

## CONSERVATION BEHAVIOR OF PLANT BIODIVERSITY: SUPPORTING ENVIRONMENTAL SUSTAINABILITY

DIANA VIVANTI SIGIT\*, RIZHAL HENDI RISTANTO AND SHAFIRA RAMADHANTY ADITYANINGSIH

*Biology Education, Universitas Negeri Jakarta, Rawamangun Muka Street, East Jakarta, Indonesia.*

\*Corresponding author: [mdianav@unj.ac.id](mailto:mdianav@unj.ac.id)

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**Abstract:** This study describes the plant-biodiversity conservation behavior among natural science and social science university students. It was conducted using survey questionnaire techniques. The instrument in this study contained statements regarding conservation behavior towards plant biodiversity. The instrument indicator was based on the principle of Conservation Law No. 5 of 1990, namely: 1) Protection, 2) Preservation, and 3) Utilization. The instrument showed that all items were valid and reliable. The data was analyzed descriptively. The result indicated that students, in general, had good responses to plant-biodiversity conservation behavior. Plant-biodiversity conservation behavior was good, with natural science students more inclined towards it than social science students. University students also had the same average percentage in each of the conservation indicator. Conservation plant biodiversity is very important to be improved to preserve environmental sustainability. This research recommends that social science students must also learn about conservation behavior to support environmental sustainability.

Keywords: Biodiversity, conservation, plant.

### Introduction

Indonesia is a country with substantial species diversity. However, there are many conservation problems, such as the high rate of plant species extinction. Some 240 species of plants have been declared rare while 36 species, especially trees, are known to be extinct (Kusmana & Hikmat, 2015). This is due to s utilization rates proportional to the lack of public awareness of the importance of plant diversity (Fauzi & Fariantika, 2018; Zhao *et al.*, 2018). One of things that can overcome the problem of reduced plant biodiversity is conservation actions (Markaki, 2014). Conservation also needs to be developed among various groups not only in the form of knowledge but also in the form of action to maintain environmental sustainability (Avan *et al.*, 2011; Komala *et al.*, 2020; Rahmayanti, Ichsan, Azwar, Damayanti, *et al.*, 2020; Suharini, Ariyadi, *et al.*, 2020; Suharini, Kurniawan, *et al.*, 2020).

Among those who still have many opportunities to practice plant diversity conservation are students. Students are a generation that is still very enthusiastic about

environmental issues, so they are more likely to adopt behavior that promotes conservation (Avan *et al.*, 2011). Although there are many opportunities, it is uncertain whether their attitude towards plant diversity conservation is put into action. Students have an important role to promote sustainability in their environment and teachers can facilitate with contextual lesson about the environment. This can improve students behavior to protect the biodiversity in environment (Azrai *et al.*, 2019; Mamun *et al.*, 2020; Sigit, Azrai, Setyawati, *et al.*, 2019).

Several studies on efforts to protect the environment are often in terms of facilities and infrastructure (Miarsyah, Sigit, *et al.*, 2019; Russo *et al.*, 2016). arious technology-based learning media have also been developed to improve students' ability to overcome various environmental problems (Boholano, 2017; Ichsan *et al.*, 2020; Miarsyah, Rusdi, *et al.*, 2019; Purwanto *et al.*, 2020; Saltan & Divarci, 2017; Sigit, Azrai, Heryanti, *et al.*, 2019). Another effort to improve students' ability and behavior in overcoming environmental problems s by developing an environment-based education

model to empower environmental sustainability (Beattie, 2015; Rahmayanti, Ichsan, Azwar, Purwandari, *et al.*, 2020; Sigit *et al.*, 2020). One way of promoting plant diversity preservation is through the development of teaching materials on the concept of plant growth and development (Supriyatin *et al.*, 2019). Various efforts have been made to empower students to overcome various science and environmental problems (Ichsan & Rahmayanti, 2020; Komala *et al.*, 2020; Paristiowati *et al.*, 2019; Sahronih *et al.*, 2019; Suryanda *et al.*, 2020). Based on the discussion, the approach of this study is novel because students' conservation behavior in order to increase awareness of plant biodiversity has not been described. This research is urgent because there are many environmental problems to be solve, especially on conservation.

Given the low likelihood of students applying conservation behavior to plant biodiversity, a learning medium will be created about the introduction of plant diversity. Through adequate knowledge they can improve their behavior (Suryanda *et al.*, 2020). Research on biodiversity mostly covers biological perspectives. There are not many studies, however, that discuss conservation behavior itself, especially in terms of natural science and social science students' point of view. The aim of this research was to analyze the students' conservation behavior and to compare these between natural science and social science students.

## Method

This research was a descriptive study and conducted in April and May 2020. The samples were 200 undergraduate students consisting of 100 natural science (NS) and 100 social science (SS) students randomly selected from several universities in Jakarta studying in several programs. The questionnaire was administered through Google Forms. The instrument used multiple-choice and agree-disagree tests. The multiple-choice instrument contained statements regarding conservation behavior towards plant biodiversity, while the agree-disagree instrument

contained statements that could measure the level of students' knowledge about plant biodiversity. The source of the instruments were derived from the conservation principles based on Law no. 5 of 1990 namely: 1) Protection, 2) Preservation, and 3) Utilization and an equivalent biodiversity concept for undergraduate students. The multiple-choice instruments were on a scale of 1-5 and the agree-disagree instrument were score 0 and 1. ests on these instruments found them to be valid and reliable. The data of students' conservation behavior on plant biodiversity were analyzed descriptively using tables, whereas the differences between natural science (NS) and social science (SS) students were tested by the t-test.

## Results and Discussion

he percentage of conservation behavior from natural science and social science students is shown in Table 1. The differences between the groups could be analyzed based on the table.

In Table 2, the conservation behavior percentage is presented, where it is found that natural science students have a higher percentage (56.7%) than social science students (46.3%). It meant that students from natural science involved better in the conservation behavior than social science students.

The differences between natural science and social science students were then analyzed statistically by t-test. The results indicated that the conservation behavior was significantly different between the two groups.

Referring to Table 4 the percentage of conservation behavior based on the three dimensions suggested that protection was a dimension with the highest percentage and followed by preservation and utilization.

Conservation behavior could also be discussed in terms of gender as shown in Table 5. Female students seemed to have higher score in conservation behavior (81.66%) than male students (71.14%).

Table 1: Percentage of Conservation Behavior of Natural Science (NS) and Social Science (SS) Students

Number of Item	Statement	NS (%)	SS (%)	Difference (%)
1	Knowing plant's extinction status	53.3	46.7	6.6
2	Supporting constitution about plant conservation	52.8	47.2	5.6
3	Prohibiting someone who wants to destroy plants	70.4	29.6	40.8
4	Giving criticism and suggestions to improve awareness of plants	52.7	47.3	5.4
5	Planting in own garden / home	53.4	46.6	6.8
6	Sharing information about plant benefits	54.8	45.2	9.6
7	Trying to protect plants	52.2	47.8	4.4
8	Sharing information for protecting plants	54.2	45.8	8.4
9	Active in plant conservation programs	54.8	45.2	9.6
10	Introducing plant biodiversity to other	55.2	44.8	10.4
11	Paying attention on everything about plant conservation	66.8	33.2	33.6
12	Collecting unique plants	66.4	33.6	32.8
13	Knowing the characteristics of some plants	56.2	43.8	12.4
14	Following the rules about plant conservation	68.6	31.4	37.2
15	Exploiting plants for own happiness	68.7	31.2	37.5
16	Donating money for plant conservation	53.9	46.1	7.8
17	Selecting the real sample of plant for study purposes	69.1	30.9	38.2
18	Always contribute to help plant lives	69.7	30.3	39.4
19	Always preserve and encourage plant conservation actions	70.7	29.3	41.4

Table 2: Percentage value of conservation behavior between university students

Group Category	Percentage
Natural Science	56.7
Social Science	43.3
Total	100

This research also gained some data on students' opinions through a case statement and response with agree or disagree answer. The instrument statements were phrased so that disagreeing with them would be the "good" answer. Table 6 showed that students' choice on item number 1 and 2 with agree and disagree

Table 3: The t-test on The Comparison of Conservation Behavior between NS and SS Student

				95% Confidence Interval of the Difference		
	T	Df	Sig. (2-tailed)	Men Difference	Lower	Upper
NS	133.755	99	.000	78.630	77.46	79.80
SS	57.164	99	.000	53.190	51.34	55.04

p<0.05

Table 4: Percentage of conservation behavior of plant biodiversity dimensions

No	Dimensions	Percentage
1	Protection	36.82
2	Preservation	30.89
3	Utilization	32.28
Total		100

Table 5: Comparison of Score between Female and Male's Conservation Behavior of Plant Biodiversity

Gender	Respondent	Mean Score
Male	100	71.14
Female	100	81.66

Table 6: Number of Students on Case Statement (Agree-Disagree)

No	Item	Agree (person)	Disagree (person)
1	Exchange of plants between countries can increase plant diversity.	146	54
2	The habit of consumption of rice as a staple food is an effort to maintain the presence of rice plants.	144	56
3	The herbal medicine industry is actually less profitable because it takes a long time to work and requires large area to grow	45	155
4	Rare plants are not a great concern as now we can learn through virtual learning media through computers	19	181
5	Horticultural plants that do not sell on the market do not need to be preserved because they are unprofitable and cost a lot of money to preserve.	30	170
6	Green open spaces were subdued by flats development as houses along the riverbank were also very important	35	165

response. This result showed that for problem number 1 and 2, students missed the concept of biodiversity.

Table 7 showed that although item number 1 and 2 were not well responded, all items obtained a similar percentage. There were no items with an extreme percentage among the six problems in conservation behavior.

Based on the agree-disagree instrument the data were analyzed in two categories. In Table 8, it was found that students with good conservation behavior (58.5%) were higher than the fair group (41.5%). This was a good result as

it indicated that students in university have good opinions on conserving plant biodiversity.

The percentage of conservation behavior in each statement of the instrument was shown in Table 1. In every statement, the percentage of NS students was higher than those of the SS students. This result was really reasonable since NS students received lessons on plant biodiversity and the concept of conservation from senior high school, while SS students did not. Social science students obtained this information from news and social media. In addition, NS students were more active in preserving the environment than SS students (Azrai *et al.*, 2019; Ichsan & Rahmayanti, 2020).

Table 7: Percentage of Item on Case Statement (Agree-Disagree)

No	Item	Percentage
1	Exchange of plants between countries can increase plant diversity.	16.2
2	The habit of consumption of rice as a staple food is an effort to maintain the presence of rice plants.	15.9
3	The herbal medicine industry is actually less profitable because it takes a long time to work and requires large area to grow	16.5
4	Rare plants are not a great concern as now we can learn through virtual learning media through computers	17.6
5	Horticultural plants that do not sell on the market do not need to be preserved because they are unprofitable and cost a lot of money to preserve.	16.9
6	Green open spaces were subdued by flats as houses along the riverbank were also very important	17.0
Total		100

Table 8: Percentage of Category on Conservation Behavior of Plant Biodiversity (Agree-disagree)

Category	Total University Students	Percentage
Fair	83	41.5
Good	117	58.5
Total	200	100

Of all the instruments, several of them had huge differences between NS and the SS students. The instruments with the most differences were numbers 3 and 19, which was about 40% to 41%. The result of item number 4 suggested that NS students tended to be more active in reprimanding others in the destruction of plants compared to SS students. This was due to several factors, including the fact that NS students tended to have the desire to get public attention for conservation issues. This is different to SS students' tendency to apply conservation only to themselves (Seechaliao, 2017; Uzun, 2012). Another supporting factor was a sense of connectedness with the environment that was higher among the NS students, so they have more desire to influence others to respect the environment. This is important because university students must advocate to keep environmentalism in the community. It is relevant with statement number 19 that NS students can be more active to influence and promote some activities to preserve plant biodiversity. In addition, SS

Students tended to be more comfortable to contribute to preserving the environment by themselves without having to influence others to support environmental sustainability (Djamahar *et al.*, 2019; Kamerilova *et al.*, 2016; Purwanto *et al.*, 2020; Rahmayanti, Ichsan, Oktaviani, Syani, *et al.*, 2020).

Other instruments with a substantial difference in value point included numbers 14, 15, 17, and 18. The differences were about 37.2% to 39.4%. For the statements in number 15 and 17 about "Using plants for one's own needs", NS students tended to have more contribution than SS students. This result represented some contradictions with previous discussion stating that NS students had more awareness of the environment than SS students. However, NS students often use the environment as their main subject of study and this creates a dilemma for them (Sigit *et al.*, 2020). For example, (according to statement number 17), NS students often picked living plants for their research and study. It is unavoidable and legal. This action will encourage NS students to be more aware in

preserving their own environment, especially for plant biodiversity (Ichsan *et al.*, 2019). This led to statements number 18 that NS students did more to contribute to saving plants' lives than SS students with a difference of 39.4%.

The differences in the percentage of student scores between the NS students and SS students were presented in Table 2. It can be seen that the percentage of conservation behavior of plant biodiversity was higher among NS students, amounting to 56.7%. This can be influenced by the type of natural science knowledge possessed by the NS students.. This could influence the students' sensitivity in preserving the environment, one of which is to preserve plants (Suryanda *et al.*, 2020). In addition, NS students also had more understanding about the conservation and awareness of the impact of human actions on other living things. Nevertheless, it does not mean that SS students are less sensitive to the environment, it's just that the scope of their learning is more directed towards humanity so that sensitivity to the environment is not as good as the NS students (Bela *et al.*, 2016).

The differences of conservation behavior among NS and SS students was statistically analyzed by using the t-test as shown in Table 3. The result showed a significant difference between NS and SS students in their conservation behavior. This was related to a statement about NS and SS that always has differences in their score regarding the environment, especially preservation actions, such as promoting environmentalism on social media and joining environmental organizations (Bidegain *et al.*, 2019).

The percentage of each dimension showed some differences as seen in Table 4. The results suggested that the dimension with the highest percentage was "Protection", 36.82%. The protection dimension includes efforts to protect the diversity of plants that the students see in the environment. In general, communities tend to be more capable of carrying out conservation efforts in the form of protection, because this effort is the easiest way to do it. For example,

when someone finds a unique plant around them, the tendency not to damage the plant would always appear. It also prevails among the students who tend to be more sensitive to the environment, they would maintain the presence of plants to support environmental sustainability (Supriyatin *et al.*, 2019). The other dimensions were preservation (30.89%) and utilization (32.28%), that had similar percentages, which were lower than the protection dimension as students were not actively involved in these dimensions.

In addition to the comparison of the dimensions between NS and SS students, their conservation behavior was also compared based on gender (Table 5). The score of conservation behavior of plant biodiversity of female students was higher than male students. This is assumed to be related to females being more sensitive to the environment than males. For example, when a woman finds some plants outdoors, she would take care of them and try her best not to harm them. The other reason was women were generally more concerned about the environment because they express greater concern over potential environmental risks than men (Aprile & Fiorillo, 2017; Braun *et al.*, 2018; Runhaar *et al.*, 2019).

This study also tried to identify students' opinion on some cases of plant biodiversity using agree-disagree opinion. There were 6 statements related to the concept of plant biodiversity that should be answered by a disagree answer. As seen in Table 6, items number 1 and 2 that seemed to be not a good answer since students responded with "agree". It showed that some people still misunderstand plant biodiversity. In item number 1, "exchange of plants between countries can increase plant diversity", seems to be good, but people have to be careful since the exchanged plant might be invasive and could be harmful to the native species. For example, in item number 2, more than half of respondents chose the "agree" opinion, Indonesians eat rice as their daily staple food, and they think this is a great way to preserve the existence of rice (*Oryza sativa L.*) species. However, there is a

statement that the existence of biodiversity can support food production (Hooykaas *et al.*, 2020). It means that the habits of people who always consume one species of staple food do not help in improving biodiversity; moreover, it causes “homogeneity” and reduces biodiversity. The respondents, however, on average, still have a good grasp about plant biodiversity indicated by their “disagree” answer for item 3, 4, 5, and 6.

In table 7, the percentage of the answers showed a similar number; thus, there was no difference in each item. In addition to the biodiversity plant instrument, the respondent category was in a good category, which means that their understanding of the biodiversity of plants was good. The introduction of plant biodiversity to the general public has a good impact (Ihsan *et al.*, 2020). Especially for students, their access to information, tends to allow them to have critical thinking and support environmental sustainability (Angelaina & Jimoyiannis, 2012; Orozco & Yangco, 2016).

Table 8 showed the results of the percentages of conservation behavior of plant biodiversity values. This result showed students’ excellent ability to obtain information about plant biodiversity to improve their knowledge (Camacho & Legare, 2015; Cukurova & Bennett, 2018; Kivunja, 2015). Therefore, high self-awareness in terms of conservation behavior from university students also increases. Through the information they obtain, certain behaviors will be inculcated to meet the needs based on the generated information. Moreover, university students are a group of high-level students so that the process of digesting information will be easier. The process of critical thinking also influences the act of applying practice directly to daily life (Fitzpatrick & Schulz, 2015; Garcia, 2015).

## Conclusion

Attitudes towards plant biodiversity among university students was in a good category, thus the conservation behavior of plants was also good. There were differences between students

in the natural science group and social science group. The natural science group had better biodiversity conservation behavior of plants than the social science group. University students also had the same average result in the conservation indicator and the students, in general, had good responses to plant-biodiversity conservation behavior. It is important to improve conservation behavior of plant biodiversity to preserve environmental sustainability. We recommend that conservation behavior be developed for natural science and social science students, due to the ongoing biodiversity loss and environmental degradation. Activity planning in conservation behavior as well as the implementation in school and universities might be a compulsory program to reach environmental sustainability. This study faced some limitations in the sample that only covered limited categories of students; therefore, another research with a large sampling might be a solution. We suggest development of learning media about conservation for students in school and university. Implications of this research for the future are schools and universities improving their curriculum and syllabus based on environmental conservation programs.

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