

## VEGETATION ANALYSIS ON RECLAMATION AREA OF COAL MINE OF PT. BUKIT ASAM TANJUNG ENIM, SOUTH SUMATERA

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### ABSTRACT

The Research of Vegetation Analysis on Reclamation Area of Coal Mine of PT. Bukit Asam Tanjung Enim, South Sumatera was aimed to determine the types of vegetation that composing reclamation area was found in PT. Bukit Asam in terms of structure and composition. The research has been done in November until Desember 2014, in four reclamation area at PT. Bukit Asam, namely the area of reclaimed the Muara Tiga Besar Selatan, Mahayung, Klawas Timur, and the Muara Tiga Selatan having different strata age. the vegetation data includes rate of growth seedlings, saplings, poles, and tree obtained through transek method in the form plot lane. In each transect made a plot in size 20x20 m for tree level, 10 x 10 for poles level, 5x5 for saplings level, and 2x2 m for seedling and cover plants level. The results of this research, in the Muara Tiga Besar Selatan area was obtained the vegetation seedlings-cover plants and saplings level, each of 17 and 7 species. In the area Mahayung are only found level vegetation of seedlings-cover plants as many of 13 species. For the area Klawas Timur and Muara Tiga Besar Selatan was obtained growth level of seedlings-cover plants, saplings, poles, and tree each of 20, 4, 3, dan 2 species for Klawas Timur area, while on Muara Tiga Selatan area each obtained 19, 8, 7, and 3 species. The diversity index of species, overall in all area of reclamation and rate of growth included in the low category with value  $0 < H' < 2$ .

Key words : PT. Bukit Asam, Vegetation Analysis, Reclamation, Transect, Diversity Index

### ABSTRAK

Penelitian yang berjudul Analisis Vegetasi Kawasan Reklamasi Tambang Batubara PT. Bukit Asam Tanjung Enim Provinsi Sumatera Selatan ini bertujuan untuk mengetahui jenis-jenis vegetasi yang menyusun kawasan reklamasi yang terdapat di PT. Bukit Asam yang ditinjau dari struktur dan komposisinya. Penelitian ini dilaksanakan pada bulan November sampai dengan bulan Desember 2014, bertempat di empat area reklamasi yang terdapat di PT. Bukit Asam, yaitu area reklamasi Muara Tiga Besar Selatan, Mahayung, Klawas Timur, dan Muara Tiga Selatan yang memiliki strata umur berbeda-beda. Data vegetasi meliputi

tingkat pertumbuhan semai, pancang, tiang, dan pohon diperoleh melalui metode transek berupa jalur berpetak. Pada tiap-tiap transek dibuat plot ukuran 20x20 m untuk tingkat pohon, 10x10 m untuk tingkat tiang, 5x5 m untuk tingkat pancang, dan 2x2 m untuk tingkat semai-tumbuhan bawah. Hasil dari penelitian ini pada area Muara Tiga Besar Selatan diperoleh vegetasi tingkat semai-tumbuhan bawah dan pancang, masing-masing sebanyak 17 dan 7 spesies. Pada area Mahayung hanya ditemukan vegetasi tingkat semai-tumbuhan bawah sebanyak 13 spesies. Area Klawas timur dan Muara Tiga Besar Selatan diperoleh tingkat pertumbuhan semai-tumbuhan bawah, pancang, tiang dan pohon, masing-masing sebanyak 20, 4, 3, dan 2 spesies untuk area Klawas Timur, sedangkan pada area Muara Tiga Selatan masing-masing diperoleh 19, 8, 7, dan 3 spesies. Indeks keanekaragaman spesies secara keseluruhan pada semua area reklamasi dan tingkat pertumbuhan termasuk kedalam kategori rendah dengan nilai  $H' = 2$ .

Kata kunci : PT. Bukit Asam, Analisis Vegetasi, Reklamasi, Transek, Indeks Keanekaragaman.

## INTRODUCTION

Indonesia's tropical forests are part of the lungs of the world. however, Indonesia's forests are damaged by a rate of 2.4 million ha/year. The region of forest in indonesia is currently experiencing heavy pressure, ranging from practice legal logging, illegal logging, forest fire and overlapping allocation between forest and oil palm plantations, Forest Management Rights (HPH), also mining (Solviana & Chairul, 2012).

The existence of the mining sector in Indonesia is a very important sector in improving the nation's economy. Humans need the support of mining resources to maintain and improve the welfare. The mineral resource is a unit of geological structure as part of the ecosystem (Djajadiningrat (2007) dalam Eddy *et al.* (2010)).

Every coal mining companies have an obligation to carry out reclamation of the former mining area and the surrounding area who are disturbed by mining activity. The results of reclamation is expected to have an impact on an ecosystem, such as setting the balance of carbon dioxide and oxygen in the air, improvement of soil properties, water regulation, etc. (Patiung *et al.*, 2011).

PT. Bukit Asam is a coal mining company that is quite old and has lots of good conduct reclamation activities in accordance with the guidelines of the Ministry of Energy and the Ministry of Environment and Forestry. Therefore, these companies realize very important to do the process of re-vegetation or land reclamation after mining activities take place. It is important to preserve and minimize damage to the environment and ecosystem.

Reclamation activities conducted by PT. Bukit Asam is sustainable over time. Land mines are no longer used for mining activities, immediately carried out land reclamation activities to preserve the environment and preserving the stability of the ecosystem in the area of mining in this company.

Reclamation has done this, required to do the vegetation analysis to discover the vegetation growing on land reclamation PT. Bukit Asam, so that can formed composition of buffer forest to maintain the stability of the ecosystem at the site of coal mining PT. Bukit Asam.

## MATERIALS AND METHOD

This research was conducted in November-December 2014. The location of this research in the area of reclamation Muara Tiga Besar Selatan (Region age 2 years), reclamation area Mahayung (Region age 4 years), reclamation area Klawas Timur (Region age 10 years) and reclamation area Muara Tiga Selatan (Region age 19 years) Coal mine of PT. Bukit Asam, Tanjung Enim in South Sumatra Province. The method used in this research is the method of double track or lines plot (transects) are modified. Plot observations will be made or placed on line (Ernawati *et al.*, 2013).

line transects in each area of research as much as 3 transects perpendicular to the topography of the location of the sampling area. Each transect was placed 4 of square plots continuous with a distance of 20 meters between plots one with the other plot, in which the placement of the transect and plot is said to have represented every area to be made in the research object.

Plot in the reclamation area of Muara Tiga Besar, Mahayung and Klawas Timur made with the size 10 x 10 m for the level of the tree and pole, 5 x 5 m for sapling dan 2 x 2 m for seedling, while in the reclamation area of Muara Tiga Selatan each plot was made with the size 20 x 20 m for tree level, 10 x 10 m for pole level, 5 x 5 m for sapling level and 2 x 2 m for seedling. Level plant species of trees, poles and saplings contained in any plot its diameter is measured on diameter breast height (dbh). To plant of the seedling to do the estimated percent canopy closure.

The data obtained from the field and then analyzed to obtain a density value, frequency, dominance, importance value and diversity index of species by the following formula:

### Species Density (K)

$$= \frac{\sum \text{individual of a species}}{\text{wide the entire plot}}$$

### Relative Density (KR)

$$= \frac{\text{density value of a species}}{\sum \text{density value all species}} \times 100\%$$

### Species Frequency (F)

$$= \frac{\text{number of plots encountered a species}}{\text{total number of plots}}$$

**Frequency relative (FR)**

$$= \frac{\text{value of the frequency of a species}}{\sum \text{frequency values all species}} \times 100\%$$

**Dominance of Species (D)**

$$= \frac{\text{number of basal area of a species}}{\text{wide the entire plot}}$$

**Relative Dominance (DR)**

$$= \frac{\text{value of the dominance of a species}}{\text{Dominance of all species}} \times 100\%$$

Calculation of the importance value from the growth level of trees, poles and saplings by the following the formula:

$$\text{Importance Value (NP)} = \text{KR} + \text{FR} + \text{DR}$$

For the importance value of seedling growth by following the formula:

$$\text{Importance Values (NP)} = \text{KR} + \text{FR}$$

## RESULT AND DISCUSSION

On the reclamation area Muara Tiga Besar is acquired plant species on the growth level of seedlings and saplings were classified into 11 families, each of which 17 plant species seedling-undergrowth and 7 spesies saplings level (Table. 1). In Seedling-undergrowth level, *Ischaemum timorense* Kth. has the highest importance value is 61,4%. *Ischaemum timorense* Kth. is a type of grass that dominates this location which is a pioneer plant species. According to Tjhiaw and Djohan (2009), natural succession process begins with the presence of pioneer plants such as grass. Sapling level, *Acacia mangium* Wild. has the highest importance value is 69,81 magnitude of importance value of *Acacia mangium*. This is because the reclamation area was originally reclaimed by planting *Acacia mangium* Wild. According to Yamashita *et al.* (2008) on Tjhiaw dan Djohan (2009), *Acacia* sp is the nitrogen fixing, so it can grow well in nutrient-poor soil.

In the reclamation area Mahayung 4 years old found only in level seedling-undergrowth with the number of 13 species were classified into 3 family (Table. 2). plant level of seedling-undergrowth, grass *Paspalum commersonii* Lamk and *Mimosa pudica* Duchass. & Walp. Has the highest importance value in this location, is 61,25% and 40,58%. This suggests that the grass *Paspalum commersonii* Lamk and *Mimosa pudica* Duchass. & Walp. have a pretty good dominance in the reclamation area this Mahayung. Hilwan *et al.*, (2013), stated that succession occurs in rainforest areas that are cultivated, then abandoned, its growth will begin with grass and shrub vegetation. Tjhiaw and Djohan (2009), add that *Mimosa pudica* is nitrogen-fixing too, so its presence in ex-mining areas characterize nutrient-poor soil of nitrogen.

**Tabel 1. Structure and composition of vegetation in the reclamation area of Muara Tiga Besar Selatan (MTBS)**

No.	Latin name	Family	Importance value(%)			
			Tree	Pole	Sapling	Seedling
1.	<i>Acacia mangium</i> Wild.	Fabaceae	-	-	69,81	6,87
2.	<i>Paraserianthes falcataria</i> (L.) Nielsen	Fabaceae	-	-	38,02	-
3.	<i>Cyperus rotundus</i> L.	Cyperaceae	-	-	-	31,06
4.	<i>Dolichos lablab</i> L.	Fabaceae	-	-	-	8,79
5.	<i>Erythrina crista-galli</i> L.	Fabaceae	-	-	-	2,15
6.	<i>Eupatorium odoratum</i> L.f.	Asteraceae	-	-	-	3,48
7.	<i>Intsia palembanica</i> Miq.	Fabaceae	-	-	25,08	11,51
8.	<i>Ischaemum timorense</i> Kth.	Poaceae	-	-	-	61,4
9.	<i>Lygodium microphyllum</i> (Cav.) R. Br.	Lygodiaceae	-	-	-	2,23
10.	<i>Melaleuca cajuputi</i> Powell.	Myrtaceae	-	-	68,5	2,23
11.	<i>Melastoma malabathricum</i> D. Don.	Melastomataceae	-	-	-	11,02
12.	<i>Mimosa pudica</i> Duchass. & Walp	Fabaceae	-	-	-	24,81
13.	<i>Paspalum commersonii</i> Lamk	Poaceae	-	-	-	8,37
14.	<i>Pterospermum acerifolium</i> Will.	Malvaceae	-	-	-	3,48
15.	<i>Robinia pseudoacacia</i> L.	Caesalpiniaceae	-	-	32,59	-
16.	<i>Scirpus acutus</i> Muhl.	Cyperaceae	-	-	-	11,14
17.	<i>Cassia siamea</i> Lamk.	Fabaceae	-	-	41,46	5,72
18.	<i>Sida cryptopetala</i> F. Muell.	Malvaceae	-	-	-	2,23
19.	<i>Theobroma cacao</i> L.	Sterculiaceae	-	-	24,57	3,48

Although it has been 4 years old At this location is not found the other growth level apart seedling-undergrowth. According to Andono (Personal interview), this is because the quality of the crop and soil quality at this location is not too good, so that the plants do not grow well planted at this location. In addition, the growth of the grass plant species in this area is very tightly so that inhibit the growth of other plants. According to Groninger *et al.* (2007) on Tjhiaw dan Djohan (2009), *arrested succession* occurs because the dense grass vegetation aggressive that can inhibit succession. The grass vegetation quickly deplete water and nutrients from the soil so that only a few essential nutrients are absorbed next growthform.

**Table 2. Structure and composition of vegetation in reclamation area of Mahayung**

No.	Latin name	Family	Importance value (%)			
			Tree	Pole	Sapling	Seedling
1.	<i>Acacia mangium</i> Wild.	Fabaceae	-	-	-	2,5
2.	<i>Albizia saman</i> (Jacq) Merr.	Fabaceae	-	-	-	18,58
3.	<i>Dolichos lablab</i> L.	Fabaceae	-	-	-	2,92
4.	<i>Digitaria sanguinalis</i> L. Scop.	Poaceae	-	-	-	8,75
5.	<i>Hibiscus tiliaceus</i> . L	Malvaceae	-	-	-	5,42
6.	<i>Imperata cylindrical</i> (L.) Beauv	Poaceae	-	-	-	2,92
7.	<i>Ischaemum timorense</i> Kth	Poaceae	-	-	-	10,83
8.	<i>Leersia oryzoides</i> (L.) Swartz.	Poaceae	-	-	-	20,42
9.	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	-	-	-	11,25
10.	<i>Mimosa pigra</i> L.	Fabaceae	-	-	-	11,67
11.	<i>Mimosa pudica</i> Duchass. & Walp.	Fabaceae	-	-	-	40,58
12.	<i>Paspalum commersonii</i> Lamk	Poaceae	-	-	-	61,25
13.	<i>Scirpus acutus</i> Muhll.	Cyperaceae	-	-	-	2,92

**Table 3. Structure and composition vegetation in reclamation area of Klawas Timur**

No.	Latin name	Family	Importance value (%)			
			Tree	Pole	Sapling	Seedling
1.	<i>Acacia mangium</i> Wild.	Fabaceae	273	210,7	30,29	7,26
2.	<i>Albizia saman</i> (Jacq.) Merr.	Fabaceae	27	12,2	147,04	11,54
3.	<i>Asystasia intrusa</i> Bi.	Acanthaceae	-	-	-	16,95
4.	<i>Cyperus rotundus</i> L.	Cyperaceae	-	-	-	21,24
5.	<i>Digitaria sanguinalis</i> L. Scop.	Poaceae	-	-	-	11,42
6.	<i>Diplazium esculentum</i> Swartz	Polypodiaceae	-	-	-	2,14
7.	<i>Elusine indica</i> (L.) Gaertn.	Poaceae	-	-	-	15,65
8.	<i>Eupatorium odoratum</i> L. f.	Asteraceae	-	-	-	8,5
9.	<i>Eurya acuminata</i> DC.	Pentaphragmalaceae	-	-	-	3,39
10.	<i>Imperata cylindrical</i> (L) Beauv	Poaceae	-	-	-	4,7
11.	<i>Ischaemum timorense</i> Kth.	Poaceae	-	-	-	64,8
12.	<i>Leucaena leucocephala</i> (Lam.) de Witt	Fabaceae	-	-	64,43	2,14
13.	<i>Melastoma malabathricum</i> D. Don.	Melastomaceae	-	-	-	2,14
14.	<i>Microcos paniculata</i> . L	Malvaceae	-	-	58,24	5,95
15.	<i>Mikania scandens</i> Willd.	Malvaceae	-	-	-	2,14
16.	<i>Mimosa pudica</i> Duchass. & Walp.	Fabaceae	-	-	-	8,09
17.	<i>Pterocarpus indicus</i> Willd.	Fabaceae	-	77,11	-	2,14
18.	<i>Ruellia prostrata</i> Poir.	Papilionaceae	-	-	-	3,39
19.	<i>Sauropus androgynus</i> (L.) Merr.	Euphorbiaceae	-	-	-	4,28
20.	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	-	-	-	2,14

This suggest that *Acacia mangium* Wild. is very dominance in area reclamation of Klawas Timur, although many other plants that are planted in this reclaimed area. According to Inonu (2008), *Acacia* plants produce root exudates

that is tend allelopathy for other plants. In addition, the proliferation of acacia through seeds and vegetative (root buds) tend to be extensive. Both of these inhibit the growth of other plants in the vicinity, so the vegetation is relatively homogeneous. In the growth level of seedling-undergrowth that is dominance is *Ischaemum timorense* Kth.(64,8%), *Cyperus rotundus* L.(21,24%), and *Asystasia intrusa* Bi. (16,95%). All three plants, has a supreme and dominant presence in each transect study.

In the recalamation area of Muara Tiga Selatanis found 19 families (Tabel 4). Famili Fabaceae with 3 species, Euphorbiaceae, Poaceae dan Dioscoreaceae each with 2 species, and the others family has 1 species composition. On the Tree, Pole and Sapling level, *Schima wallichii* (DC.) korth. has the highest importance value with the each importance value is 160,29 %, 103,74%, and 86,03%.

**Table 4. Structure and composition of vegetation in the reclamation area of Muara Tiga Selatan**

No.	Latin name	Family	Importance value(%)			
			Tree	Pole	Sapling	Seedling
1.	<i>Acacia mangium</i> Wild.	Fabaceae	-	-	9,37	-
2.	<i>Adenantha pavonina</i> . L.	Fabaceae	113,64	75,50	23,51	-
3.	<i>Alstonia scholaris</i> (L.) R. BR.	Apocynaceae	-	6,71	29,40	-
4.	<i>Amomum dallachyi</i> F. Muell.	Zingiberaceae	-	-	-	6,92
5.	<i>Aporosa aurita</i> Miq.	Euphorbiaceae	-	61,15	58,96	5,34
6.	<i>Bauhinia pottsii</i> G. Don.	Fabaceae	-	-	-	7,76
7.	<i>Clausena anisata</i> (Willd.) Hook. f.	Rutaceae	-	-	-	18,69
8.	<i>Cyperus rotundus</i> L.	Cyperaceae	-	-	-	8,1
9.	<i>Dioscorea hispida</i> Denst.	Dioscoreaceae	-	-	-	5,26
10.	<i>Dioscorea villosa</i> L.	Dioscoreaceae	-	-	-	27,78
11.	<i>Dracontomelon dao</i> Merr & Rolfe	Euphorbiaceae	-	10,84	-	-
12.	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	-	-	-	2,42
13.	<i>Eupatorium odoratum</i> L. f.	Asteraceae	-	-	-	2,84
14.	<i>Eurya acuminata</i> DC.	Pentaptylaccaceae	-	-	14,59	21,94
15.	<i>Ficus</i> Sp	Moraceae	-	4,28	7,35	-
16.	<i>Gleichenia pectinata</i> (Willd.) K.	Gleicheniaceae	-	-	-	6,09
17.	<i>Lygodium conforme</i> C. Chr.	Lygodiaceae	-	-	-	6,85
18.	<i>Nephelium juglandifolium</i> Blume.	Sapindaceae	26,07	37,77	70,79	3,67
19.	<i>Pandanus tectoris</i> Sol.	Pandanaceae	-	-	-	2
20.	<i>Paspallum conjugatum</i> Berg.	Poaceae	-	-	-	10,52
21.	<i>Psychotria viridis</i> Ruiz & Pauv.	Rubiaceae	-	-	-	5,26
22.	<i>Ruellia prostrate</i> Poir.	Papilionaceae	-	-	-	16,61
23.	<i>Schima wallichii</i> (DC.) korth	Theaceae	160,29	103,74	86,03	22,86
24.	<i>Selaginella willdenowii</i> (Desv.) Becker.	Selaginellaceae	-	-	-	19,11

According to Aprianti (2013), *Schima wallichii* (DC.) korth. or puspa (Local name) able to live in a wide range of soil conditions, climate, and habitat. Grow abundantly in lowland primary forests to mountains, This tree is also common in

secondary forests and disturbed areas, even in grassland. Can live up to Puspa not selectively condition the soil texture and fertility. Although it prefers a well drained soil.

While the growth level of seedlings, *Dioscorea villosa* has the highest importance value than other species, is 27,78%, followed by *Schima wallichii* (DC.) korth. with importance value 22,86% and *Eurya acuminata* DC. With importance value is 21,94%. Density of seedling-undergrowth in this reclamation area is not too high. This is because this area has been overgrown by trees that have been great with a canopy that is wide enough, so that sunlight can not penetrate to the forest floor below where undergrowth life. According to Indriyanto (2006), on the forest floor or the bottom layer is dark and very humid, certainly there are fewer life of the plants compared with the existing layers thereon. Plants that require a lot of sunlight would not be able to live on the bottom layer in the forest.

Species diversity index for area reclamation of Muara Tiga Besar Selatan consecutive for seedlings and saplings is 0,8101 and 0,9962. On the Reclamation area Mahayung index values diversity found only growth level of seedling is 0.912. While in the Reclamation area of Klawas Timur, in a row for the level of the tree, pole, saplings and seedlings is 0.1314; 0,316; 0.534; and 1.0226; while for the area of Muara Tiga Selatan in a row is 0.3973; 0.6797; 0.7783 and 1.1672.

based on Diversity index in each location, it can be said that the reclamation area in the coal mine has been progressing very well seen from the diversity of species. Although the area of reclaimed 2-year and 4-year have species diversity is very low, compared to the reclamation area who are 15 years old and 20 years old who have a diversity of medium species.

Indriyanto (2006), Stated a community can be said to have a high diversity of species if the community was composed by many species. Instead of a community is said to have a low species diversity if the community was composed by few species, and if only a few dominant species.

## CONCLUSION

Based on the research that has been done, we concluded as follows:

1. The structure and composition of vegetation coal mine reclamation area of PT. Bukit acid based on the reclamation area, as follows :
  - a. Reclamation Area of Muara Tiga Besar Selatan obtained growth level species seedling-undergrowth and saplings each as much as 7 and 17 species were classified into 11 families, each dominated by *Acacia mangium* Wild and *Melaleuca cajuputi* (saplings) and *Ischaemum Timorense* Kth. (Seedling-undergrowth). Reclamation area of Mahayung obtained species plant growth level seedling-undergrowth as many as 13 species classified to the 3 families, dominated by *Paspalum commersonii* Lamk and *Mimosa pudica* Duchass & Walp.



- b. Reclamation Area of Klawas Timur obtained a growth level of trees, pole, saplings and seedlings-undergrowth each as much as 2, 3, 4 and 20 species. Spesies yang dominan adalah *Acacia mangium* Wild (trees level), *Acacia mangium* Wild (pole level), *Albizia saman* (Jacq.) Merr. (saplings level), dan *Ischaemum timorense* Kth. (seedling-undergrowth level).
  - c. Reclamation Area of Muara Tiga Selatan obtained a growth level of trees, pole, saplings and seedlings-undergrowth, each as much as 3, 7, 8 and 19 species. On a growth level of trees, poles and saplings, species *Schima wallichii* (DC.) Korth dominate this area, while at the seedling-undergrowth dominate is *Dioscorea villosa* L
2. Diversity index of species all around the reclamation area in the ranges  $H' = 0,1314-1,1672$  thus the species diversity in all reclamation area of coal mine of PT. Bukit Asam is quite low.

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