

Mapping And Development Of Geographic Information System Spreading And Biomass Potential In Java And Sumatra

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Abstract. Indonesia is one of the countries on the equator. This geographical position makes the soil of Indonesia become fertile and have high rainfall. It also makes forests and plantations grow well. The main product of forest and plantation products in Indonesia gives positive and economical value to society and country. However, it also gives negative value, one of them is the biomass waste that it produces. If not managed properly, then this will be bad for the cleanliness and aesthetic environment. Through the bioenergy program, it can be done how to utilize biomass waste into Biomass Power Plant (PLTBM). In this research, mapping and development of geographical information distribution system and bioenergy potential by classifying the biomass sources used by the plant and also the analysis of land area to potential energy that can be used.

1. Introduction

Identification of Potential and Study of Biomass Utilization, Municipal Rubbish and Biogas for Electrical Energy in Sumatera and Kalimantan Island, so that biomass potential can be obtained, for electricity on the island of Sumatra of 15,588 MWe and potential for biomass for electricity in Borneo island of 5.062 Mwe. The biomass potential for electricity is unevenly distributed and requires a power grid to be connected to the bioenergy plant that has been built. The current state of electricity network development by the State Electricity Company is still constrained by geographical aspects, and economics so that the available power distribution network is not yet connected to the state electricity company network. Forest Energy is a program of the energy sector and the forestry sector, to encourage the involvement of all parties in campaigning for the potential of forests to prosper the surrounding communities and create national energy independence and resilience. Energy Plantation Forest is the allocation of productive forest land and growing crops above it as biomass feedstock devoted entirely to biomass-based bio-based fuel or electricity production for domestic purposes. The process of energy formation from this biomass alone, kind of a lot to be able to generate energy, from the start of the combustion system (boiler) to the fermentation system, and so on. [1] In this research will map out the scattered biomass resources especially in Sumatera and Kalimantan Island, where in these two islands, biomass resources are very large, especially the remaining resources of palm oil waste and waste woodchip waste. [2][3]

This research hopes to describe the map of the distribution of biomass-based energy, so it can be concluded and analyzed the benefits for the people and prosperity of the Unitary State of the Republic of Indonesia.



2. Method

The methodology used in this study is how data are collected, including non spatial data (biomass power generation points, industrial forests, oil palm plantations), and spatial data on village, sub-district, district and provincial districts [4][5]. Then the data is processed, there are processes of segregation / merging / intersection data, then data in overview or visualized in GIS tools [6] [7], as shown in Figure 1. below :



Figure 1. General Process Methodology Mapping and Development of Geographic Information System Distribution and Biomass Potential in Java and Sumatera

Data input can be tables, reports, maps, satellite photos, remote sensing, field measurements etc. This process is to collect, prepare and store spatial data, as well as convert to a format that can be used by GIS devices. Then Data management, in this process is to organize spatial data and related attribute tables into a database system so easily recalled or retrieve, updated and edited. Then manipulation and data analysis, this process to determine the information that can be generated by GIS. In addition, it also manipulates and modeling to produce the expected information. Finally output / analysis results, shaped map display results include exporting it to the desired format as in the form of tables, graphics, reports, maps and so on [8] [9][10].

The steps are as shown in Figure 2. as follows:

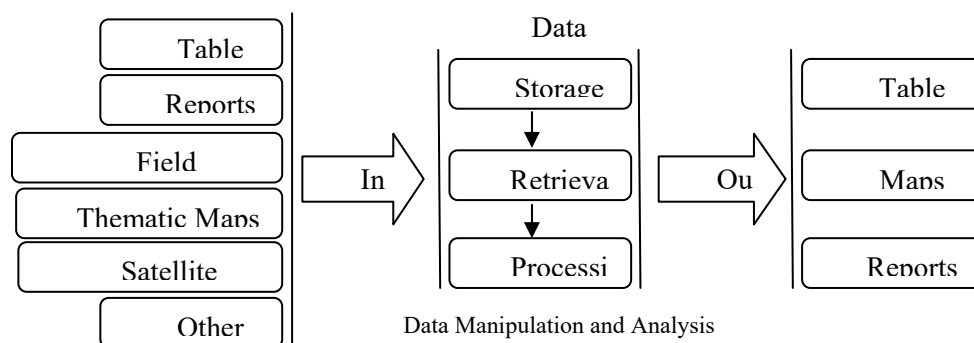


Figure 2. Special Process Methodology Mapping and Geographic Information System Development Analysis of Biomass Distribution and Potential in Java and Sumatera

3. Data Analysis

Plantations are all natural resource management, human resources, production, tools and machinery, cultivation, harvesting, processing and marketing activities related to Plantations. In the framework of energy security, plantation waste can be a source of raw materials of bio-energy such as palm oil, coconut, sugar cane, sago, kemiri sunan and jatropa. The yield of the oil palm area is a source available for bioenergy feedstock, of the total area Total Area 10.9 Million Ha, smallholdings: 4.6 M ha, large plantation of the country: 0.7 M Ha, large private plantation: 5, 6 Million Ha, can be classified as follows: People's Plantation, Large State Plantations, Large Private Plantations, Plants have not yet produced, Plants Produce, and Plant Damaged / Old. Oil palm plantations have a high CO₂ absorption capacity (251.9 tons / ha / yr) and are very useful in reducing CO₂ concentrations in the air due to increased greenhouse gases causing climate change on Earth as well as O₂ production capability of O₂ (183, 2 ton / ha / yr), and high biomass (C). Biomass production of oil palm plantations is higher than that of tropical forests. Oil palm waste, both trees, midribs, empty fruit bunches and shells are a considerable source of energy that can be utilized for biofuels and suppress

the use of fossil fuels, thereby significantly reducing emissions. Oil palm plantations have potential for biofuels, data from the Ministry of Forestry show that, area of oil palm plantations in Indonesia: 10,465 million hectares, CPO production (crude palm oil): 27.78 million tons (Exports of 20.57 million tons, domestic demand 7.21 million tons). Cultivation:

Farmers: 44%, and Large State / Private Plantations: 56%. Palm Oil byproducts: Pome: 73,294,200 tons (58%), Shell: 17,102,248 tons (7%), Empty bunches: 28,096,386 tons (23%), Fiber: 14,650,984 tons (14%), Farmers: 2.01 million, and Labor: 1.8 million

Table 1. Recapitulation of Oil Palm Companies in Indonesia

No	Province	Number of Companies	Area (Ha)	Production	Number of Oil Palm Plant	Capacity (Ton / Hour)
1	Aceh	117	366.343,54	828.256,81	26	863,00
2	Sumatera Utara	68	260.149,53	793.176,28	88	3.552,00
3	Bengkulu	42	129.165,00	171.232,76	26	1.090,00
4	Riau	310	1.462.118,03	4.237.736,70	215	9.610,00
5	Jambi	133	646.996,40	1.060.985,05	44	1.965,50
6	Sumatera Selatan	48	42.047,49	158.813,33	45	345,00
7	Lampung	25	58.353,89	166.217,61	12	592,00
8	Bangka Belitung	32	151.398,63	510.717,48	12	780,00
9	Banten	4	4.057,14	9.440,96	1	30,00
10	Jawa Barat	1	7.768,30	34.147,00	1	20,00
11	Kalimantan Barat	104	590.345,70	861.048,30	58	2.370,00
12	Kalimantan Tengah	87	642.383,81	1.563.091,97	64	4.347,00
13	Kalimantan Selatan	84	650.082,87	394.066,09	33	1.532,30
14	Kalimantan Timur	96	942.143,05	491.103,21	65	3.075,00
15	Sulawesi Selatan	4	49.492,74	54.689,48	2	60,00
16	Sulawesi Tengah	10	140.806,63	108.980,37	3	210,00
17	Sulawesi Barat	8	48.036,85	152.467,65	-	-
18	Papua	8	99.041,60	93.070,80	7	390,00
	Total	1181	6.290.731,20	11.689.241,85	702,00	30.831,80

Table 2. Number of Palm Oil Mill in Sumatera and Kalimantan

Territory	Area (Ha)	Production (Ton)	Number of Oil Palm Companies	Capacity (Ton / Hour)
Sumatera	3.116.572,51	7.927.136,02	468	18.797,5
Kalimantan	2.824.955,43	3.309.309,57	220	3.075,0
Total	5.941.527,94	11.236.445,59	688	30.121,8

Table 3. Sample of Data, Distribution of potential sources and utilization of Bioenergy In plantation sector, in Aceh Province, Babel, Bengkulu & Jambi, as follows:

City or District	Type of Industrial Area	Potential (MWe)		Utilized (MWe)	
		Technical	Optimization	on-grid	off-grid
Aceh	shell of desicated coconut, Sawit	0	0	1.2	0
Aceh Barat	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	20.14	23.66	0	4.5
Aceh Besar	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	4.24	4.92	0	1
Aceh Singkil	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	2.28	2.68	0	0.5
Aceh Tamiang	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	11.99	14.77	0	2
	Pabrik Sawit, Tg Seumantoh, POM Residue, Sawit	0	0	10	0
Aceh Timur	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	27.11	32.31	0	5.58
Aceh Utara	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	2.12	2.46	0	0.5
Langsa	POME, Oil	0	0	2	0
	POM Residue, Oil	0	0	1.5	0
Nagan Raya	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	5.07	6.09	0	1

Simeulue	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	3.44	4.06	0	0.75
Bangka	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	6.57	7.44	0	1.75
Bangka Barat	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	13.52	14.4	0	4.5
Belitung	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	4.36	5.09	0	1
Belitung Timur	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	21.85	25.3	0	6.75
Bengkulu Selatan	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	10.43	13.08	0	1.5
Bengkulu Utara	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	40.15	50.12	0	6
Muko Muko	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	28.25	35.49	0	4
Seluma	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	8.36	10.44	0	1.25
Batang Hari	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	30.11	37.59	0	4.5
Bungo	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	14.13	17.75	0	2
Jambi	POM Residue, Sawit	0	0	10	0
Merangin	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	40.15	50.12	0	6
Muaro Jambi	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	33.45	41.77	0	5
Sarolangun	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	10.04	12.53	0	1.5
Tanjung Jabung Barat	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	31.78	39.93	0	4.5
Tebo	Oil Palm Factory (Fiber, Shell, Empty Bunch, Liquid Waste)	10.04	12.53	0	1.5

4. Results

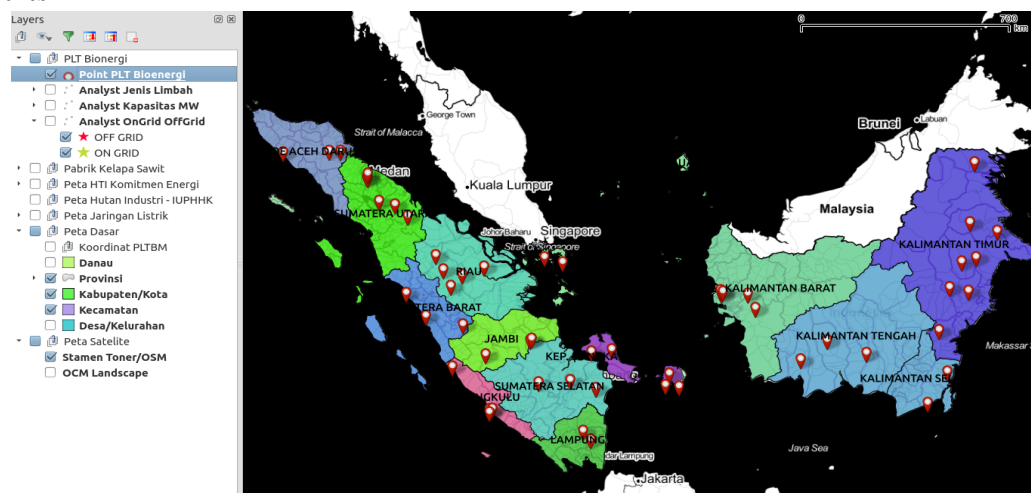


Figure 3. Composite Layer, Red Polygon is a spread of plantation / natural forest that has IUPHHK, and red dot is the distribution of Bioenergy power plants in Sumatra Island and Kalimantan

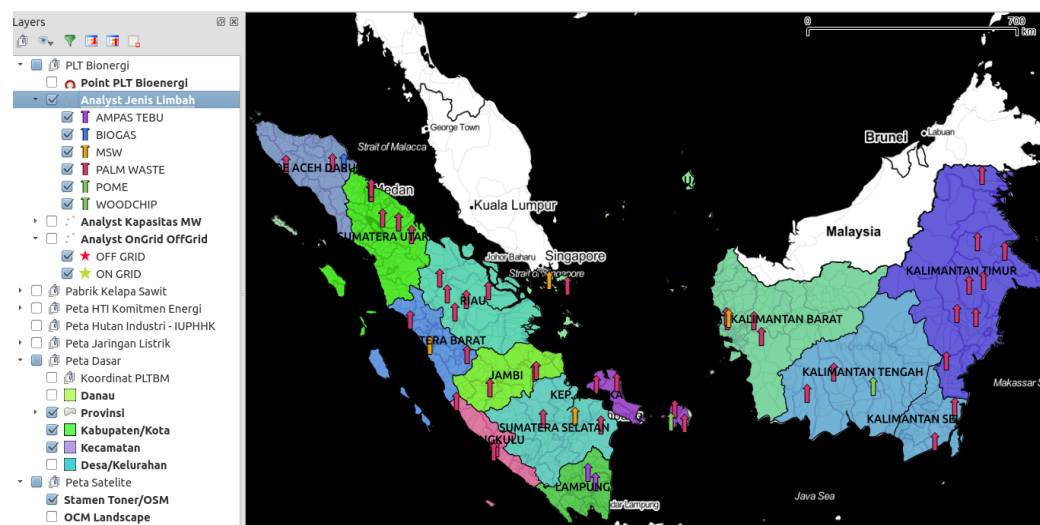


Figure 4. The following thematic maps appear on the map, the Bioenergy power plant is classified into: Sugar Cane, Biogas, MSW, Palm Waste, Pome and Woodchip. Palm waste appears to dominate the distribution of waste types for Bioenergy power plants.

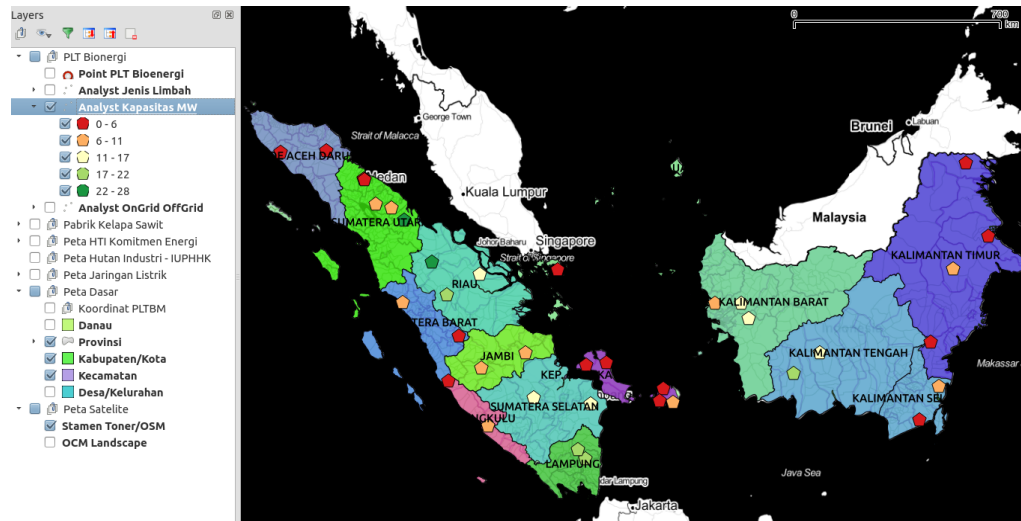


Figure 5. In the following thematic maps shown on the map, the Bioenergy power plant is classified into: 0-6 MW, 6-11 MW, 11-17 MW, 17-22 MW, and 22-28 MW. Looks a capacity of 0-6 MW dominates the distribution for Bioenergy power plants

5. Conclusion

These forests and plantations give positive and economic value to the people and the state. But giving a negative value, especially the waste of biomass that it produces, if not managed properly will adversely affect the cleanliness and environmental aesthetics. So with the bioenergy program how to utilize biomass waste into Biomass Power Plant (PLTBM). In this research, mapping and development of geographical information distribution system and bioenergy potential by classifying biomass sources used by plant and also analysis of land area to potential energy that can be used. So the conclusions of this research have been analyzed and described the potential of biomass energy, especially on the island of Sumatra and Kalimantan.

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