POTENTIAL OF RECLAMATION AREA OF COAL MINING SITES IN MEDICAL FIELD

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POTENTIAL OF RECLAMATION AREA OF COAL MINING SITES IN MEDICAL FIELD

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ABSTRACT

Besides giving many benefits, coal mining has an impact to the environment as well. Reclamation is one of the efforts conducted to minimalize the environmental damage it causes. This research was been carried out in the reclamation area of PT Borneo Indobara concession. The well-grown plants in the reclamation site are not

only woody plants and relay-cropping plants, but also various kinds of shrubs which not only showing the return of physical and chemical properties of land but also showing the potential for further exploration and development of the plants, so therefore it can be the added value for reclamation area. The aim of study is to explore the plant diversity in reclamation area and its potential to be developed in medical field. The study of vegetation is conducted to inventory plants growing wild in shrubs and herbs classification in reclamation land. The reference search is also conducted to find out the medical potential of plants deriving from the inventory. The result of study shows that there are 41 types of flowering plants deriving from 17 tribes and 3 types of ferns deriving from 3 tribes. Further analysis reveals that there are 8 species growing dominantly in the reclamation area. The result of reference search from these dominant plants reveal the promising potential in medicine either in vitro, in vivo or traditionally in which the community around the world has used to cure various diseases.

Key words: Reclamation, Post-mining, Medicinal plants

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1. INTRODUCTION

Post-mining land reclamation was conducted as efforts to restore the land condition after conversion due to mining activities. Land reclamation at mine sites in forest areas was carried out by land clearing of excavated land and proceeded to revegetation. The success of reclamation is not only measured by the return of the area value from ecological point of view, but also from land economical value point of view. Even farther, the reclamation efforts can restore the ecosystem structure as before. (Cooke&Johnson, 2002). Therefore, that must restore the land function on the whole, both ecologically and economically for the community live in the reclamation sites (Skousen et al., 2019).

Mining activity produces ecological change in post-mining land such as the biological characteristic of the soil and microorganism community (Quadros et al., 2016). Ecological change triggers plant species diversity growing in post-mining land (Batty, 2005). It occurs in East Kalimantan where 104 types of plant species are found in post-mining land 16 years after reclamation (Komara et al., 2016).

A study on the success of revegetation is commonly a measurement of plant diversity found in post-mining land reclamation areas. Further studies on the potential of the plants are rarely conducted. The more focused search on the vegetation diversity value of post-mining reclamation land is important to carry out. Naturally, one of the plant values found in several mining land is medicinal plants. The aim of this study is to find out medicinal plant diversity in post-mining land reclamation sites and its potential to be developed in medical field.

2. METHODOLOGY

2.1. Location and Study Time

A study of medicinal plant diversity in coal post-mining reclamation land and its potential to be developed in medical field, was conducted in reclamation area of PT Borneo Indobara, Angsana, South Kalimantan as shown in Figure 1. The study was conducted in the range of

June until August 2019. The study stage consisted of initial survey, field data retrieval, reference search to find out the medical potential of plant types in reclamation land.

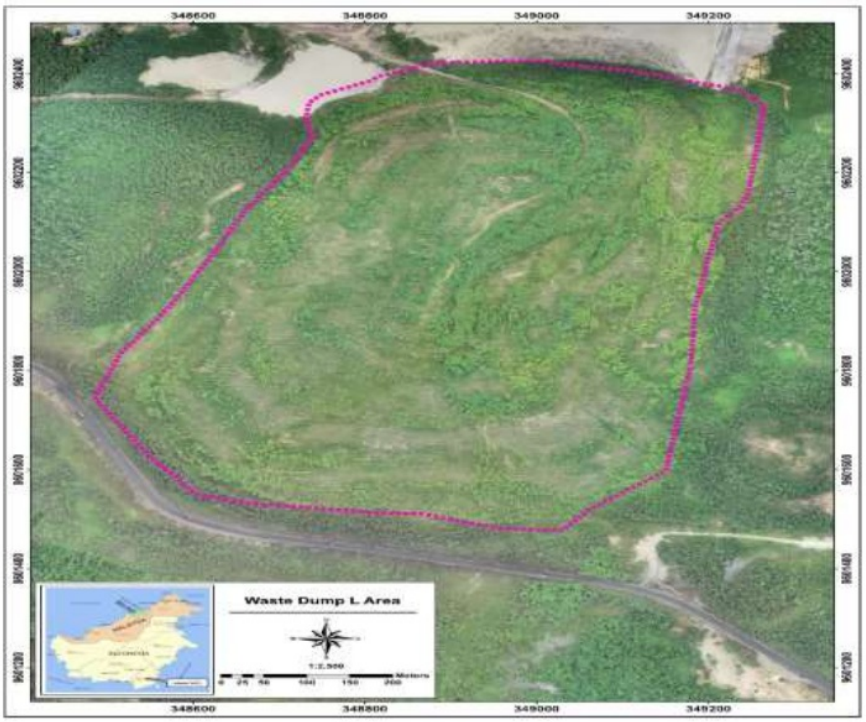

Figure 1 Location study of plants potential reclamation area

2.2. Study Tools and Materials

Tools used in the study were ropes, measuring instrument, plant shears, machete, stationeries, plastic bags to store the plant samples, plastic bags to make herbarium, raffia string, press tools/boards, books and identification reference. As for the material used in the study was rubbing alcohol to make herbarium.

2.3. Sampling Technique

The study was divided into two stages, field data retrieval and reference search. The aim of field data retrieval is to find out. The types of medicinal plants diversity that can be found in the study site. The field data retrieved was types of plant found in reclamation area. The method of field data retrieval was conducted qualitatively in which the combination between transect and plotless sampling as well as distance sampling data retrieval (Navaro, 2015). Figure 2 shows the random transect construction combined with plotless sampling. The inventory of plants in location was conducted by randomly assigning in three locations considered to represent reclamation site condition (location A, B and C). Six transects were made in location A, 5 transects were made in location B, and 4 transects in location C. The number of transect was made as representative on the area where the data collection took place. Each type of plants in classification of herbs and shrubs found in those lines were recorded and identified directly. Types of plants obtained were listed as total plants and its medical potential was traced through references (Quattrocchi, 2012) and research articles.

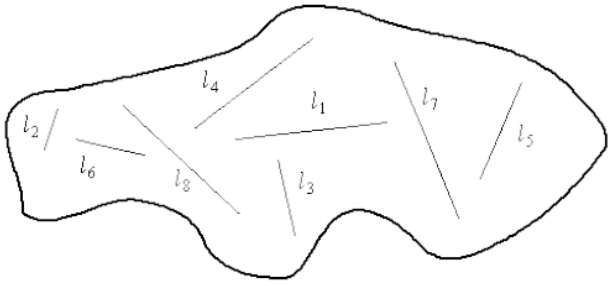

Figure 2. The random transect construction combined with plotless sampling

3. RESULTS AND DISCUSSION

Plotless sampling is used as a method of data collection because this method has high accuracy level in the inventory of all plant types that might be found in location of data location, it is different from quantitative methods which limited in plot area and neglects the potential of new types outside plot to be found (Navaro, 2015). According to Buckland et al. (Navaro, 2015), distance sampling is one of qualitative data collection methods that can reinforce the obtained data. As for transect which randomly spread, it is used because data collection area is not homogeneous with variation of high community structure. This combination of qualitative methods is used to obtain representative data on number of types. This is different from quantitative methods used for area that is likely homogeneous (Navaro, 2015).

Trees classification of plant types is not listed in the recording because trees found in location are trees planted as a part of reclamation program. Therefore, plant types of trees classification don't represent the result of natural growth of the reclamation program.

Data collection result of plant types located in reclamation area is 41 types of flowering plant (Magnoliophyta) deriving from 17 tribes and 3 types of fern (Pteridophyta) deriving from 3 tribes. The name of plant types located in reclamation area can be seen in Table 1.

Table **1** Shrubs and herbs found in the reclamation area

No.	Plant Tribe	Type Name	A	B	C	∑
1	Acanthaceae	*Asystasia gangetica* (L.) T. Anderson	✓			1
2	Asteraceae	*Ageratum conyzoides* L.	✓	✓		2
3		*Chromolaena odorata* (L.) R.M.King & H.Rob.	✓	✓		2
4		*Eclipta prostata* (L.) L.	✓			1
5	Convolvulaceae	*Ipomoea cairica* (L.) Sweet.	✓	✓		2
6	Cyperaceae	*Cyperus amabilis* Vahl.	✓			1
7		*Cyperus andreanus* Maury		✓		1
8		*Cyperus babakans* Steud.	✓	✓		2
9		*Cyperus compactus* Retz.	✓	✓		2
10		*Cyperus entrerianus* Boeckl.	✓	✓		2
11		*Cyperus iria* L.	✓	✓		2
12		*Fimbristylis millicea* (L.) Vahl	✓	✓		2
13		*Scirpus mucronatus* L.	✓	✓		2
14		*Scleria sumatrensis* Retz.	✓	✓		2
15	Fabaceae	*Centrosema pubescens* Benth.	✓	✓	✓	3
16		*Calopogonium mucunoides* Desv.	✓	✓	✓	3
17		*Fabaceae sp 2*.	✓	✓	✓	3

No.	Plant Tribe	Type Name	A	B	C	∑
18		*Desmodium heterophyllum* (Willd.) DC.	✓		✓	2
19	Melastomataceae	*Melastoma malabathricum* L.	✓	✓	✓	3
20	Mimosaceae	*Mimosa pudica* L.	✓	✓	✓	3
21		*Mimosa invisa* Martius ex Colla	✓			1
22	Onagraceae	*Ludwigia hyssopifolia* (G. Don) Exell	✓		✓	2
23	Oxalidaceae	*Oxalis barrelieri* L.	✓			1
24	Passifloraceae	*Passiflora foetida* L.	✓	✓		2
25	Phyllanthaceae	*Breynia cernua* (Poir.) Müll.Arg.	✓	✓	✓	3
26		*Phyllanthus urinaria* L.			✓	1
27	Poaceae	*Eleusine indica* (L.) Gaertn.	✓		✓	2
28		*Eragrostis unioloides* (Retz.) Nees ex Steud.		✓		1
29		*Imperata cylindrica* (L.) P.Beauv.	✓		✓	2
30		*Chloris barbata* SW.	✓		✓	2
31		*Cynodon dactylon* (L.) Pers.	✓		✓	2
32		*Ottochloa nodosa* (Kunth.) Dandy	✓		✓	2
33		*Panicum repens* L.	✓		✓	2
34		*Paspalum conjugatum* P.J.Bergius	✓	✓	✓	3
35		*Paspalum dilatatum* Poir.	✓	✓	✓	3
36		*Paspalum scrobiculatum* L.	✓	✓	✓	3
37	Rosaceae	*Rubus chrysophyllus* Reinw. ex Miq.		✓	✓	2
38	Smilaccaceae	*Smilax* sp.			✓	1
39	Typhaceae	*Typha angustifolia* L.	✓			1
40	Ulmacecae	*Trema micrantha* (L.) Blume	✓	✓	✓	3
41	Verbenaceae	*Lantana camara* L.	✓	✓	✓	3
42	Gleicheniaceae	*Dicranopteris lineraris* (Burm.f.) Underw.	✓	✓	✓	3
43	Lycopodiaceae	*Lycopodium cernuum* L.	✓			1
44	Lygodiaceae	*Lygodium microphyllum* (Cav.) R.Br.	✓		✓	2

Note: *"A" shows the plants found in location A; "B" shows the plants found in location B; "C" shows the plants found in location C; "∑" shows the frequency of plants found in data collection location ("∑" doesn't show the abundance of species).*

Location A is reclamation land planted with silk tree (Albizia chinensis (Osbeck) Merr.). The condition of location shaded by silk tree is likely windy-shady. All shrubs and herbs can grow in open areas found in this location. One of dominant plant types found in location A is Scleria sumatrensis (Cyperaceae). Location B is reclamation land where fragrant lemongrass (Cymbopogon nardus (L.) Rendle) are cultivated. Location B is an open place without shade. In this location, most of shrubs and herbs are those resistant to direct sun exposure such as tribe members Poaceae and Cyperaceae. One of dominant plant types found in location B is Breynia cernua (Phyllanthaceae). Location C is reclamation land located around silk tree planting. In this location, there are many native plants existed before the location converted into mining sites. In location C, there are trees with high shade density leading to minimal herbs and shrubs diversity under the shade. One of dominant plant types found in location C is Breynia cernua (Phyllanthaceae).

Several plants have adequate ability to survive and grow. These plants are not found only in these three locations, but also has high abundance (large biomass). Types of plant with high dominance in three locations are *Chromolaena odorata* (L.) R.M.King & H.Rob (Figure 5), *Dicranopteris linearis* (Burm.f.) Underw. (Figure 6), *Trema micrantha* (L.) Blume. (Figure 7), *Melastoma malabathricum* L. (Figure 8), *Scleria sumatrensis* Retz. (Figure 9), *Breynia*

cernua (Poir.) Müll.Arg. (Figure 10), *Lycopodium cernuum* L. (Figure 11), and *Typha angustifolia* L. (Figure 12). Medical application and use of these eight plant types are searched using reference to find out its development potential in medical field (Table 2).

Table 2 Benefits in medical field of 8 dominant species grow in three locations

Species Name	Parts	Benefits	Reference
Chromolaena odorata (L.) R. M. King & H.Rob.	Steam	To stop bleeding	Quattrocchi, 2012
	Leaf	To heal wound, to cure dysentery, to stop bleeding	
	Flower	To relieve cough, diabetes natural treatment	
Dicranopteris linearis (Burm.f.) Underw	Leaf	To relieve testicular pain, to cure skin disease, asthma and insomnia	Quattrocchi, 2012
	Rhizome	As anthelmintic	
Trema micrantha (L.) Blume.	Sap	To cure sore eyes	De Fillipps et al., 2004
	Leaf	To reduce blood glucose in hyperglemic rats	Schoenfelder et al., 2006
Melastoma malabathricum L.	Tree bark	To cure skin disease, antibacterial, anti fungi	Joffry et al., 2012
	Flower	Anemia medicine	
	Leaf	To stop bleeding	
Scleria sumatrensis Retz.	Fruit	To cure diabetes	Zainon et al., 2001
Breynia cernua (Poir.) Müll.Arg.	Leaf, bark, root	As antibacterial, anti fungi, anti cancer	Khan&Amoloso, 2008; Dirgantara et al., 2018
	Leaf	To relieve high fever caused by malaria	WHO 2009, Holdsworth 2009, National Department of Health Papua New Guinea 2002
Lycopodium cernuum L.	Stem, leaf	As antibacterial, to cure digestive pain	Ndip et al., 2008
Typha angustifolia L.	Stem, leaf	To prevent intestinal inflammation	Fruet et al., 2012

6. CONCLUSION

The result of study shows that there are 41 types of flowering plants deriving from 17 tribes and 3 types of ferns deriving from 3 tribes. There are 8 plants with high dominance in the reclamation area. They are Chromolaena odorata (L.) R.M.King & H.Rob., Dicranopteris linearis (Burm.f.) Underw., Trema micrantha (L.) Blume., Melastoma malabathricum L., Scleria sumatrensis Retz., Breynia cernua (Poir.) Müll.Arg., Lycopodium cernuum L., and Typha angustifolia L. The result of reference search shows that this dominant plant has a promising potential in health field either in vitro, in vivo or traditionally that has been used as a cure by community to cure various disease such as skin disease, digestive pain, malaria, cancer and diabetes.

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