WHERE THE LAND GOES?
Land Use Change Trends in Indonesia

Marissa Malahayati[a] and Toshihiko Masui[b]

a) Department of Industrial Engineering and Economics, Tokyo Institute of Technology
b) Centre for Social and Environmental System Research, National Institute of Environmental Studies

INTRODUCTION AND CONDITION OVERVIEW

Most GHG emission (63%) in Indonesia is a result of land use change both in mineral and peatland area .

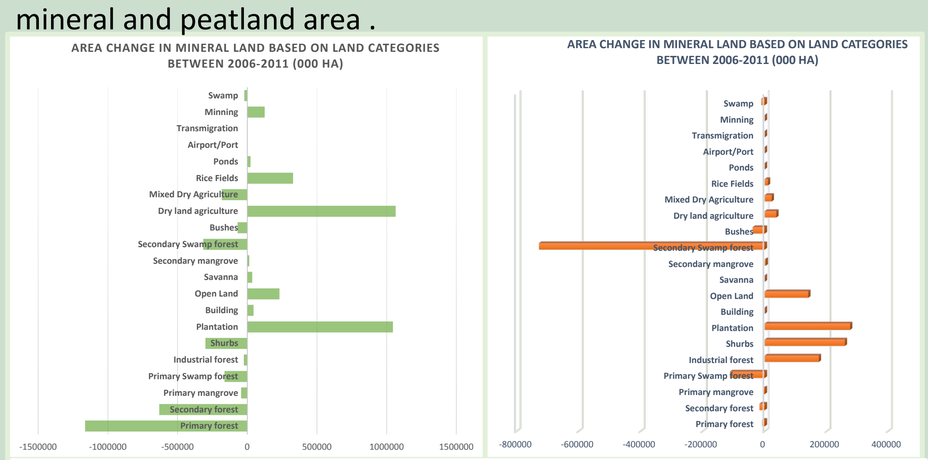


FIGURE 1. Total Area Change from Mineral and Peatland area from 2006-2011 (Source: F Agus et al, 2013- calculated)

The most significant land area lost in the **mineral land** came from Primary and Secondary Forest and predicted to be switched for dryland agriculture, plantation, and rice field. On the Other side, in **peatland**, there is a vast area lost from swamp forest, and the highest additional land is for plantation, shrubs, and industrial forest. It is because the land productivity factor which makes peatland more potential to be used as plantation area than for the agriculture.

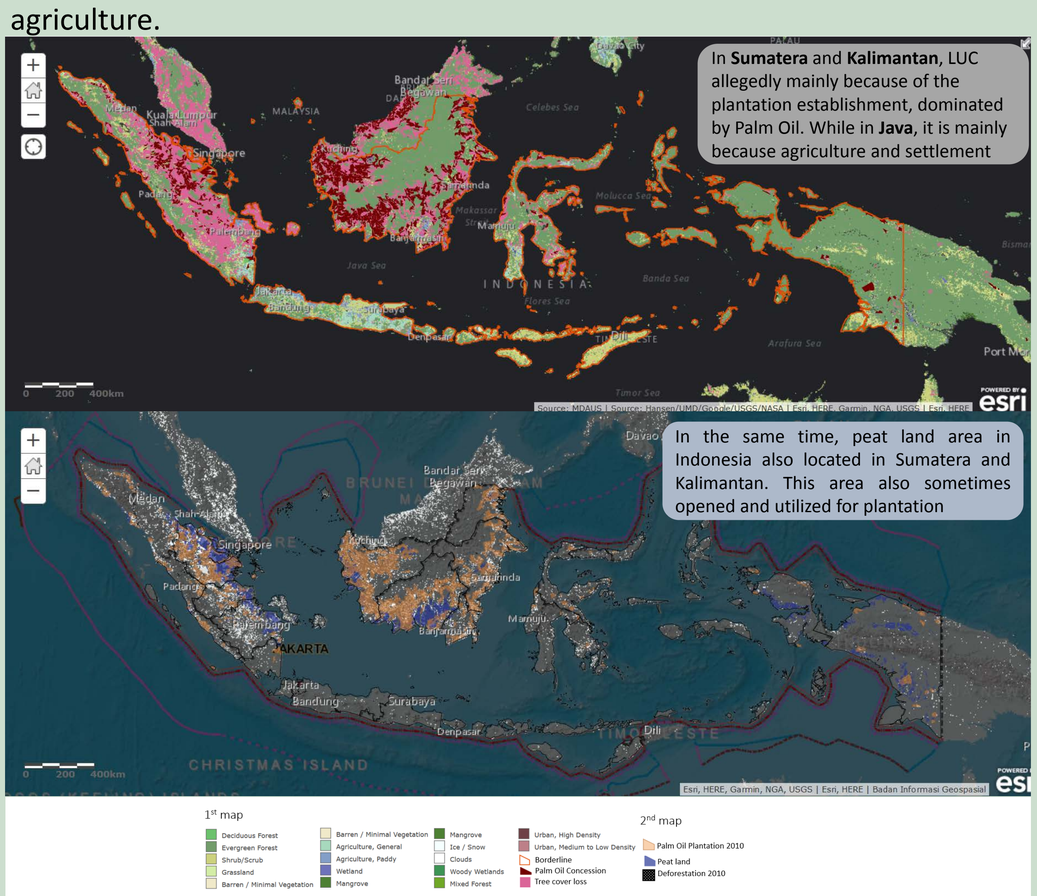


FIGURE 2. (Top-Below) 1. Indonesia Land Cover by type (Ministry of Forestry, 2009), Palm Oil (Ministry of Forestry , 2012), tree cover loss 2000-2010 (Hansen et al, 2013). 2. Indonesia Peat Land (Ministry of Agriculture, 2012) and Palm Oil Plantation (Ministry of Forestry, 2012)

Although the total area of peatland is far below the total area of mineral land, the vast peatland decomposition due to the establishment of the plantation and other commercial plantation make peatland gives a huge contribution to GHG emission.

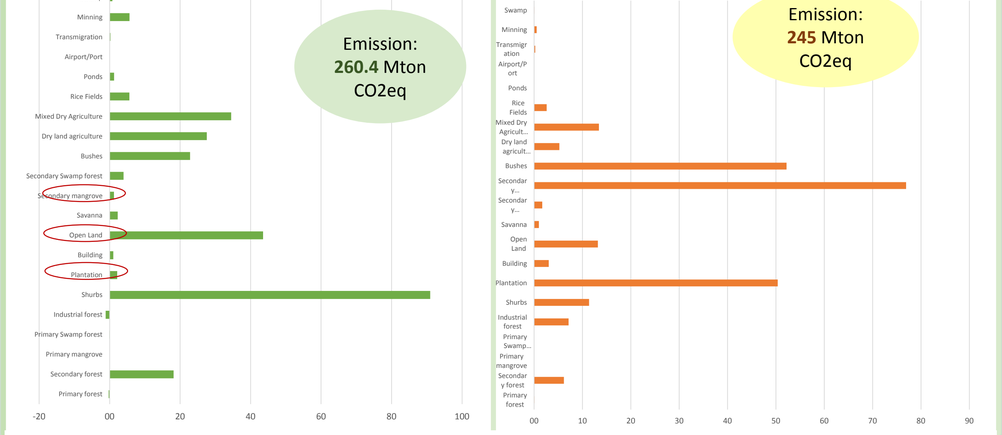


FIGURE 3. Carbon Emitted by the Land Use Change in 2006-2011 period in Mineral land and Peat Land

Although we found that primary forest, primary mangrove, and industrial forest in the mineral forest still hold a role for carbon sequestration, but that becomes too small compared to the carbon emitted by the land conversion to lower density land.

FUTURE RESEARCH: HOW THE EMISSION MITIGATION IN LAND USE CHANGE MAY AFFECT THE ECONOMY

The limitation of the available statistical and spatial data is it still couldn't predict the impact of land use change and its mitigation action to the Indonesia economics. To do that, we are building a national CGE model for Indonesia which also considering the land use change factor.

Despite, we need to re-classify the land category from "forest land-based classification" to "social economy classification" to match with Indonesia Input-Output table.

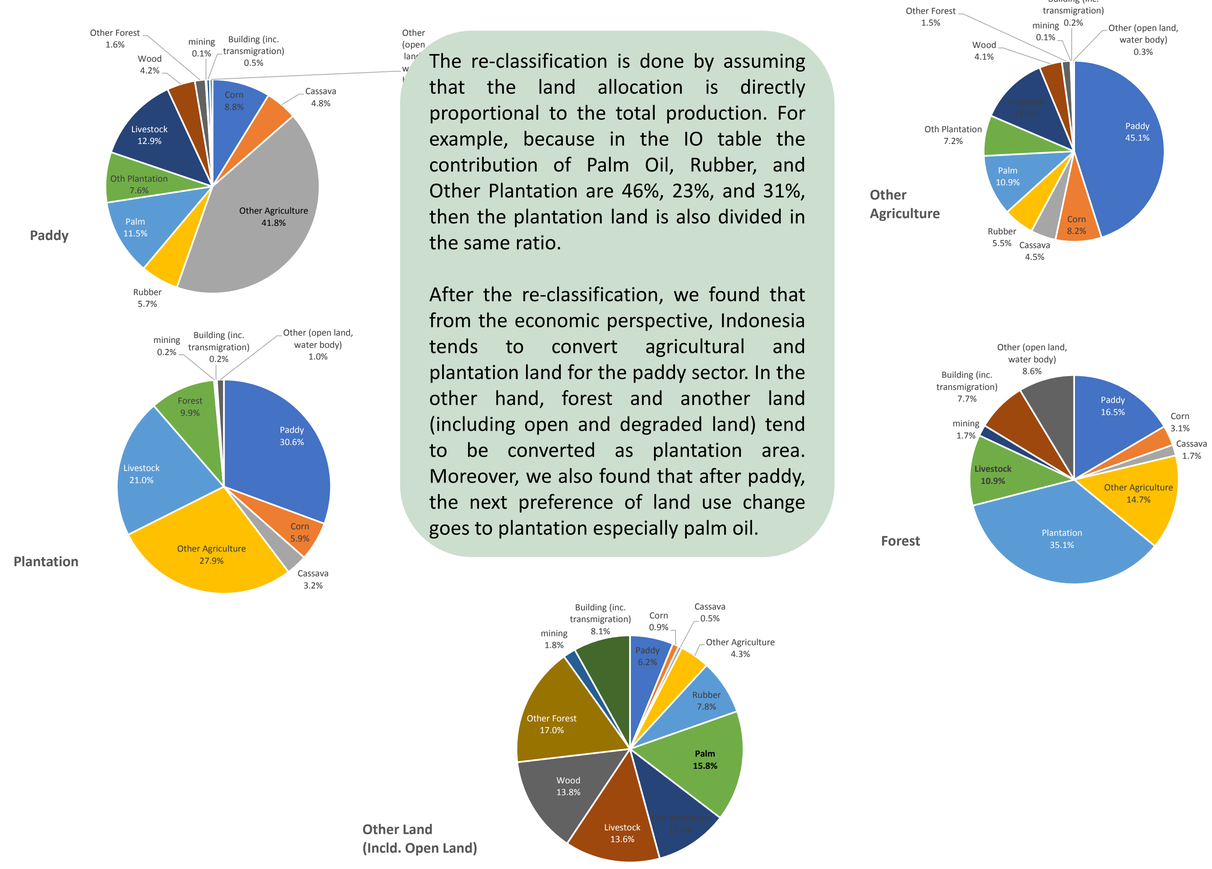
Forest land-based classification

- The most complete source of land allocation and land conversion come from Ministry of Forestry

Social Economy Classification

- Keep the consistency with economic data
- To ease cost determination between each land utilization

INPUT → **CGE Model**

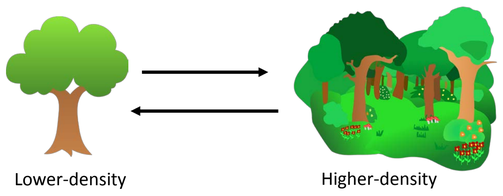


The re-classification is done by assuming that the land allocation is directly proportional to the total production. For example, because in the IO table the contribution of Palm Oil, Rubber, and Other Plantation are 46%, 23%, and 31%, then the plantation land is also divided in the same ratio.

After the re-classification, we found that from the economic perspective, Indonesia tends to convert agricultural and plantation land for the paddy sector. In the other hand, forest and another land (including open and degraded land) tend to be converted as plantation area. Moreover, we also found that after paddy, the next preference of land use change goes to plantation especially palm oil.

FIGURE 4. Land Use Change between 2006-2011 after re-classification to Socio-Economics Classification

RESEARCH CHALLENGES: CONVERSION COST AND CONSIDERATION OF THE PEAT LAND



For example, Gran (2008) shows the cost of converting the forest to other land use. However, there still lack of information about how much the cost by converting those LU to the forest. Good assumption and consideration still needed.

TABLE 1. Example of Land Use Conversion Cost

Land Use Change	Cost (USD/ha/year)
Forest→ Oil Palm	4,439 USD
Forest→ Rubber	1,171 USD
Forest→ Rice field	28 USD
Palm, rubber, rice field → Forest	? ? ?

One of the biggest challenges for LUC modeling in Indonesia is about the cost. To get more accurate and reasonable result, the cost for each land use change should be considered. However, mainly available research only shows the cost of doing the land-based high-profit economic activity (e.g., converting forest to palm oil plantation). But rarely about the cost of doing land rehabilitation or recover the degraded area to higher density land such as agriculture or plantation.

Another concern about peatland emission treatment also needs to be considered. Without the distinction between the land use change in mineral land and peatland in the CGE simulation, the total GHG emission in the simulation become undervalued.

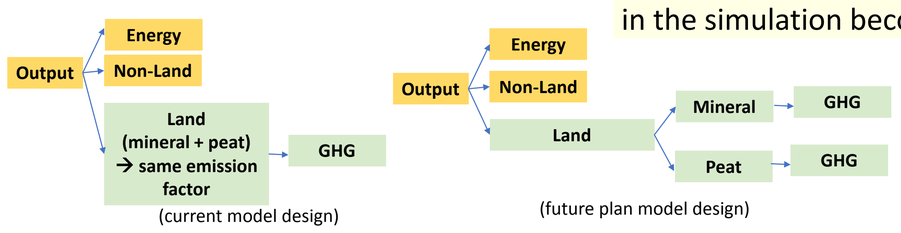


FIGURE 5. Simple Diagram for LUC-CGE Model Design

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