edulis*, as well as their dominance of *Egretta alba* in Ketingan, Mlati which made the village known as a fauna-tourism village of *Egretta alba*. The advantages (excellence) of plants and animals that possessed both of the villages can develop the village as a tourist village.

**Keywords:** *biodiversity, homegardens, survival and tourism development*

## I. INTRODUCTION

The biodiversity in homegardens are part of the global biodiversity of our nation and have an important role for a community's life. In terms of ecology, the homegarden is an area with an integrated system and has a strong relationship between the human being as an owner with crops, plants, fish, wildlife and animals are cultivated, in addition to the diversity of plants and animals in homegardens also has a function in the interests of social, cultural and religious (Danoesastro, 1977, Soenoadji, 1983 and Arifin et al., 2009). The homegarden is also often referred to as the granary of life (food source of life such as food crops and horticulture, the results of pets and fish), tavern life (different kinds of plants and animals are at all times ready for sale for family purposes) and herb (various types of plants drugs that can be used for traditional medicines are efficacious (Danoesastro, 1977 and Soemarno, 2011), so the homegardens has the potential to increase incomes and families meet the nutritional needs, so the homegardens is able to contribute the public income between 4.47% - 61% (Soenoadji, 1983; Yulida, 2012 and Saptana, 2014).

The choice of plants and animals are cultivated in homegardens is strongly influenced by land management purposes by the owner both in terms of economic, social, cultural, religious, comfort and satisfaction as well as the economic value of a crop and animal products. Changes in socio-economic

conditions have affected the orientation of farmers in managing the diversity of plants in their homegardens of subsistence to the commercial so the effect on the number of plant species cultivated in homegardens (Kehlenbeck, et al. (2007), Arifin, et al. (2012). Mohri et al. (2013), Piyre, et al. (2006).

The biodiversity of plants and animals have important value in an area that can be seen both from the number of species of plants and animals as well as the number of individuals of each species of plants and animals are cultivated by farmers, so that the same plant may not necessarily have equal importance value in the region different. In addition, it can be seen from the use of plants and animals by the people to meet the needs of daily life and to develop the villages, therefore, this study aims to assess the potential of biodiversity both seen from the significance, benefits in contributing to family income as well as plants and animals that are the hallmark of products to be used as a tourist attraction of plants and animals cultivated or wild living.

## II. RESEARCH METHODS

This study uses a combination approach, which is a quantitative approach while also using a qualitative approach (Sugiyono, 2013). A Quantitative approaches are used to assess the biological diversity of both plant and animal and qualitative approaches to assess the characteristics of social, economic and cultural community in utilizing biodiversity in home gardens both to increase family income and to increase the potential of village. Determination of the village is used purposive sampling. It is based on a village that has featured both of plants and animals cultivated or wild life in Sleman. Furthermore, every village taken one hamlet in the same way and every hamlet of 20 families were taken as respondents randomly (Singarimbun and Effendi, 1989). Based on this method were selected as sample village is Hamlet Manggungsari, Wonokerto, Turi which has featured plants of *Sallaca edulis* and Hamlet Ketingan, Tirtoadi, Mlati which have featured wild animals of *Egretta alba*. Methods of data collection is done through observation, interviews, questionnaires and in-depth interviews with respondents and community leaders as well as the identification of plant and animal diversity. Further analysis of benefits and vegetation analysis by calculating the density, relative density, frequency, relative frequency, and the important value of plants and animals. In addition it also conducted vegetation analysis by counting the Shannon-Wiener index of species diversity ( $H'$ ), uniformity index (E) and richness Index (R1). (Soerianegara and Indrawan 2005, Odum, 1993; and Setiadi, et al., 1989).

## III. RESULTS AND DISCUSSION

### A. *The Role of The Biodiversity In homegardens Based on Important Value of plants and animals and the Benefits In Families Life Sustainable*

The Important value can be used to determine the dominance of a plant or animal species to others species that describes ecological notch a plant or animal species in the community (Mueller-Dombois and Ellenberg, 1974). Based on the results of analysis show that the important value of plant species ranged from 0.15% - 59.81% to the highest important value is *Sallaca edulis*, while the important value of animals ranged between 1.08% - 89.91% to the highest important value is wild birds *Egratta alba* in Ketingan, Mlati. The number of plant species ranging between 191-196 species, with a number of individuals ranging between 3094-17358 individual plants. Based on Shannon Wiener index diversity value of plants ( $H'$ ) in Ketingan, Mlati obtained indices the diversity of plants in the high category ( $> 3$ ) that is equal to 4:58 and in Manggungsari, Wonokerto, Turi, the value diversity index of 1.89 is included in the medium category. The medium Value due to the dominant plant in Turi is *Sallaca edulis*. *Sallaca edulis* in Turi has important value is very high at 59.81%. This is because *Sallaca edulis* become a major income source community in Turi, so plants are less productive and do not have a lot of economic value are replaced with plants of *Sallaca edulis*.

The results showed the number of species of fauna in Ketingan as many as 25 kinds with 1084 individuals and animal species diversity index of 1.19, while in Manggungsari, Wonokerto as many as 23 species with 228 individuals and animal species diversity index of 2.46. Based on the value of Shannon Wiener diversity index ( $H'$ ) of animal species has a value that is medium classified (Odum, 1993). In the hamlet of Ketingan there are animals that dominate is *Egretta alba*. The presence of wild animals that dominates cause the value of animal species diversity index approaching the lower categories, namely 1,19, even the important value of *Egretta alba* reached 89.91%.

Besides the type of plant, people in Sleman too many cattle to seek revenue sources, increase revenue, or to meet the needs of daily life of the family. Cattle that are commonly is beef (Hamlet Ketingan, Tirtoadi), goats (Hamlet Manggungsari, Wonokerto), chickens, ducks and wild duck. In addition, some small communities work on the fish in the pond located in homegardens. Of the cultivated cattle can be

produced meat, milk and eggs. Meat and dairy plays an important role in meeting the food needs according Dietary Pattern of Good Hope, which is one element of animal food. (Ministry of Agriculture, 2012).

The potential biodiversity based on benefits can be classified as food crops, fruits, vegetables, coloring and flavoring, ornamental plants, medicinal plants, plantation plant, and building materials plants, handicrafts plants, wood plants and others, while the animals can be classified as economically valuable animals, pets and animals for pleasure and wildlife.

In the grouping based on these benefits, there is a type of plant that can have dual functionality both as a medicinal plant, or as ornamental plants, such as leaves of red betel.. Likewise, there is a plant that belongs to the group of vegetables, but also as an alternative food ingredient, eg breadfruit. Breadfruit can be used as an alternative source of food substitution of rice for carbohydrates contained in 100 g breadfruit flour equivalent to 100 g rice (Supriati 2010) and substitutes the use of wheat (Djaafar and Siti Rahayu, 2005).

Utilization of plant based on important values in Manggungsari and Ketingan Hamlet can be seen in Table 1.

Table 1. Utilization of Plant Community Based Important Value (INP)

No	Grouping		Hamlet of Manggungsari, Turi		Hamlet of Ketingan, Mlati	
			Type of plant	NP (%)	Type of plant	NP (%)
1.	crops	3 biggest	<i>Monihot utilisima</i>	2,74	<i>Monihot utilisima</i>	3,02
			<i>Calocasia esculenta</i>	1,76	<i>Calocasia esculenta</i>	2,33
			<i>Canna edulis</i>	0,80	<i>Canna edulis</i>	0,79
2	fruits	3 biggest	<i>Sallaca edulis</i>	59,81	<i>Musa balbisiana</i>	6,42
			<i>Musa balbisiana</i>	2,32	<i>Nephelium lappaceum</i>	4,45
			<i>Artocarpus heterophyllus</i>	2,20	<i>Carica papaya</i>	3,84
3	vegetables	3 biggest	<i>Capsicum frutescens</i>	21,86	<i>Amaranthus hybridus</i>	2,99
			<i>Brassica campestris</i>	4,71	<i>Sauropus adrogynus</i>	1,71
			<i>Phaseolus vulgaris</i>	1,99	<i>Pandanus amaryllifolius</i>	1,31
4	plantation or indus-trial plants	3 biggest	<i>Gnetum gnemon</i>	1,35	<i>Gnetum gnemon</i>	5,16
			<i>Ricinus communis.</i>	0,53	<i>Theobroma cacao</i>	0,89
			<i>Syzygium aromaticum</i>	0,47	<i>Coffea arabica</i>	0,49
5	ornamental plants	3 biggest	<i>Codiaeum variegatum</i>	1,81	<i>Sansevieria trifasciata</i>	5,45
			<i>Sansevieria trifasciata</i>	1,56	<i>Euphorbia sp.</i>	4,72
			<i>Euphorbia sp.</i>	1,34	<i>Adenium sp.</i>	3,77
6	medicinal plants	3 biggest	<i>Zingiber officinale</i>	1,50	<i>Alpinia galanga</i>	1,98
			<i>Alpinia galanga</i>	1,27	<i>Zingiber aromaticum</i>	1,79
			<i>Citrus aurantifolia</i>	1,06	<i>Aloe vera</i>	1,22
7	plants for building.	3 biggest	<i>Albisia sp.</i>	3,18	<i>Gigantochloa apus</i>	5,68
			<i>Swietenia mahagoni</i>	2,39	<i>Swietenia mahagoni</i>	4,29
			<i>Glyricidia sepium</i>	2,01	<i>Cocos nucifera</i>	3,31
8	plants for culture	3 biggest	<i>Sallaca edulis</i>	59,81	<i>Cocos nucifera</i>	3,31
			<i>Cocos nucifera</i>	2,38	<i>Codiaeum variegatum</i>	2,82
			<i>Codiaeum variegatum</i>	1,81	<i>Chrysalidocarpus lutescens</i>	1,66

Source: The Primary Data Analysis

Based on Table 1 note that for food crops, cassava has a high importance in both locations. This is because in addition to cassava as a food crop leaves are also used as a vegetable that is appreciated by the community. Fruit of *Sallaca edulis* in Turi has important value 59.81%, this was due *Sallaca edulis* is a plant which became a major source of income in Turi. Fruits that have a high importance in both locations was the banana, it is because banana breeding through shoots quickly form clumps without having to

plant a new crop. In addition, bananas kapok is also favored by the people to serve fried bananas, Molen or boiled.

Plant vegetables that have high economic value in Manggungsari Turi is a chili that has important value of 21.86%. This is because the chili in Turi is a plant that is generating income after *Sallaca edulis*, while the chili in Ketingan planted community in homegardens is not for sale but for self-sufficient. As for plantation or industrial plants, *Gnetum gnemon* dominate at both locations. This is because the fruit *Gnetum gnemon* have economic value and easy to sell. Traders of *Gnetum gnemon* fruit in its season will come to a citizen to purchase *Gnetum gnemon* (nebas) so that people feel disadvantaged by planting *Gnetum gnemon*. In one year *Gnetum gnemon* plants can produce fruit twice.

The community activities are related to the cultivation of plants and animals in homegardens in addition to supplement the family income is also closely related to the role of plants and animals in people's lives, such as for initial steps disease prevention, cultural activities followed all citizens, or by a family in the life cycle (births, marriages and deaths).

In addition to plants, people also raise animals that have economic value as beef (Ketingan, Mlati) and goats (Manggungsari, Wonokerto) were all in the form of fattening, after fat or big it will be sold and bought again smaller with more number to be raised again. The family sold the animals ahead of Eid al-Adha, thus raising goats and cows can be a family's savings. Other animals that are kept are cats, dogs, canaries were all in the form of pets and can give pleasure to the family. Dogs kept apart to give pleasure can also help keep the house so that if there are foreigners who come already barking first.

Pet who score the highest importance in both locations was a chicken (from 36.8 to 46.5%), and this is because almost all of the peoples raise chickens for the purpose of eating leftovers family, to produce eggs for family purposes or slaughtered when needed family. As for the wild animals that have a high important value is the *Egretta alba* in the hamlet of Ketingan, Tirtoadi, Mlati which reached 89.9%, so that this animal has its own advantages for Hamlet of Ketingan. To preserve the *Egretta alba*, the community provides comfort by planting crops that became a favorite the *Egretta alba* perched like mahogany and bamboo as well as prohibiting people who are poaching the *Egretta alba*.

In daily life in the countryside can not be separated with cultural activities that take advantage of biodiversity as a manifestation of human relationships, whether it is man's relationship with God as the religious event (Eid al-Adha, Christmas with fir tree, Palm Sunday with palm leaves, assortment of flowers on a Hindu religious ceremony), the relationship between humans at weddings, births and deaths are all using plants. Man's relationship with each other as in a wedding event is marked by a variety of foliage as leaf croton in a twin Mayang, sugarcane wulung, fruit plantain on Tarub, mert earth with a variety of produce from home gardens as a form of thanksgiving and invoking the protection of God, banquet (feast relating to births, marriages, seven monthly, death), wiwitan as thanksgiving for rice that has been ready for harvest using bark plants, Pulutan, artocarpus camansi. Man's relationship with the people who have died, for example, sow a wide variety of flowers on the tomb like rose, jasmine, ylang-ylang, magnolia and telasih.

### **B. Role of Biodiversity Based Product Advantages To Develop Tourism**

Livelihood or their livelihoods greatly influence the choice of plants and animals grown in home gardens. People in the hamlet Manggungsari, Turi, the majority still rely necessities of life on land owned, so the land becomes very important both to support their daily living and to satisfy all their needs in various aspects of life of short-term and long-term by utilizing livestock or cultivated plants is primarily by planting pondoh and chilli and raise goats as the main source of income.

In areas are closer to urban areas, namely in Ketingan, Mlati, some people have wetland and also working as an employee, then either plants or animals that are cultivated or wild not be the primary source of revenue to sustain life. The presence of wild animals are huge numbers, were able to provide additional income for the community because of the existence of these animals attract many people to come see it so Dusun Ketingan into a tourist village fauna. This happens in Hamlet Ketingan, Tirtoadi, Mlati, Sleman, where the village is home to *Egretta alba* like the place to stay and nest, especially at the beginning of the rainy season until the beginning of the dry season. In the season *Egretta alba* easy foraging in the area and its surroundings because many people who grow rice so much food available for birds kuntl. , The change of season is also sometimes shifted the presence of *Egretta alba* in the hamlet Ketingan, it is sometimes for people less profitable, because the village board has been willing to accept vacationers turns at the specified time *Egretta alba* have not come to the hamlet Ketingan so vacationers coming void visit. There are three types of herons who live in Ketingan namely:

1. Little *Egretta alba* (*Egretta garzetta*) with the characteristics of her rather large and slender, larger than the buffalo herons. In the breeding season, this bird has two thin white ornamental feathers

elongated on the back of his neck. Legs and feet are black. Like little *Egretta alba* foraging in the fields and eat many kinds of fish, tadpoles, water insects and grasshoppers.

2. Great *Egretta alba* (*Egretta alba*) with the characteristics of large-sized body. Much larger than the white herons, typical knotted neck, black legs, yellow beaks are usually tipped black, black feet and legs, live alone or in groups, stand a little straighter and peck prey encountered. These birds eat fish, shrimp, grasshopper, dragonfly larvae that inhabit the rice fields
3. Buffalo *Egretta alba* (*Bubulcus Ibis*) with the characteristics of small, white fur, but during the mating season, the feathers on the head, neck and back are yellow orange. Yellow beak and thicker than other herons and black legs. *Bubulcus ibis* foraging in fields and rice paddies as fish, frogs, invertebrates, insects. Herons buffalo in Indonesia, including the species of birds that are protected by the Act through 1931 No. PP Wild Animals 266, SK Mentan No. 301 / Kpts- 11/1991 and Law No. 5 of 1990 (Aldio 2004, Noerjito and Maryanto, 2001)

In addition to the three types of *Egretta alba* in above Ketingan above there are also blekok birds (*Ardeola speciosa*) is a discrete body length of about 46 cm. Part of yellow and black on the ends. During the non-breeding brown color backs. These birds foraging in the fields such as insects, fish, and crabs. *Egretta alba* have made their village Ketingan increasingly recognized from the outside and the many tourists who come. To increase the attractiveness of tourists, the local community, led by Mr. Haryana complement fauna travel with a package that includes cultural attractions and activities associated with farming in rice fields. Cultural attractions include: a. Gejok dimples played by the PKK, b. Peng Bung namely music using klenteng and flute accompanied by dances and c. jathilan, while the events related to agricultural activities, among others: a. plowing fields using cattle to plow and harrow, b. angler ie activities after planting rice with a cone and ingkung (whole chicken) as the hope that a good harvest is not attacked by pests or diseases, c. wiwit, as a form of thanksgiving before the rice harvest, usually done one week before the rice is harvested in the form of rice, sauce sprawl, botok Yuyu (Crab fields) and are equipped with a variety of foliage as the leaves barking as a symbol to refuse reinforcements or pests; Pulutan plant as a symbol of the adhesive, so that the crop is not quickly exhausted; leaf shoots cane as a symbol of steadiness heart, leaves artocarpus camansi as a symbol so that the result is always excessive.

In addition to cultural attractions and activities associated with agriculture, in July also held that merti earth, except the month of fasting coincides month, then postponed event. Such activities as a form of gratitude and thanks to God for the land that has been acquired by the event: jamasan kris, sent to the grave, tirakatan followed by all citizens, Parade around the village and puppet with a story that has to do with bringing home Dewi Sri ( rice).

#### 1. Tourism Village Based On Product of Excellence Plant (Agrotourism)

Tourism village based on products of superior plants that are cultivated or agrotourism in this study was found in Wonokerto village, Turi. The village is famous as the agrotourism of *Sallaca edulis*, where visitors can learn how the cultivation of *Sallaca edulis* and can pick their own fruits desired. In addition to the agrotourism, in Wonokerto village also was built Museum of *Sallaca* "Dewi Pule" which provides information on various things about the cultivation of *Sallaca*, ranging from farmer equipment of *Sallaca edulis*, kinds of *Sallaca sp.*, plant pests of *Sallaca sp* preserved in the form of a mounted, processed craft of *Sallaca sp.*, processed culinary of *Sallaca sp* and information services on various issues regarding of *Sallaca sp.* that is located in the hamlet Pulesari, Wonokerto, Turi, Sleman.

The Cultural activities using the fruits of *Sallaca* is an event "Tunggul Arum" in Wonokerto. In this activity, created a mountain of fruits of *Sallaca* to complement the cultural activities

#### 2. Tourism Village Based On Fauna

Wild fauna living in an area in Sleman is *Egretta alba* in Hamlet Ketingan, Tirtoadi, Mlati. In this village visitors can find *Egretta alba* perched in various types of leafy trees in front of the gate, along the road in the hamlet Ketingan and in front of the houses of residents. In addition visitors can find the natural atmosphere of the village, visitors can also enjoy a variety of activities and enjoy a wide variety of art and cultural performances special typical of Ketingan. Performances related to the agriculture is starting from dropping directly into soil to grow rice, plowing, wiwit, and harvesting rice yellowed. Furthermore, visitors can enjoy cultural activities and artistic performances special of Ketingan Hamlet, like jathilan, gamelan, wayang kulit and Peng bung are played by locals community. For visitors who want to settle down temporarily, in the village are provided home stay with traditional Javanese house (joglo) is unique and comfortable.

Another interesting thing in Hamlet Ketingan is dreamy and see the activity of white *Egretta alba* in viewing post. The right time if you want to see *Egretta alba* was in the morning and evening, in the morning *Egretta alba* doing activities with blown out with clustered village, whereas in the evening *Egretta alba* will return home to Hamlet Ketingan. In addition, during the full moon visitors can view the behavior of unique *Egretta alba*, *Egretta alba* will fly from afternoon until night above the hamlet Ketingan. Hamlet of Ketingan already become habitat and home to *Egretta alba*, because of the environmental wisdom of communities to provide a comfortable atmosphere for *Egretta alba* by planting trees favored by *Egretta alba* such as mahogany and bamboo.

#### IV. CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis and discussion, the biodiversity in homegardens has benefits and important values that have the potential to:

- a. The biodiversity in homegardens based benefits to plants are classified as food crops, fruits, vegetables, coloring and flavoring, ornamental plants, medicinal plants, plantation crops and building materials plants and crafts. As for the animals grouped in economically valuable animals, pets and wild animals for pleasure.
- b. Based on the important values obtained plants with important value is the highest (*Salacca sp.*) and animals with the highest important value is *Egretta alba*. Important value of plants as product excellence has been the primary source of revenue in the hamlet Manggungsari, Wonokerto, Turi in the form of fruits of *Sallaca* as well as a village have become agrotourism of *Sallaca edulis*. While this type of wild animals *Egretta alba* that have the highest important value has been able to attract tourists to view thereby increasing people's incomes and simultaneously develop the village into a tourist village of fauna.

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