

The environmental impact of the clay industry in Sri Lanka: with special reference to Dankotuwa Divisional Secretariat Division (DSD)

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Abstract- This paper examines the environmental impact of the clay industry. Today, the environmental impact of the clay industry has gained a major concern. Among them the major impacts are raw materials of clay is obtained from the earth, digging huge pits in the earth's surface, loss of biodiversity, soil erosion, disrupts ecosystems, the formation of sinkholes, changing water quality, and land use. Therefore, this research mainly is aimed to identify the environmental impact and changes that have occurred in the land use patterns, as well as migratory measures that can be applied on the identified several issues of clay mining. The methodology of the research was the mixed method under the holistic approach. Data were collected from clay factory owners and the residents in the vicinity in Six Grama Niladari Divisions (GNDs) in the Ma Oya South bank of Dankotuwa DSD and obtained water sample test reports from Long Life Laboratory. The collected data were analyzed by using descriptive statistics such as mean, mode, median, standard deviation, regression and ANOVA, geoprocessing, and spatial analyze is (IDW) were used to identify land use changes and water quality changes. Through the analysis, there were 67951sq. (m) of water pits and 478663 sq. (m) of clay digging spots in 2004. Comparatively in the year 2018, there were 167633sq. (m) of water pits and 556907sq. (m) of clay digging spots. The maximum values of water quality were identified as 7.9 of PH, 462 mg/l of total dissolved, 98 mg/l of turbidity, 107 mg/l of alkalinity 203 mg/l total hardness, and 489 us/cm of electric conductivity. There was a positive relationship between the income and expenditure ($R=0.849$) of the factory owners. The income of the population resides near these factories have been increased by 58.33% and 75% of the population resides by the Clay Pits. The knowledge of these people about the political influence on this industry varies; people near the clay pits are 100% aware and people near the factories, 75% aware of this factor. The result of the study further indicated that the highest land use allocation was given for the clay digging and deep water pits. Clay digging for brick and tile industries is a significant problem affecting negatively on the environment. Clay digging has also become a considerable issue in the Ma Oya reservation causing severe damage to the river bank and water quality. Finally, digging clay has drastically changed the landscape of the area and the land use has been changed. Therefore, the clay industry directly affects the environment in this region. To mitigate these issues, it can be suggested to implement such as restrictions on clay mining along the Ma Oya and enforcement of the existing laws on clay mining.

Index Terms- Clay industry, Environmental impact, Land use change, Ma Oya.

I. INTRODUCTION

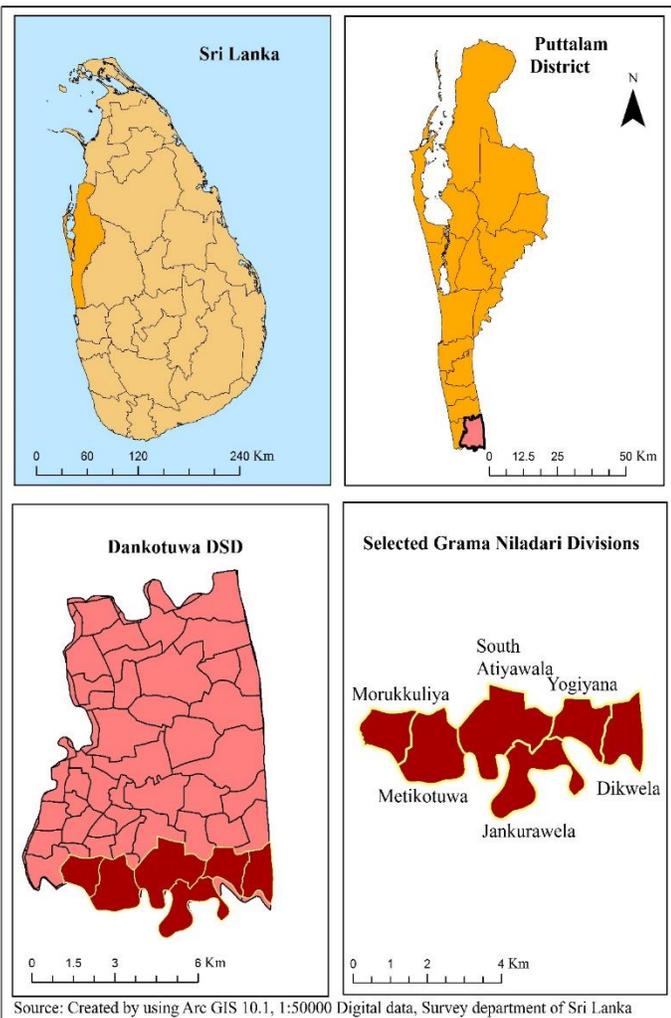
The history of the clay industry, started after man stopped their hunting for food. The use of clay began and it was used for making home utensils, building homes, for decorations, and also recovered useful information, they used clay (Ranaveera, 2004). After they left the Stone Age, they began to use clay to build houses, by making bricks. Excavation has shown that man had used bricks to build houses. Civilization from the Indu River Vally, such as Mohendajaro and Harappa cities have clearly shown that they had used clay (Jesse, 2003). Buddhist stupas have built by using clay, history shows used in Sri Lanka the use of clay started after they arrived of the Rev: Mahinda with the travel of Bikkuni Sangamiththa, many clay craftsmen came, and there among them houses build also (Sumangala, 2016). With the construction of many buildings, the bricks and tiles became very essential. So, Dankotuwa DSD became very prominent in the Puttalam district. Ma Oya becoming the center of the clay industry, at present, the economic, social, and environmental impact has become very clear (Panagoda, 2015). The studies conducted so far have shown clearly the environmental impact is very evident. The objective of the research is to find out and show the land use change, spatially, and temporally.

II. METHODOLOGY

The holistic approach has been used for this study. The random sample is 6 from the tile section, 6 from the brick section, people living area the clay mining area, that's 12 persons, and also the resides living closer to the factories, that's 12 persons. Irrespective of gender 36 persons were considered as samples for the above study. The data analyzed are as follows is tile production brick production sections. The qualitative and the quantitative data of the primary and the secondary data has been collected from interviews, discussions, and questionnaires. The data has been gathered from the various offices relative to the industry. Descriptive and statistical methods have been used to analyze a particular study. The computer software, such as SPSS, Microsoft excel, Arc GIS 10.7. The SWOT method used to analyze the qualitative and quantitative levels for the above study.

A. Study area

The Puttalam district is situated in the Western coastal line, in the North Western province. There are 16 DSDs in the Puttalam district. Out of these 16 divisions, Dankotuwa DSD has been identified as a study area. The Dankotuwa DSD area, that is 7890.5 ha has been distributed and the administration is looked after by 47 GNDs (DSD reports, 2018). The area between Kala Oya and Ma Oya is being used as industrial zones, so it has become urbanized. So, the wetland area and the low land area of the Dankotuwa DSD has been created. The land bordering a lot of clay, so the vast area such as Dikkwela, Yogyiyana, Jankurawela, South Atiyawala, Metikotuwa, and Morukkuliya GSDs have been chosen to this study.



Map 1: The Location of the Study Area

B. Research problem and objectives

Has been the clay industry impact on the natural environment in Sri Lanka?

The main objective of the study is to identify the environmental impact of the clay industry. The other objects are,

- To identify the spatial and temporal land use change
- The impact on the people living in the area

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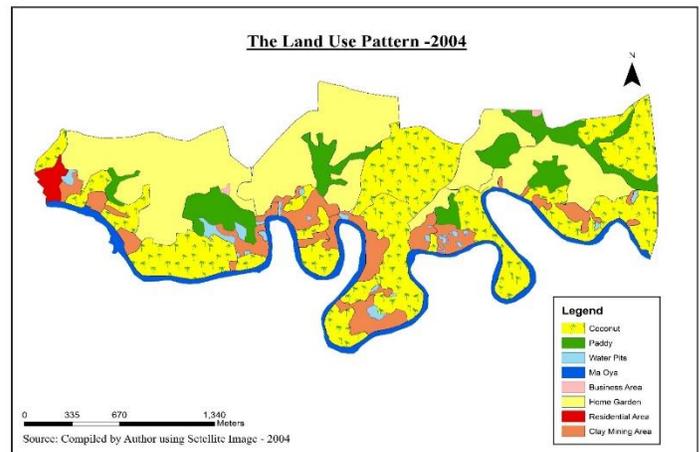
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III. FINADING

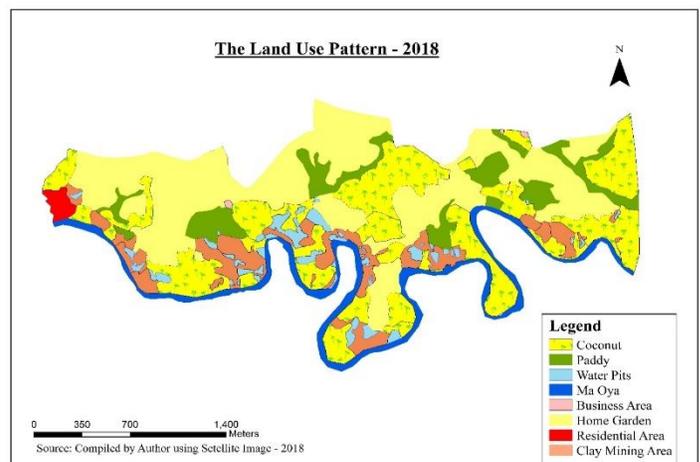
Through the analysis, the various impacts have been identified. The difference section of this study has been identified clearly.

A. Identify land use changes

The nature of the physical features has influenced the changes in land use, temporally. The maps of 2004 and 2018 have been used to show the land used difference.



Map 2: The Land Use Pattern 2004



Map 3: The Land Use Pattern 2018

Table 1: Trends of the Changing Land Use

2004			2018	
Land Use Type	Land Extent (m ²)	(%)	Land Extent (m ²)	(%)
Coconut	1588999	34.74	1369375	29.94
Paddy	459016	10.03	347589	7.60
Water pits	67951	1.48	167633	3.66
Clay Mining	478663	10.46	556907	12.17
Ma Oya	319593	6.98	343506	7.51
Business area	7295	0.15	7795	0.17
Home Garden	1610627	35.21	1730423	37.83
Residential	40957	0.89	49873	1.09
Total	4573101	100	4573101	100

The data relative to 2004 to 2018 has shown the decrease in coconut land and paddy land cultivation is due to clay mining. The land for coconut growing has been 34.74% in the year 2004, but in 2018 has been decreased up to 29.94%. The land for paddy cultivation has been 10.03% for the year 2004, but for the year 2018 the land has decreased up to 7.60%. The reason for this decrease is to clear due to clay mining in these lands. Relative to 2004-2018, the land area the South bank of the Ma Oya has increased, due to the water pits, in clay mining, Ma Oya, business area, home garden, and residents. The water pits in the year 2004 had been 1.48%, but in the year 2018 has increased to 3.66%. The clay mining in the year 2004, 10.46% has increased to 12.17%. During these 04 years continuous clay mining has increased the water pits. Compared to the bank of the Ma Oya land in the year 2004, it had been 6.98%, but in 2018 it has increased to 7.51%. The reason for the width of the bank of the Ma Oya is due to the flow of the water been collected in the water pits. The home garden area had been in 2004, 35.21% but in the year 2018, it has increased to 37.83%. The residential area had been in 2004, 0.89%, but in 2018 1.09%. With the migration of people to these industrial zones, the home garden, and the residential area has increased.

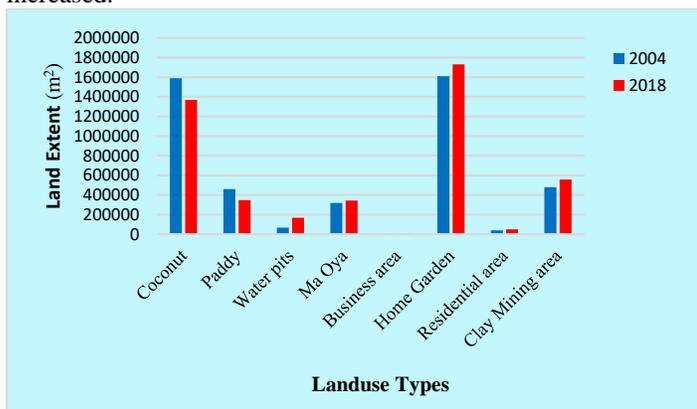
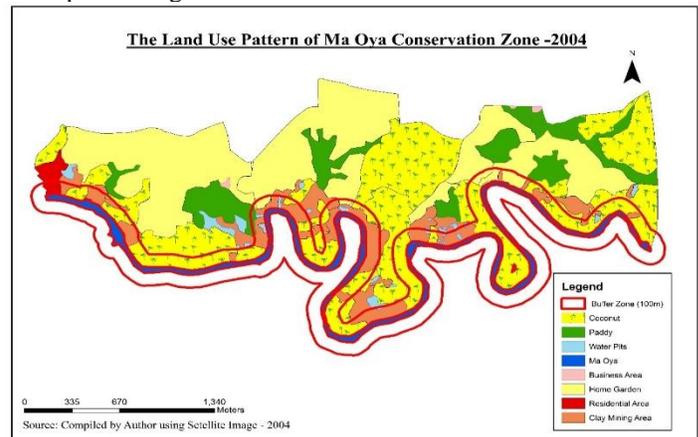
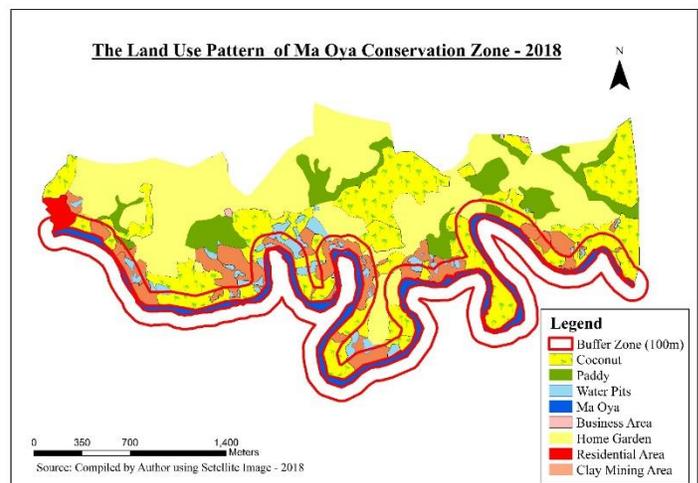


Figure 1: Comparison of the Land Areas Use Changes

Act 12 of 1990, environmental profanation of the North West Province has declared land area of 100 meters been prohibited from the bank of the Ma Oya (Karunaratne, 2004). But unfortunately the area of clay mining had gone beyond the permitted area, Table 3.2 And 3.3 shows it. The Metikotuwa, South Atiyawala, and Jankurawela GNDs, clay mining has been going on at an increased place. It is mainly due to the clay mining areas purchasing the land suitable for cultivation.



Map 4: The land use pattern of Ma Oya conservation zone 2004



Map 5: The land use pattern of Ma Oya conservation zone 2018

B. Spatial changes of the land use by effect from the Clay industry
The area studied has shown that the land area has spatially changed. The most affected areas are Morukkuliya, Matikotuwa, South Atiyawala, and Jankurawela GNDs. The reason for this changed due to the use of clay mining and the deepwater pits been created. This is especially evident in the South Atiyawala bank of the Ma Oya. The water pits in the Metikotuwa GND in 2004 had been 3.1%, but in 2018, 4.85% has increased. The clay mining area of the Metikotuwa GND in 2004 has been 7.14% but 2018 has drastically increased to 28.23%. The paddy cultivation area of the Metikotuwa GND in 2004 had but in 2018 it has decreased to zero. It is mainly due to the land been transformed into clay mining.

Table 2: The land use pattern according to the GNDs 2004

GND	Land Extent (%)							
	Coconut	Paddy	Water pits	Ma Oya	Business area	Home Garden	Residential area	Clay Mining area
Morukkuliya	25	4.4	1.4	6.4	0	44.3	8.2	9.9
Metikotuwa	24	12.9	3.1	6.3	0.3	45.8	0	7.1
South Atiyawala	35.8	6.6	0.5	3.7	0	43.9	0	9.1
Yogiyana	10.2	29.1	0	3.4	0.6	53.6	0	2.8
Jankurawela	56.5	3.4	2.4	17.3	0	4.05	0	26.1
Dikwela	57.3	11.0	1.0	4.4	0	20.3	0	5.7

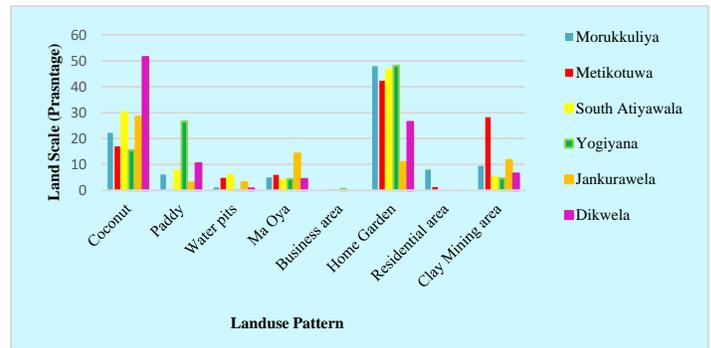


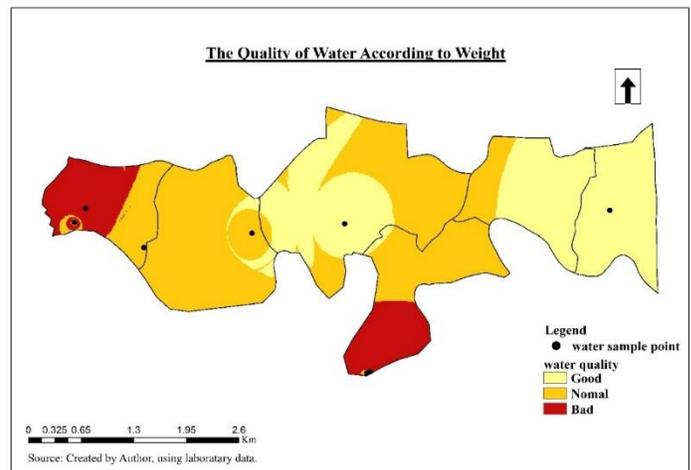
Figure 3: The land use pattern according to the GNDs 2018

Table 3: The land use pattern according to the GNDs 2018

GND	Land Extent (%)							
	Coconut	Paddy	Water pits	Ma Oya	Business area	Home Garden	Residential area	Clay Mining area
Morukkuliya	22.1	6.1	1.1	5.0	0	47.9	8.0	9.4
Metikotuwa	16.9	0	4.8	6	0.3	42.3	1.2	28.2
South Atiyawala	30.0	7.5	5.8	3.9	0	46.5	0	5.1
Yogiyana	15.4	26.6	0.1	4.4	0.5	48.1	0	4.6
Jankurawela	28.4	3.0	3.1	14.2	0	10.9	0	11.7
Dikwela	51.4	10.4	0.7	4.3	0	26.4	0	6.5

D. Spatial distribution of water quality

The water quality that has been tested from August to September 2018 that's about the 8 samples has shown the chemical and the physical qualities. The water parameters result has shown the percentage of the change. Arc GIS 10.7 software used and to do spatial analysis the researcher has been used IDW tool, Weighted overlay tool to analyze water quality. It can be identified on the below map 6.



Map 6: The quality of water according to weight

According to the map Morukkuliya and Jankurawela GNDs and the area near the Ma Oya, water pollution is very great. The reason for the pollution is due to the deepwater pits. Dikwela area water quality is good because clay mining is less than other GND areas. The above land area relative to 2004 to 2018 has shown the use as less. In most areas of Metikotuwa, South Atiyawala, Jankurawela, and Yogiyana GND, the water quality is normal, the above map shows it well. The quality of the water is varied at present, especially in these areas.

IV. CONCLUSION

The objective of this study was successfully reached, as current negative environmental impacts were identified in various stages of the clay industry in Sri Lanka. Especially digging clay near the Ma Oya river bank has drastically changed the landscape of the area in spatially and temporally. It has affected badly the quality of the well water around the Ma Oya residents. The reasons for the

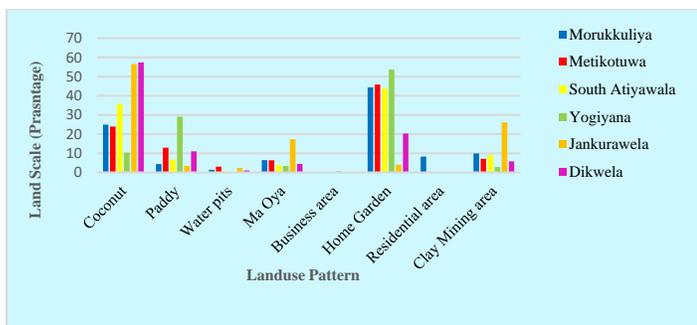


Figure 2: The land use pattern according to the GNDs 2004

bad effects are due to, not following the rules and regulations of the environment authority. The bad effects on the land have been identified by this study.

REFERENCES

- [1] S. Ranaveera, "History of Art", Wasana Publication, Dankotuwa, 2004.
- [2] F. Jesse, "Early ceramics in the Sahara and the Nile valley." Cultural markers in the later prehistory of Northeast Africa and Recent Research Studies in African Archeology & Poznan Archeological Museum, 2003.
- [3] S. Pahiyangala, "Prehistoric settlement in Sri Lanka through Archeological Evidence." International postgraduate research Conference, Faculty of graduate studies, University of Kelaniya, Sri Lanka, 2016.
- [4] D.M.D.P.K. Panagoda, "Evaluation of land resource utilization of Dankotuwa Divisional Secretariat Division: Puttalam District using GIS techniques", University of Sri Jayawardenapura, 2015.
W. Karunaratne, "Impact of the Land and Clay Mining on the River and Coastal Ecosystem of the Ma Oya: Legal and Policy Issues and Recommendations. Environmental Foundation," 2004.

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