

## Exploring Potential of Tree Diversity Using Ecoprint Techniques in Tahura Bunder, Gunungkidul, Yogyakarta

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### ABSTRACT

Forest products that currently need to be developed are studies of diversity and opportunities for increasing their economic value. The value developed is to reduce the rate of forest destruction. This study aims to determine the potential of ecoprint from the diversity of plant species in the Traditional Block of the Bunder Grand Forest Park, Gunungkidul, D. I. Yogyakarta. Ecoprint as an eco-friendly fabric dyeing technique. The research method is observation, trial and interview. Observation is carried out to identify diversity. Trial with ecoprint making processing and interviews for result assessment. The determination of the number of samples used is Purposive Sampling of 30 species for observation. Ecoprint making using the pounding method ecoprint technique. The results were assessed through a Likert Scale-based questionnaire by 93 respondents consisting of students and lecturers of the Faculty of Forestry Instiper, as well as Tahura managers. The result showed that there The application of the ecoprint pounding technique, not only serves as a method for identifying tree diversity but also offers an opportunity to increase the economic value of non-timber forest products (NWFP) while supporting environmental conservation. Nine species in three clusters received the highest or most preferred ratings are (1) Randu (*Ceiba pentandra* Gaertn.); (2) Gambiran (*Carmona retusa*); (3) Dadap (*Erythrina variegata* L.) (4) Kesambi (*Schleichera oleosa* (Lour.); (5) Sapodilla/Sawo Kecil (*Manilkara kauki* (L.) Dubard); (6) Candlenut (*Aleurites moluccana* L.); (7) Bungur (*Lagerstroemia speciosa*); (8) Bendo (*Artocarpus elasticus*) and (9) Walikukun (*Schoutenia ovata* Korth.).

Keyword: ecoprint, biodiversity, botanical forest park.

### ABSTRAK

Hasil hutan yang saat ini perlu dikembangkan adalah studi keanekaragaman dan peluang untuk peningkatan nilai ekonomisnya. Penelitian ini bertujuan untuk mengetahui potensi *ecoprint* dari keanekaragaman jenis tumbuhan di Blok Tradisional Taman Hutan Raya Bunder, Gunungkidul, D. I. Yogyakarta. *Ecoprint* sebagai teknik pewarnaan kain yang eco-friendly. Metode penelitian adalah observasi, trial dan interview. Observasi dilakukan untuk identifikasi keanekaragaman. Trial dengan pemrosesan pembuatan *ecoprint* dan interview untuk penilaian hasil. penentuan jumlah sampel yang digunakan adalah *Purposive Sampling* terhadap 30 jenis untuk diobservasi. Pembuatan *ecoprint* dengan teknik *ecoprint* metode pukul (*pounding*). Hasilnya dinilai melalui kuesioner berbasis *Skala Likert* oleh 93 responden yang terdiri dari mahasiswa dan dosen Fakultas Kehutanan Instiper, serta pengelola Tahura. Penelitian menunjukkan teknik *ecoprint* tidak hanya sebagai metode pembelajaran untuk identifikasi keanekaragaman pohon tetapi sebagai peluang peningkatan nilai ekonomis HHHK dengan tetap mendukung kelestarian alam. Sembilan jenis pohon yang mempunyai potensi tertinggi adalah 1) Randu (*Ceiba pentandra* Gaertn.); (2) Gambiran (*Carmona retusa*); (3) Dadap (*Erythrina variegata* L.) (4) Kesambi (*Schleichera oleosa* (Lour.); (5) Sapodilla/Sawo Kecil (*Manilkara kauki* (L.) Dubard); (6) Candlenut (*Aleurites moluccana* L.); (7) Bungur (*Lagerstroemia speciosa*); (8) Bendo (*Artocarpus elasticus*) dan (9) Walikukun (*Schoutenia ovata* Korth.).

Kata kunci: ecoprint, keanekaragaman, taman hutan raya.

## INTRODUCTION

Abundant biodiversity was boasting Indonesia, yet its utilization remains high price. Forest product have been primarily focused on timber, while the potential of non-timber forest productt (NTFPs), such as plants producing natural dyes, has not been fully found. Futhermore, the use of syntehetic chemical dyes in the attire or others industry development, poses serious problems in the form of pollution and unsafety envoronmnet and health hazards. This is verry important to find safer, natural, and more sustainable dye alternatives beside from research.

Taman Hutan Raya (Tahura) is one of form protected area for conservation that built to collecting plants and animals, both natural and artificial, native and non-active, which are used for reserach, science, cultivation development, culture, tourism and recreation (Undang-Undang Nomor 5, 1990 on Winarno et al., 2019). Many threats for tahura, some of them are form of land conversion, tin mining, illegal logging, expansion of plantations and wildlife hunting (Pratama MR, 2020). Preserving have effort to the area by utilizing its potential without destroying are have to be increased. As its function as life-supporting area, serves as a place for conserve flora and fauna also their unique natural phenomena (Winarno et al., 2019).

One potential use case is ecoprint development. This is a form of NFTP utilization that aligns with conservation by prevention from destruction. Ecoprinting is a fabric dyeing technique taht uses direct contact printing. The term ecoprint is a combination of the words “eco” that meaning nature and “print” for printing (Pramudya et al., 2024). Along meaning “eco” in ecoprint, natural colored textile materials usually come from extracts of various plants part, including roots, wood, leaves, seeds and flowers (Rosyida & Zulfiya, 2013). Therefore, plants remain sustainable in their habitat, while stakeholders giving limit permit to community around it, gain added value from environmentally product with high artistic so ekological and economic value. Because the colors and motif used in ecoprint are derived from plants, other material used in this technique must also be made from natural fibers (Aryani et al., 2022).

Thus, study of tahura ecoprint used to address the problem of preventing ecological damage such as diversity loss in the protected area. In line as win win solution for the utilization zones of conservation area, is developing ecoprint derived from natural dyes. This aims to significantly improve environmental health by reducing the high dependence on synthetic dyes. Furthermore, ecoprints are unique natural products due tu their high artistic styles and patterns, which are inherently unrepeatabe. This is because the natural dyes used, derived from leaves and flowers, are always different in their production (Prastica et al., 2023). Its product are often the main attraction at variuous textile exhibitions and fashion shows. This indicates that its business opportunity in Indonesia is quite promising (Salma & Eskak, 2022). This study identified tree biodiversity in the Bunder Forest Park, Gunungkidul, Yogyakarta. Leaf samples were then taken from each identified tree species. After the ecoprints were successfully created using the pounding technique, community assessment was required. The resulting ecoprints were documented and then assessed by the community. Ecoprints were deemed to have potential for development based on the values and validation received from respondents.

## METHOD

This research was conducted in May 2025 in the Traditional Blocks of Petak 23 and 24 of the Bunder Grand Forest Park, Gunungkidul, and at the STIPER Yogyakarta Agricultural Institute for the ecoprinting process. This study consist of three step on its step. They are observation, trial and interview. The observation including identification on tree diversity. Trial is on steps processing ecoprint untill has product. Therefore, interview is the last but not least on assesment ecoprint product. The samples are selected by purposive sampling method. The employed a purposive sampling method, where samples were selected based on specific characteristics determined by the researcher, rather than randomly (Kumara, 2018). The data used in this study are plants in the tree phase in Traditional Blocks Plots 23 and 24. From secondary data in the form of Tahura Inventory data in 2021, there are 118 plant species in the research location. The sample used in the ecoprint is 30. Respondents were selected using a purposive sampling method from Instiper Forestry Students and non-students represented by Instiper Forestry Lecturers and Bunder Tahura Managers. The number of respondents was determined using rule-of-thumb guidelines, resulting in a total of 93 respondents.

Data were collected using a questionnaire instrument with a three-category Likert Scale (Agree, Undecided, and Disagree) which is commonly used in surveys to measure individual perceptions or attitudes (Budiaji et al., 2013; Ngongo et al., 2024). Respondents' responses to ecoprinting were analyzed to determine the potential of each plant species as a natural dye, categorized as high, medium, or low. High as like, medium is netral and low is dislike for the ecoprint product. Respondents' responses were assessed using a Likert scale, measuring the value of indicators created by the researchers, which included their perceptions and the level of suitability of the ecoprinting results for each plant species studied. Each indicator has its own value calculation. The resulting values were ranked using the following research scale.

$$\text{Difference per category} = \frac{\text{highest score} - \text{lowest score}}{\text{number of categories}} [1]$$

The formula used to calculate the total score is:

$$\text{Total Score} = (\text{SS} \times 3) + (\text{SR} \times 2) + (\text{STS} \times 1) [4]$$

Note:

SS = Agree Count

SR = Undecided Count

STS = Disagree Count

## RESULT

### Biodiversity

*Ecoprint* is a development of ecofashion techniques, involving the process of transferring plant colors and patterns onto fabric to create environmentally friendly products. Ecoprint displays uniqueness through unpredictable color combinations and leaf-like shapes, even when arranged in a precise manner (Puspaningtyas & Ratyaningrum, 2022). Based on

observations made in locations are block 23, 24 and 30 to get leaf sample were used for ecopyrinting. These plants are predominantly from the Fabaceae and Moraceae families. Other plant families can be seen in Table 1.

**Table 1.** Tree Diversity

Local Name	Family	Species
Ketapang	Combretaceae	<i>Terminalia catappa</i> L.
Cemara Gunung	Casuarinaceae	<i>Casuarina junghuhniana</i> Miq.
Duwet	Myrtaceae	<i>Syzygium cumini</i> (L.) Skeels.
Kesambi	Sapindaceae	<i>Schleichera oleosa</i> (Lour.)
Sawo Kecil	Sapotaceae	<i>Manilkara kauki</i> (L.) Dubard.
Kemiri	Euphorbiaceae	<i>Aleurites moluccana</i> L.
Kemloko	Phyllanthaceae	<i>Phyllanthus emblica</i> L.
Lamtoro	Fabaceae	<i>Leucaena leucocephala</i>
Secang	Caesalpinaceae	<i>Caesalpinia sappan</i> L.
Jarak Merah	Euphorbiaceae	<i>Jatropha gossypifolia</i> L.
Pulai Legaran	Apocynaceae	<i>Alstonia angustiloba</i> Miq.
Kweni	Anarcadiaceae	<i>Mangifera odorata</i> Griff.
Randu	Malvaceae	<i>Ceiba pentandra</i> Gaertn.
Gambiran	Boreginaceae	<i>Carmona retusa</i>
Dadap	Fabaceae	<i>Erythrina variegata</i> L.
Murbei	Moraceae	<i>Morus</i> spp.
Ri Sisir	Moraceae	<i>Maclura cochinchinensis</i>
Pulai	Apocynaceae	<i>Alstonia scholaris</i> L. R. Br.
Bisbul	Ebenaceae	<i>Diospyros blancoi</i> A. D.
Nyamplung	Clusiaceae	<i>Calophyllum inophyllum</i> L.
Ki Putri	Podocarpaceae	<i>Podocarpus nerrifolius</i>
Bungur	Lythraceae	<i>Lagerstroemia speciosa</i>
Bendo	Moraceae	<i>Artocarpus elasticus</i>
Walikukun	Malvaceae	<i>Schoutenia ovata</i> Korth.
Awar-awar	Moraceae	<i>Ficus septica</i> Burn. F.
Johar	Leguminosae	<i>Cassia siamea</i> Lamk.
Tayuman	Fabaceae	<i>Bauhinia purpurea</i> L.
Gayam	Fabaceae	<i>Inocarpus fagifer</i> Fosberg.
Sonokeling	Fabaceae	<i>Dalbergia latifolia</i> Roxb.
Ilat-ilat	Moraceae	<i>Ficus callosa</i> Willd.

Source : Primarily Data

These plants are predominantly from the Fabaceae and Moraceae families, as shown in Table 1. All of leaves were then harvested from all identified trees. Leaf samples were taken using pruning shears, the branches are cut at an angle to create a larger cutting surface. This allowed for better water absorption. The cut branches were then placed in one of water soaked oasis basker to maintain leaf freshness. The leaf sampling cut process can be seen in Figure 1 below :

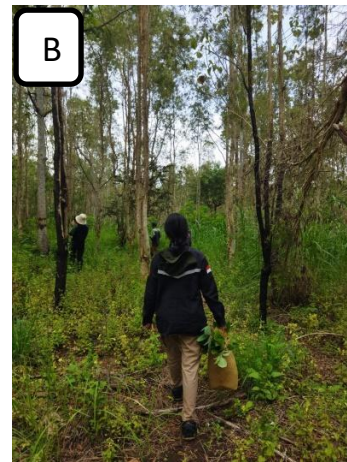


Figure 1. Identification process, sampling and distribution to the laboratory (A) Leaves cutting use scissors; (B) Storing levaea in a basket

The sample specimens are then taken to the INSTIPER Faculty of Forestry Laboratory to undergo the pounding technique to create ecoprints. The steps of the process are as follows :

(1) Leaves arrangement on a cloth and layering by plastic

The collected leaves are soaked for fifteen to thirty minutes and cleaned to maintain freshness and prevent drastic water loss after being picked. The cleaned leaves are then wiped or wiped clean, then arranged on a cloth covered with plastic. This plastic coating prevents the leaves from sticking together when struck with a wooden mallet.

(2) Poudning technique using wooden hit

The pounding process uses a wooden hit. This process involves striking evenly to achieve the optimal leaf shape and color on the fabric. The force applied during pounding, or the required strength or softness, depends on the type of leaf. Leaves with thicker morphological and anatomical characteristics require more forceful pounding.

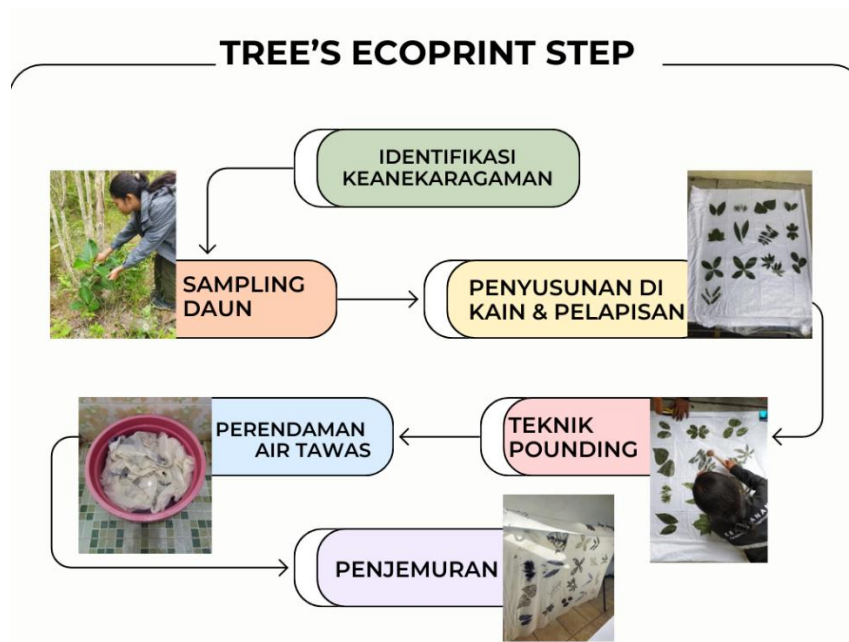
(3) Soaking the cloth in water with

The ecoprint pounding product were then soaked in a 1:1 solution of alum in a ratio of 7.5 grams of each solution per 15 liters of water. This dosage was used to prevent the natural color of the leaves from fading or spilling outside the leaf pattern on the fabric. The alum acts as a color binder, while the tunjung helps to concentrate the color. The soaking process was carried out overnight for optimal results.

(4) Dring

The ecoprint product which have been soaked overnight, are then dried outside of the sun. The drying process takes time, depending on the weather, so the time required will vary. After drying, the resulting ecoprints have strong colors and will not fade even after repeated washing.

The step of this pounding ecoprint study can be briefly described in the following Figure 2 bellow :



Source : Primary data

Observation data are collected in traditional block 23 and 24 in Tahura Bunder shows thirty trees are potential as ecoprint material. These are dominated by Fabaceae and Moraceae families, as seen in Table 1. The thirty diverse tree species that have become ecoprints are grouped into several clusters for analysis. Cluster analysis is a statistical method that groups based on their level of proximity or similarity. The purpose of clustering is to understand the structure of each level or group of complex data (Johnson dan Wichern, 1982 dalam Fathia et al., 2016). Depending on color density and clarity of the resulting ecoprint pattern, ten clusters are made, namely A; B; C; D; E; F; G; H and I. Cluster A is the cluster that has the clearest color and pattern potential and the lowest clear is cluster I. The determination of the ten clusters is based on the range of Nmax and Nmin. Nmax and min are the clarity values of the strongest and weakest or unclear ecoprint patterns and colors. Each cluster consists of three kind ecoprint products, so that each cluster has the same number of ecoprints. The products and documentation of the diversity of tree species that have been grouped into ten clusters are presented in Figure 3 below: **(A) on left side** - conditions during diversity identification and **(B) right side** - ecoprint product from the pounding technique



Ketapang (*Terminalia catappa* L.)



Mountain cypress (*Casuarina junghuhniana* Miq.)



Duwet (*Syzigium cumini* (L.) Skeels)

Gambar 1. Kluster A



Kesambi (*Schleichera oleosa* (Lour.)



Sapodilla/Sawo Kecil (*Manilkara kauki* (L.) Dubard)  
Gambar 2. Klaster B



Candlenut (*Aleurites moluccana* L.)



Kemloko (*Phyllanthus emblica* L.)



Lamtoro (*Leucaena leucocephala*)  
Gambar 3. Klaster C



Secang (*Caesalpinia sappan* L.)



Jarak Merah (*Jatropha gossypifolia* L.)



Pulai Legaran (*Alstonia angustiloba* Miq.)  
Gambar 4. Klaster D



Mango/Kweni (*Mangifera odorata* Griff.)



Randu (*Ceiba pentandra* Gaertn.)



Gambiran (*Carmona retusa*)  
Gambar Klaster E



Dadap (*Erythrina variegata* L.)



Murbei (*Morus* spp.)



Ri Sisir (*Maclura cochinchinensis*)  
Gambar Klaster F



Pulai (*Alstonia scholaris* L. R. Br)



Bisbul (*Diospyros blancoi* A. D.)



Nyamplung (*Calophyllum inophyllum* L.)  
Gambar Klaster G



Ki Putri (*Podocarpus nerrifolius*)



Bungur (*Lagerstroemia speciosa*)



Bendo (*Artocarpus elasticus*)



Walikukun (*Schoutenia ovata* Korth.)

Gambar Klaster H



Awar-awar (*Ficus septica*. Burn. F)



Johar (*Cassia siamea* Lamk.)



Tayuman (*Bauhinia purpurea* L.)

Gambar Klaster I



Gayam (*Inocarpus fagifer* Fosberg.)



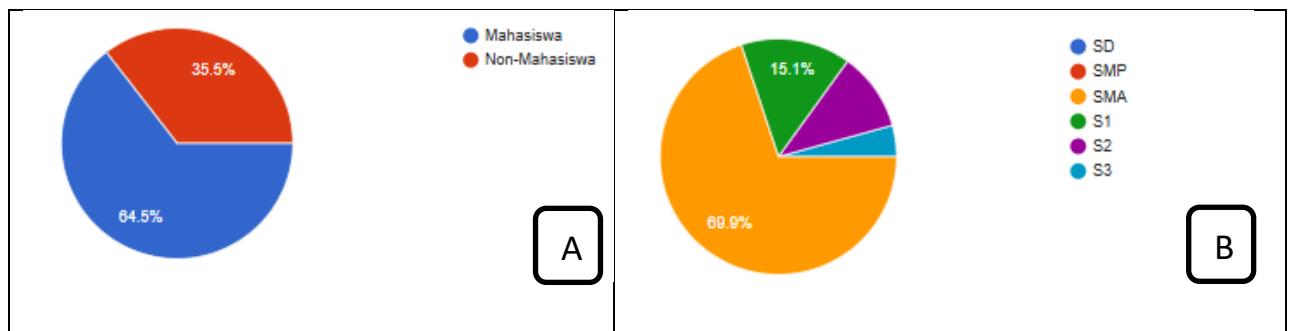
Rose wood (*Dalbergia latifolia* Roxb.)



Ilat-ilat (*Ficus callosa* Willd.)

Gambar Klaster J

Assesment is need to assess the potential value each product. It a must for ecoprint development from tree species found in the traditional block of Tahura Bunder, the ecoprint results were assessed by the community. The scores were used for validation. The assessors were called respondents who were sampled. The sample was selected using a purposive sampling method representing the student and employee community. Student respondents were students from the Forestry Study Program at the Yogyakarta Agricultural Institute (INSTIPER). Student respondents consisted of the classes of 2022, 2023, and 2024. Meanwhile, employee respondents were lecturers and managers of Tahura Bunder. The number of student respondents was 60 and non-student respondents was 33. These respondents were used to assess the ecoprints created in the study. The characteristics of the respondents are presented in the following Figure 4:



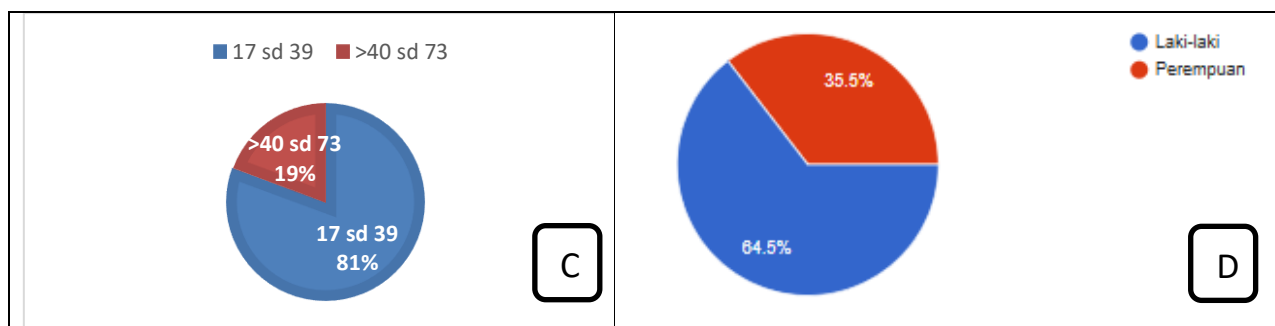


Figure 4. Characteristics of Respondents Evaluating Ecoprint Products (A) by profession (B) by education (C) by age and (D) by gender

The characteristics of respondents who provided an assessment of ecoprint were classified based on (figure A) based on their status as students and non-students. Students who were respondents were 64.5% while 35.5% were employees and/or Tahura staff. Figure B explains the description of respondents' education. The results were dominated by high school graduates at 69.9%, Bachelor's or S1 15.1% and the rest were Master's and S3 graduates. Meanwhile, based on age grouping, 19% of respondents were aged 40 to 73 years and 81% 17 to 39 years, all of which consisted of 64.5% men and 35.5% women and Lecturers of the Faculty of Forestry INSTIPER Yogyakarta and Managers of Tahura Bunder Gunungkidul.

## DISCUSSION

All data of plant species found in the Traditional 23 and 24 Blocks of Tahura Bunder Gunungkidul, which have been used as ecoprints, will be explained further. The analysis aims to provide an assessment of each type that has been ecoprinted. The assessment was conducted using a questionnaire method. This questionnaire contains 10 questions with three answer choices: agree, undecided, and disagree. These three answers reflect the level of respondents' assessment of the quality and potential of leaves as ecoprint materials. Respondents assessed the answer as agreeing that the ecoprint results from a particular leaf type have good potential, the answer as unsure is not convincing enough, and the answer as disagreeing that there is no potential or is less suitable for use. Respondents provided answers that were then percentageed and scored to classify the ecoprint potential of various plant types as high, medium, or low. High is meaning the sample very liked. The product of ecoprint is high potential for developing. Sequently meaning for medium eithers low. Based on the results of the observations that have been made, 30 plant species were used for ecoprints and placed into several clusters. Cluster analysis is a statistical technique used to group data based on their proximity in order to understand the group structure of complex data (Johnson & Wichern, 1982; Fathia et al., 2016). The following is tabel 2 shows percentage of like, neutral and dislike responden answering for each cluster.

Table 2 shows the number of respondents who chose each cluster based on likes, neutrals, and dislikes in assessing the product results. The assessment of each cluster can be explained by the top three most preferred clusters being cluster E followed by B and H. Cluster E received the largest number of voters among the other clusters. The number of respondents who chose the

clusters was 83; 81 and 80, respectively. Cluster E consists of the types of Randu (*Ceiba pentandra* Gaertn.); Gambiran (*Carmona retusa*) and Dadap (*Erythrina variegata* L.). Cluster B consists of ecoprint Kesambi (*Schleichera oleosa* (Lour.); Sapodilla/Sawo Kecil (*Manilkara kauki* (L.) Dubard) and Candlenut (*Aleurites moluccana* L.). The following cluster H with its types are Bungur (*Lagerstroemia speciosa*); Bendo (*Artocarpus elasticus*) and Walikukun (*Schoutenia ovata* Korth.).

**Tabel 2.** Persentase Like, Netral and Dislike of Ecoprint Product

Cluster	Like		Netral		Dislike	
	Σ	%	Σ	%	Σ	%
A	55	59,14	25	26,88	13	13,98
B	81	87,1	9	9,67	3	3,23
C	74	79,57	18	19,35	1	1,08
D	79	84,94	13	13,98	1	1,08
E	83	89,24	9	9,68	1	1,08
F	59	63,44	22	23,66	12	12,9
G	38	40,86	34	36,56	21	22,58
H	80	86,02	12	12,9	1	1,08
I	40	43,01	27	29,03	26	27,96
J	37	39,78	34	36,56	22	23,66

Source : Primary data

Assessment of ecoprint results that have a large dislike or have little development opportunities. The data results show that clusters I, J and G have the largest dislikes. The number of voting respondents is 26, 22 and 21 respectively. Cluster I which has the largest number of dislike raters, consists of the types of Awar-awar (*Ficus septica*. Burn. F); Johar (*Cassia siamea* Lamk.) and Tayuman (*Bauhinia purpurea* L.). And neutral potential with the meaning that there can be an opportunity for improvement so that the product becomes liked is cluster G, J and I with the number of raters respectively being 34; 34 and 27. Cluster G consists of Bisbul (*Diospyros blancoi* A. D.); Nyamplung (*Calophyllum inophyllum* L.) and Ki Putri (*Podocarpus nerrifolius*).

## CONCLUSION

The application of the ecoprint pounding technique, not only serves as a method for identifying tree diversity but also offers an opportunity to increase the economic value of non-timber forest products (NWFP) while still supporting environmental conservation. Nine species in three clusters received the highest or most preferred ratings are (1) Randu (*Ceiba pentandra* Gaertn.); (2) Gambiran (*Carmona retusa*); (3) Dadap (*Erythrina variegata* L.) (4) Kesambi (*Schleichera oleosa* (Lour.); (5) Sapodilla/Sawo Kecil (*Manilkara kauki* (L.) Dubard); (6) Candlenut (*Aleurites moluccana* L.); (7) Bungur (*Lagerstroemia speciosa*); (8) Bendo (*Artocarpus elasticus*) and (9) Walikukun (*Schoutenia ovata* Korth.).

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