Assessing the Potential Economic Impact of GHG Mitigation Policy in Land Use Change and Forestry (LUCF) in Indonesia

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INTRODUCTION

Indonesia GHG emission mostly comes from the Land-Use Change and Forestry (LUCF) sectors. The challenge is that the concept of GHG mitigation in LUCF is a bit different than the mitigation in the other sectors. In the other sectors, the mitigation can be done by carbon restriction and increase the carbon tax. However, in the LUCF, the mitigation can be done by control the land use change, but due to different land cover and condition, the amount of emission that can be reduced can't easily predicted. In this study, we tried to first assess the potential of mitigation in LUCF sectors to the GHG emission and the economics. The mitigation we use here is increasing the yield and prepare some land endowment for reforestation.

METHODS

This study is using Computer General Equilibrium (CGE) that constructed based on Indonesia Input-Output Table (IOT) 2010, with the structure as below:

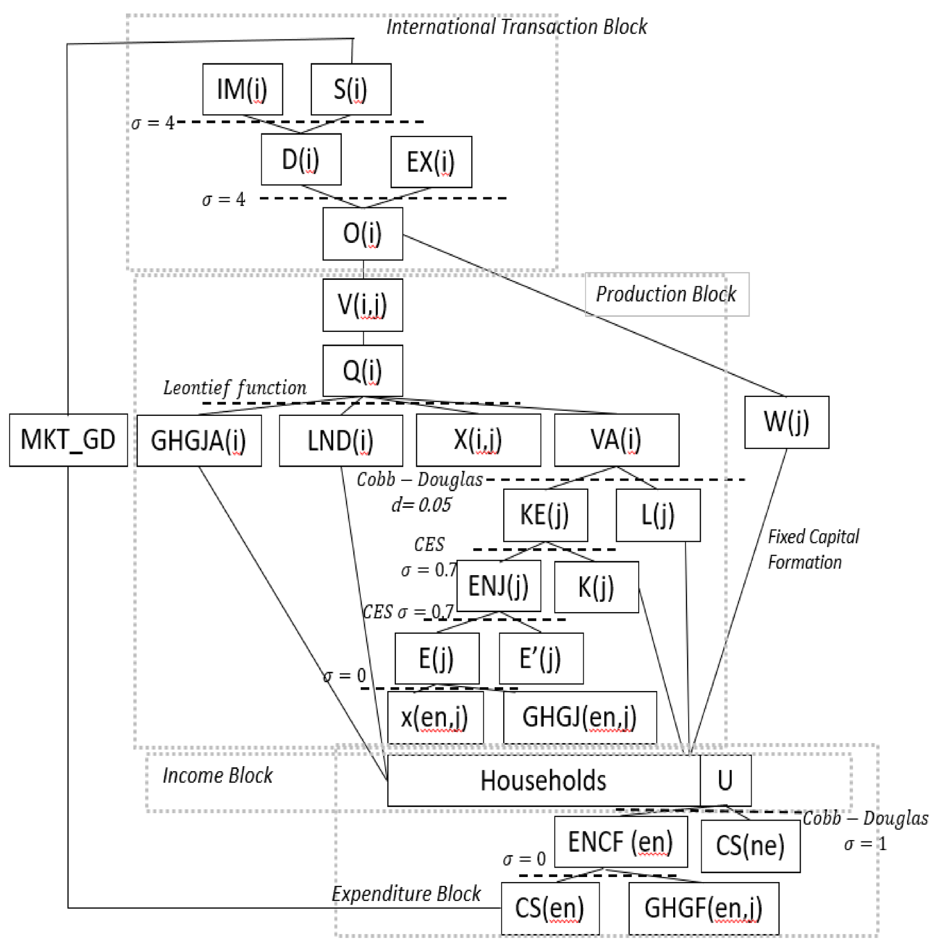


Figure 1. Model Structure of the Study

However, to asses the LUCF, the information of land use change is needed. For this study we use the land conversion matrix gained from Santosa et al. (2014). The matrix was divided into 22 land types, but as the sector should be adjusted with the aggregation/disaggregation of IOT so the matrix then aggregated into 10 sectors (Table 1).

Table 1. Land Transition Matrix (ha)

	PAD	COR	CAS	OAG	RUB	PAL	OPL	LIV	WOO	OFO
PAD	**6,881,200**	4,855	2,662	23,142	739	1,491	985	0	420	105
COR	13,432	**2,603,034**	35,224	305,663	35,448	71,534	47,261	45	26,540	6,555
CAS	7,365	35,238	**1,424,478**	168,133	19,627	39,608	26,168	25	14,695	3,630
OAG	64,018	305,711	168,090	**13,568,596**	169,587	342,227	226,102	213	126,969	31,363
RUB	1,933	39,141	22,115	186,087	**3,845,311**	269,302	177,745	22	44,859	11,109
PAL	3,901	78,987	44,629	375,527	269,302	**8,033,000**	358,630	45	90,525	22,418
OPL	2,576	52,187	29,485	248,114	177,747	358,633	**5,181,575**	30	59,809	14,812
LIV	400	512	282	2,443	517	1,043	689	**3,247,000**	252	63
WOO	3,741	30,678	16,965	146,697	45,239	91,292	60,316	17	**5,583,731**	10,899
OFO	1,035	13,275	7,339	63,470	35,854	72,343	47,756	204	23,377	**87,777,641**
	Note	**Text**	: Own sector							
		text	: highest converted land							

Moreover, this land is treated as input for some sectors. The future land use change will be following the profit optimization scheme designed in the model. The land demand will also depend on another macroeconomics assumption (e.g. GDP growth) stated in the model.

We also add some scenario to test the model. The scenarios are follows:

Scenarios:
1: Business as Usual (BaU)
2: Yield Improvement
3: Yield + Carbon Limit
4: Yield + Reforestation
5: Yield + Carbon Limit+ Reforestation

The yield improvement and rate of reforestation/ afforestation is following the rate that DDPP scenario that stated by the (Boer et al. 2016). However, we haven't added mitigation action from another sectors. So, for the carbon restriction, we still assume 3% carbon restriction in other sector.

RESULT

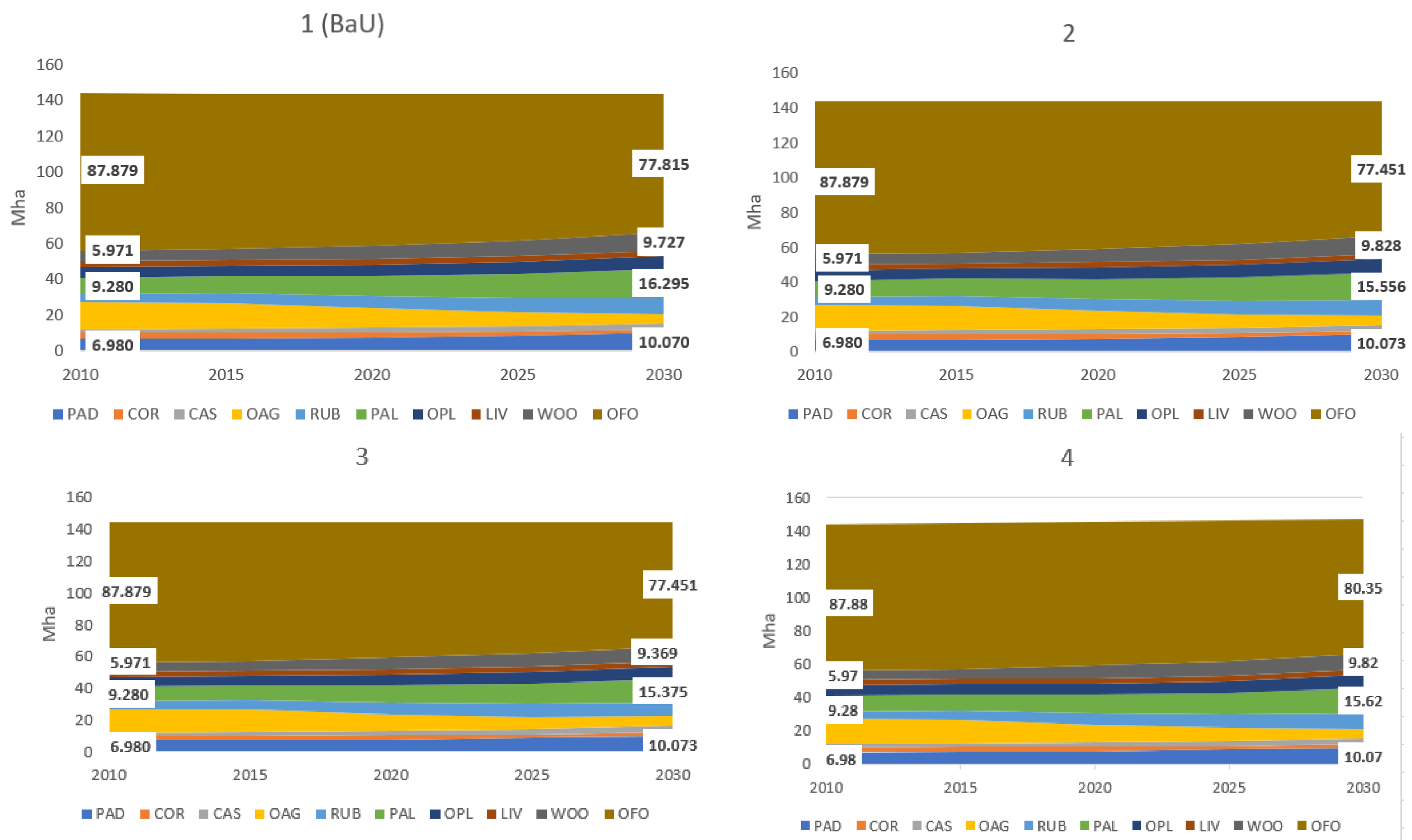
a. GDP

A higher GDP can be achieved by Indonesia, if they increase the yield of the crops. Another finding is, under the carbon restriction condition, reforest/afforestation may help to reduce the GDP loss.

Table 2. GDP Comparison (Trillion IDR)

Year	1 (BaU)	2	gain/ loss		3	gain/ loss		4	gain/ loss		5	gain/ loss	
				%			%			%			%
2015	8941.0	8941.1	0.1	0.001%	8941.1	0.1	0.001%	8942.6	1.6	0.02%	8942.6	1.6	0.017%
2020	12887.3	12892.9	5.6	0.044%	12891.5	4.2	0.033%	12896.6	9.3	0.07%	12896.4	9.2	0.071%
2025	18192.2	18207.0	14.8	0.081%	18207.1	14.9	0.082%	18214.4	22.2	0.12%	18213.5	21.3	0.117%
2030	26649.7	26752.3	102.5	0.385%	26171.2	-478.6	-1.796%	26662.8	13.0	0.05%	26174.6	-475.2	-1.783%

b. Land Area



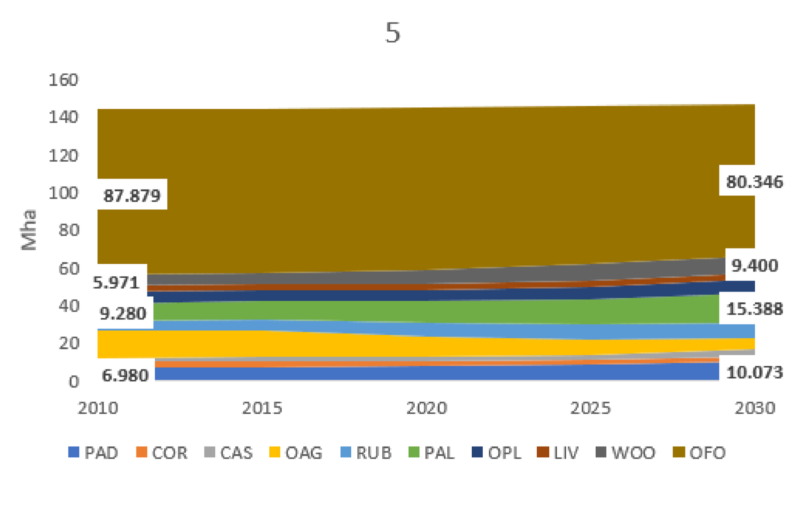


Figure 2. Land Area Comparison

Increasing yield for profitable crops, especially cash crops like palm and other plantation crops, may giving positive impact on economics, but not to the forest area. We predict that if there is no reforestation/ afforestation effort, the deforestation and land use conversion will still high, because people tend to convert the land to more profitable crops.

c. Total GHG emission

Table 3. Total GHG emission (Mton Co2eq)

year	1 (BaU)	2	increase/decrease (%)	3	increase/decrease (%)	4	increase/decrease (%)	5	increase/decrease (%)
2010	1243.8	1243.8		1243.8		1243.8		1243.8	
2015	1553.6	1556.3	0.2%	1556.3	0.2%	1556.4	0.2%	1556.4	0.2%
2020	1836.8	1842.2	0.3%	1770.1	-3.6%	1840.6	0.2%	1768.2	-3.7%
2025	2262.7	2266.9	0.2%	2143.6	-5.3%	2267.1	0.2%	2144.8	-5.2%
2030	2895.7	2926.7	1.1%	2673.8	-7.7%	2907.7	0.4%	2675.2	-7.6%

While in the GHG emission, we predict that only improving yield will not giving a significant reduction of GHG gases. This is a reason why reforest/afforestation is important to introduced along with the yield improvement.

NEXT STEP

- Complete the scenario development and assumption for the LUCF
- Combine with mitigation technologies from other sectors
- Matching up with Indonesia emission reduction target

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