

# The potentials of home garden plants and animals in Minggir and Godean sub-districts, Indonesia as the learning resources of biodiversity

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## ABSTRACT

The biodiversity in home gardens is a part of the nation's biodiversity and has a leading role for a community to produce the supplementary food, vitamins, proteins, minerals, fat, crude fiber from fruit and vegetables to meet the needs of their daily lives. This study aims to identify the diversity of plants and animals found in the researched home gardens, describe the benefits of both for the community, and utilize the results of this study as a learning source of biology, especially biodiversity. The sample members in this study were determined by stratified random sampling done in strata, namely the region, sub-district, village, and hamlet. As many as 20 respondents had been involved randomly from each hamlet, including from Brajan (Minggir sub-district) and Berjokulon (Godean sub-district) in Yogyakarta Special Province, Indonesia. The data were collected through observation, questionnaires and in-depth interviews and analyzed by the vegetation analysis, the Shannon-Wiener diversity index, and the descriptive analysis technique. The results show that in Minggir there have been 163 types of plants and 24 types of animals. The plant diversity index (DI) is 3.99, its fairness index is 0.79, and its wealth index is 19.76. Besides, Godean has 143 types of plants and 24 types of animals with its plant DI, fairness index, and wealth index respectively are 3.96, 0.79, and 19.75. The plant biodiversity in home gardens based on their benefits is classified into crops, fruit, vegetables, coloring and flavoring plants, ornamental plants, medicinal plants, plantation crops, building material plants, and crafts. The animals can be classified into economically valuable animals, pets for fun, and wild animals. The results of this study can be used as a biology learning resource, especially biodiversity.

*Key words* : Home garden, Biodiversity, Learning resource

## Introduction

The biodiversity of home gardens is a part of the biodiversity owned by the nation and has a major role for people's lives in producing additional food, vitamins, proteins, minerals, fats, crude fiber from fruits and vegetables to meet daily living needs. The home garden has the potential to increase people's income and meet the households' nutritional needs because the homegardens can contribute to the com-

munity income from 4.47% to 61% (Yulida, 2012; Saptana, 2014). The diversity of plants and animals in the homegardens can sustain the lives of the community continuously and has an important meaning in ecology, economy, society, culture, and health. Minggir and Godean sub-districts are the western parts of Sleman Regency that are noted as agricultural and handicraft-based areas, so that they can be the bases for studying biodiversity. Agriculture and handicraft-based areas are those where the majority

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of the population work as farmers and artisans or employees, but still, have a part-time job as farmers or artisans. The importance of bamboo as a handicraft basic material certainly affects the selection of plants planted in the homegarden, so it is necessary to know how biodiversity is present.

Based on the objectives of plant biodiversity by the community can be grouped into 4, among others are (a) for the main source of income to meet the needs of life, (b) for additional income, (c) to provide comfort, beauty and satisfaction, and (d) to preserve plants or animals and provide a set of cultural activities. Based on the biodiversity in the homegarden, it is necessary to know how the potential diversity of plants and animals in the homegardens is used as a learning resource. During the last five years, in Minggir and Godean sub-districts there has been relatively high land conversion (BPS, 2016) as well as land fragmentation due to the distribution of inheritance to their grandchildren. Besides the increasing number of people, more and more people need land for settlements so that there is a change in the area of ownership of the homegarden. The change in the area of the homegardens certainly affects the landowners in managing their homegardens with various alternatives and innovations, for example by choosing how to plant cultivated crops such as planting directly in homegardens, pots, hangingpots, or through verticulture, and so on.

Based on this, it is necessary to know whether there is a land management model leading to sustainable biodiversity conservation. The selection of plant species that will be cultivated will affect the type of wild animals that come in their homegarden and then affect the diversity of animals in homegardens (Adisoemarto and Soenartono, 1998) so the question arises is "how is the diversity of animals that exist now?" It is important to examine the plant and animal biodiversity in homegardens and its potentials as a source of learning the biodiversity. Based on the background above, this study aims to identify the diversity of plant and animal species found in the researched homegardens, describe the benefits of both for the community, and utilize the results of this study as a source of biology learning, especially biodiversity.

## Method

The members of the research sample were deter-

mined by the stratified random sampling, in which they were selected based on the strata, namely region, sub-district, village, and hamlet (Singarimbun and Effendi, 2008). In a researched region were 2 sub-districts taken, in each sub-districts was one village taken, and in each village was a hamlet chosen as the smallest government unit with the purposive random sampling. Then in each hamlet 20 heads of households were randomly drawn as respondents. Based on this method, the hamlets selected as sample members were Brajan hamlet, in Sendangagung village, Minggir sub-district, and Berjokulon hamlet, in Sidoluhur village, Godean sub-district, the agriculture and handicraft-based hamlets. The data obtained include primary and secondary data. The primary data were collected through observation, questionnaires, in-depth interviews, and the identification of plants and animals, while the secondary data were taken from the documents of Department of Agriculture, District Offices, Central Bureau of Statistics and literature studies including books, journals, documents and study reports. The data obtained were used to calculate the species density, relative density, type frequency, relative frequency and the importance value. To illustrate the species diversity, ecosystem stability, productivity and pressure on ecosystems, data from each researched location were calculated by the Shannon Wiener diversity index, uniformity index, and the wealth index.

## Results

### Identification of Biodiversity in Home Gardens

In Brajan, Minggir, there have been 163 types of plants and 24 species of animals, and in Berjokulon, Godean there have been 143 types of plants and 22 species of animals. Based their benefits, they are classified as food crops (12 species) planted by 92.5% residents, fruit (33 species) grown by 100% residents, vegetables, coloring, and seasoning plants (28 species) by 97.5% residents, ornamental plants (71 species) by 100% residents.

Additionally, medicinal plants (28 types) are grown by 100% residents, plantation crops (10 species) are planted by 67.5% residents, and plants for building materials, crafts, wood, and others (34 types) are maintained by 100% of citizens. As for the importance value and the diversity index of plants and animals in the areas based on agriculture and handicraft can be seen in Table 1.

**Table 1.** The Importance Value (IV) of Plant and Animal Diversity

No	Description	Agriculture and Handicraft	
		Brajan	Berjokulon
1	Number of plant types	163	143
2	Number of individuals	3631	1323
3	The highest IV of plants	10.95	11.16
4	The lowest IV of plants	0.17	0.27
5	Shannon-Wiener DI	3.99	3.96
6	E	0.79	0.79
7	R <sub>1</sub>	19.76	19.76
8	Number of animal types	24	22
9	Number of individuals	361	233
10	The highest IV of animals	54.93	85.65
11	The lowest IV of animals	1.29	2.02
12	Shannon-Wiener DI	2.38	1.69
13	E	0.75	0.55
14	R <sub>1</sub>	3.91	3.85

Source: Primary Data Analysis  
 where: DI = Diversity Index,  
 E = Evenness Index,  
 R<sub>1</sub> = Wealth Index

The people in Minggir sub-district, especially Sendangagung village, are mostly farmers and craftsmen of bamboo and *Fimbristylis globulosa*, while the communities in Sidoluhur village are tile makers, farmers, and employees. However, even though working as an employee, people in Minggir sub-district, in the afternoon or during their free time, cultivate their farmland, either rice field or cropland, by planting various crops. From the results of farming in the fields it is known that the rice produced in addition to being cooked for daily meals, the people also sell the crop in the form of grain or rice so that it can be a source of income for the community.

In addition to rice plants, there are also so many *Mendong (Fimbristylis globulosa)* plants in the Minggir sub-district that this place is famous for its *mendong* producers who make *mendong* mats or *klasa* and other products such as *mendong* bags and *mendong* wallets. In addition to *mendong*, other people's livelihoods are bamboo handicrafts, especially those made of bamboo *apus (Gianthochloa apus)*, so that in Minggir sub-district bamboo *Apus* has relatively high importance index, which is 6.18%, and includes the top five in terms of the importance value of the existing plant species. Bamboo woven craft centers produce household appliances

such as *asbesek, tenggok, tumbu, tambir, tampah, kalo, and kepang*, and also home decoration like hanging lamps. They can be found in the Saidan, Brajan, Diro and Kwayuhan areas. If the bamboo in their home garden is not available anymore, the bamboo used for the craft business can be obtained from Kulon Progo and Purworejo areas which are sold in the field near Sendangagung market, Minggir sub-district. In this case, many people take the opportunity to market the raw material for handicrafts, namely selling bamboo that has been sliced/sliced (ready for weaving).

The livelihood of the Godean Sub-District community, especially in Sidoluhur village besides farming, is the tile industry. Even though in the tile industry they are the employees, they still work on their own rice fields with partially paid labors or having it done entirely by others. Godean, an area closer to the sub-district and urban capitals compared to Minggir sub-district, also has more newcomers, namely 814 permanent residents and 310 impermanent occupants, as well as its human population density which are 2,455 per km<sup>2</sup> in Godean, while in Minggir are 1,073 per km<sup>2</sup>.

**Patterns of Life**

The community life in agricultural and handicraft-based areas, both in Minggir and in Godean, is still relatively close to one another, which is shown by their mutual cooperation or community work to work on the environmental hygiene program and patrol to maintain the village security. The tile industry in Godean is mostly a home industry, in which the workforce is all family members on their own and some employ 2-4 workers. This tile industry uses clay obtained from Godean sub-district, especially from Sidorejo village and from Kulonprogo (Kalibawang). The Clay from these two places is intentionally mixed to obtain better tile products. Through tile business, the community has important knowledge, including (a) characteristics of good clay to make tiles, (b) appropriate mixing procedure for the better clay, (c) good proportion of clay mixture for tile, (d) proper tile printing, (e) good tile thickness, (f) proper tile heating, and (g) tile marketing methods.

The people in Sendangagung village, Minggir sub-district mostly work as artisans and at the same time as farmers by working on their rice fields. Artisans are businesses that are involved in descending ways that always get innovation and coaching

carried out by the industry, trade department, and universities carrying out community service in the bamboo and *mendong* industrial areas in Minggir Sub-District. Through crafts, the community also has important knowledge that is closely related to the process of bamboo and *mendong* craft making, such as (a) characteristics of good *mendong* and bamboo for use as craft materials, (b) bamboo cutting techniques, (c) the process of making the handicraft from raw materials to finished materials, and (d) handicraft product marketing.

Both Godean and Minggir hold routine events related to *mertidusun*. Godean people hold it at the sub-district level, while Minggir people hold it at the village level, namely in Sendangagung village with an event known as *Tunggul Wulung* held annually in the Javanese month *Sapar*. In this event, the community brought various kinds of raw and processed agricultural products and then assembled in the form of mountain-like decorated agricultural products. The attractions shown in the *Tunggulwulung* program include *tayuban* and *wayangan* (puppet) with a permanent play, "*Betari Sri Mulih*" as a symbol of prosperity. *Tunggul Wulung* is also hold as a tourist attraction and scheduled for tourism activities in Sleman Regency.

### Biodiversity

In agriculture and handicraft-based areas, especially in Minggir sub-district, many kinds of crops are well cultivated so that they appear green. Sendangagung village community in Minggir maintains a variety of plants to make the living environment comfortable, economically these plants do not bring any profit in a short time or to enjoy the results required for a long time, for example, *Tectonagrandis*, *Swietenia mahogany*, and *Albisia sp.* Therefore, in this area there is no dominance of one type plant due to commercialization as stated by Kehlenbeck *et al.*, 2007; Arifin *et al.*, 2012; Mohri *et al.*, 2013. In Sendangagung village, there are also people who plant *Ficus Benjamina* trees, where this plant also has a function to maintain the ground waters. Besides, the plants that are used for wood such as *Pterocarpus indicua* and *Leucaena leucolepala* are also grown.

In agriculture and handicrafts based areas, the plant diversity, especially food crops, has a high number of plant species (12 species). This is because people in areas based on agriculture and crafts, especially the parents, still like to eat food made from

food crops such as Ganyong (*Canna edulis*), *Uwi* (*Dioscorea alata*), *Garut* (*Maranta arundinacea*) and *Gembili* (*Dioscorea esculenta*). The number of various kinds of food actually supports the government's program on the policy of accelerating the diversification of food consumption based on local resources. Regarding this, Presidential Regulation Number 22 of 2009 and Food Consumption Diversification Acceleration (P2KP) requires people to optimize the use of the homegarden as programmed by the government in the General Guidelines for the Sustainable Food House Area Model (KRPL Model).

In addition to food crops are also a lot of fruit plants, vegetables as living stalls, and ornamental plants. Medicinal plants as living pharmacies are also grown to anticipate minor health problem, like burning in children can be medicated with *Erythrina lithosperma* leaves, diarrhea with guava leaves, and any wound with iodine latex and Aloe vera. In this area, people also plan some plants for building materials. The yield or product of plants cultivated in the homegarden in this area supports many people to meet their daily needs such as vegetables for cooking, thus reducing their daily expenditure. However, not all of the crops are sold for their own purposes. In addition, some are used for social purposes by sharing with the nearest neighbors or for cultural purposes. There are people who deliberately plant crops that are needed for health, namely *Erythrina lithosperma*, *Ricinus comunis* and customary needs such as wedding and *wiwitan* by planting *Saccharum officinarum* (*Tebu Wulung*), salacca, and coconut. If there are other people who need them, such as coconut leaves and *Saccharum officinarum* for wedding purposes, the owner may let them take it by themselves free. Likewise, the fruit and the vegetables planted in the homegarden also often function for social purposes because ordinary owners share their fruit to their neighbors. Plants whose crops are sold are only plants that almost all neighbors already have, like *Nepheleum lappaceum*, *Musa balbisiana*, and *Mangifera indica*. To increase production, farmers usually use fertilizers, both organic fertilizers and anorganic fertilizers, so they use the usual compost made by farmers. Biofertilizers are biologically active product containing selective strains of microorganisms which can contribute nutrients to the plants through microbial activity. These are supplements of chemical fertilizers as they contribute plant nutrients through bio-

logical nitrogen fixation and solubilization of immobile phosphorus (Sivakumar *et al.*, 2002). Besides other crops biofertilizers have also been found beneficial in flower crops like gladiolus, tuberose, dahlia, rose, chrysanthemum and marigold etc. (Maurya and Beniwal, 2003)

The results of the analysis show that in the area of agriculture and handicraft are found 211 types of plants consisting of 163 plant species in Brajan, Minggir with 3,631 individual plants and 143 species of plants in Godean, Berjokulon with 1,323 individual plants. As for animals, in Brajan, Minggir are found 24 species of animals with 362 individuals, and in Berjokulon, Godean are 22 species with 233 individual animals.

The small number of species and the number of individual plants in the Godean Berjokulon may be caused by the condition, that the homegarden is normally used to dry the tiles, so the land to plant crops is only on the backyard or at the edge of the house foundation. Based on the importance value of plant species, plants that have high importance in Brajan, Minggir are *Pisang Kapok* (*Musa balbisiana*, 11.16%) and cassava (9.59%), whereas in Berjokulon, Godean is *Musa balbisiana* (10.95%) and *Sansevieria trifasciata* (10.38%). This shows that the community members retain plants that have existed since the

XV century banana plants as written in Serat Centhini (Kamajaya, 1990). Meanwhile, animals that have high importance in Brajan, Minggir are chicken (54.93%) and dog (14.64%), whilst in Berjokulon, Godean are chicken (85.65%) and cat (24.59).

This is because the *Musa balbisiana* has an important meaning for the community in the area of agriculture and handicrafts, namely the fruit can be boiled or fried with a good taste, does not require special maintenance, has a rather high selling value of Rp 150,000 - Rp 200,000 per banana bunches. Meanwhile, in Godean *Sansevieria trifasciata* has high importance because this plant does not need a lot of space, can be planted along the foundation of the house, breeding it with fast shoots and also serves to absorb the air pollution. The plant diversity index (DI) values and crop uniformity index in Brajan, Minggir are 3.99 and 0.79, while in Berjokulon, Godean the DI values are 3.96 and 0.79. While the animal DI and uniformity index in Brajan, Minggir are 2.38 and 0.75, and in Berjokulon, Godean both are 1.69 and 0.55. The index value of diversity and uniformity of plant in Brajan and Berjokulon are included in the 'high' category, so that the condition of the ecosystem is stable, highly productive, and has low ecological pressure. Additionally, the animals are included in the balance cat-

**Table 2.** The Plants and Animals Having the Highest Importance Value in Brajan, Minggir and Berjokulon, Godean

No	Brajan, Minggir		Berjokulon, Godean	
	Name of Species	IV (%)	Name of Species	IV (%)
<b>Plants</b>				
1	<i>Musa balbisiana</i>	11.16	<i>Musa balbisiana</i>	10.95
2	<i>Manihot utilisima</i>	9.59	<i>Sansevieria trifasciata</i>	10.38
3	<i>Calypha siamensis</i>	8.26	<i>Cocos nucifera</i>	10.07
4	<i>Cocos nucifera</i>	8.09	<i>Manihot utilisima</i>	7.60
5	<i>Gigantochloa apus</i>	6.18	<i>Carica papaya</i>	7.37
	H'	3.99	H'	3.96
	E	0.79	E	0.79
<b>Animals</b>				
1	<i>Gallus domesticus</i>	54.93	<i>Gallus domesticus</i>	85.65
2	<i>Canis lupus familiaris</i>	14.64	<i>Felis catus</i>	24.59
3	<i>Felis catus</i>	14.45	<i>Capra aegagrushircus</i>	11.19
4	<i>Cairinamoschata</i>	12.57	<i>Cairina moschata</i>	11.19
5	<i>Anas platyrhyncos</i>	11.75	<i>Prinia familiaris</i>	10.08
	H'	2.38	H'	1.69
	E	0.75	E	0.55

Source: Analysis of Primary Data where:

H' = Species Diversity Index,

E = Type Uniformity Index

egory. Therefore, the high value of plant DI in terms of biodiversity sustainability has good prospects. The plants and animals that have the high importance value in Brajan, Sendangagung, Minggir, and Berjokulon, Sidoluhur, Godean can be seen in Table 2.

Some plants, such as coconut, banana, bamboo, Durian (*Durio zibethinus*), Teak (*Tectona grandis*), Galangal (*Alpinia galanga*), Melinjo (*Gnetum gnemon*), Papaya (*Carica papaya*) are owned by almost all families. In the area based on agriculture and handicraft, 65% of the people still plant crops in their homegardens with more than 30 species of flora, while those who plant 11-15 species of flora are only 10%. Besides, the use of medicinal plants is still relatively high, for example, a child or adult suffering from diarrhea can be temporarily medicated by Dadap Serep (*Erythrina lithosperma*) as medicine, while many others may use guava leaves for the disease, therefore, the traditional use of local medicinal plants still appears in the agriculture and craft-based areas. Likewise, medicinal plants are widely used for certain diseases by the people in Minggir and Godean. One of the examples is the use of *Kepel* leaves (*Stelechocarpus burahol*) for gout and *Mengkudu* or Noni (*Pace Morinda citrifolia*) for high blood pressure. For plants that are always used in traditional events such as weddings and funeral ceremonies, some people still maintain such crops, namely *Saccharum officinarum*, Sallaca, and *Awar-Awar* (*Ficus septica*). Thus, the agricultural area and home garden are still important to support people's daily lives, for either cooking, medicine, or house building. Besides being planted with various kinds of plants, the homegardens are also worked to look after animals such as cattle, goats, chickens, ducks, dogs, cats and fish such as Gurame (*Osphronemus goramy*), *Oreochromis niloticus*, and *Clarias sp.* The activities carried out in the home gardens are primarily to meet the needs of everyday lives so as to reduce daily expenses, for example, to meet the protein needs derived from fish and chickens. Meanwhile, cattle and goats be used for savings that can be sold on the Eid al-Adha on the Javanese month of *Besar*.

### Benefits of Plants in the Home Gardens

Based on the results above, it can be seen that the most types of plants are ornamental plants (71), and the smallest ones are the plantation, industrial, and trade plants (10). The plant grouping based on these

benefits found that some plants may have doubled functions, either as a medicinal plant or as an ornamental plant, for example, the Dewa Leaf and Red Betel. Likewise, some plants are included in the vegetable group, but they can also be alternative food sources, such as Breadfruit. Breadfruit can be used as an alternative food source for substituting rice because carbohydrates it contains in 100 grams of breadfruit flour are equivalent to 100 grams of rice (Supriati, 2010) and it may also substitute the flour (Djaafar and Rahayu, 2005).

The production plants that include food crops, fruit, vegetables and trade or Industrial crops that have the high importance in Minggir and Godean are the same, namely cassava with the importance value 7.60-9.59%, *Musa balbisiana* (10.95-11.16%), *Amaranthus hybridus* (3.36-3.66%), and *Gnetum gnemon* (1.09-3.64%). As for the ornamental plant, the same species is *Sansevieria trifasciata* (5.58-10.38%), and for the medicinal plant is *Alpinia galanga* (3.78%) in Minggir and Aloe Vera (3.36%) in Godean. Moreover, the same plant intended for house buildings in both places is coconut (8.09-10.07%). The results of the analysis show that the *Sansevieria trifasciata* has fairly high importance in both locations. This may be caused by the proliferation of the *Sansevieria trifasciata* that is proven relatively quick with buds or tillers forming clumps, and at the same time, it is used as one of the ornamental plants.

### Discussion

The potentials of the biodiversity in the homegardens can be seen from a couple of items, namely the potentials based on the importance value and the benefits of plant and animal species. The importance value (IV) can be used to determine the dominance of a species against other types or describe the ecological position of a species in a community (Mueller-Dombois and Ellenberg, 1974; Nahdi, 2012) and in this study *Musa balbisiana* and chicken are found to have the highest IV.

The results of the overall significance value analysis of plants and animals in Minggir and Godean show that the values vary from 0.17 to 11.16 for plants, and from 1.29 to 85.65 for animals. The importance values for chickens in the two regions are relatively high, from 54.93 to 85.65 because almost every family maintains chickens even though the number is only a few to eat the household food

remains.

In the area based on agriculture and handicraft, 211 species of plants are found, namely in Minggir as many as 163 species of plants with 3,631 individuals, and in Godean 143 species of plants with 1,323 individuals. Additionally, 24 species of animals with 361 individuals are found in Minggir, and in Godean there have been 22 species of them with 233 individuals. The diverse plant and animal species can be grouped based on their similarities and differences of types, as well as the diversity of genes found in one species such as the various types of banana plants found. Through this grouping, such species of plants and animals can be used as a source of biodiversity learning, especially on the gene diversity and species diversity (Indrawan, *et al.*, 2007)

Bases on the plant biodiversity in home gardens, especially based on benefits, plants are classified into crops, fruit, vegetables, coloring and flavoring, ornamental plants, medicinal plants, plantation crops, and building material plants, and crafts. The animals are classified into economically valuable animals, pets for fun, and wild animals. Based on the utilization, the role of plant biodiversity in the homegardens for human lives can be further examined.

In managing the crops in the homegardens, the research respondents may not act as economical as they are oriented, but most of them think about the community needs for cultural and social activities so that even if these plants are not profitable, the people still try to plant or preserve them. Through this activity, such plants can be used as a source of biodiversity learning, especially regarding biodiversity conservation based on the local wisdom of the community. This is in line with Haryanto's (2013) that the management of biodiversity based on the environmental wisdom can be sustained as there needs to be a balance between economic, social and environmental development through the principles of sustainable development which includes environment and environmental preservation, local community empowerment, local economic strengthening, and culture preservation.

#### Utilization as a Learning Source

Based on these plant and animal biodiversity potentials, learning resources for the biodiversity can be

developed in the following directions.

1. Based on the identification of plants that have been obtained, the learning resources can be directed to the grouping of plants in the home gardens based on the species diversity and its genes.
2. Based on the utilization, the role of plant biodiversity in the home gardens for human lives can be studied.
3. Based on the management carried out by the community, the learning resources can be directed to efforts to conserve the biodiversity in the home gardens by the community members.

#### Conclusion

The results show that in Brajan, Minggir there have been 163 types of plants and 24 types of animals with the plant diversity index (DI) of 3.99, fairness index of 0.79 and the wealth index of 19.76. Additionally, in Berjokulon, Godean are 143 types of plants and 24 types of animals with the plant DI of 3.96, fairness index of 0.79 and the wealth index of 19.75. The biodiversity in home gardens based on the benefits show that plants are classified into crops, fruit, vegetables, coloring and flavoring plants, ornamental plants, medicinal plants, plantation crops, and building material plants, and crafts, and animals can be classified into economically valuable animals, pets for fun, and wild animals. The results of this study can be used as biological learning resources, especially the biodiversity.

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