Integrating bioenergy and food production on degraded landscapes in Indonesia

Syed Ajijur Rahman and **Himlal Baral**

Center for International Forestry Research (CIFOR), Bogor, Indonesia
Corresponding author, email: s.rahman@cgiar.org and h.baral@cgiar.org

Background

Energy demand in Indonesia is increasing rapidly, by 43% between 2005 and 2016. Indonesia thus relies on imported fuel (27%).

~16.8 mill ha of land in Indonesia is severely or highly severely degraded (Figure 1).

Restoration is very costly, ranging from approximately US$250 to 3000/ ha.

Biofuel species such as nyamplung (*Calophyllum inophyllum*) could be used to restore ~5.7 million hectares, at a relatively low cost. C. *inophyllum* has multiple benefits:

- » It provides up to 58.3% crude *Calophyllum* oil (CCO) and 53.0% refined crude *Calophyllum* oil (RCCO).
- » It improves soil quality, reverses biodiversity loss and enhances ecosystem services.

Objective and methods

- To assess the socioeconomic and environmental benefits of nyamplung-based agroforestry in Wonogiri, Central Java.
- Data collection: field observations, focus group discussions (FGD) by involving 20 farmers.
- Data analysis: net present value (NPV) over 35-year time period and qualitative narrative.

Results

Economic

- Cultivating nyamplung with local crops is the best option. Nyamplung plus honey provides highest profit (Table 1).
- Nyamplung and nyamplung plus honey are the most sensitive to decreases in production (Figure 4).
- Local employment is created, i.e. traders, and wage-labourers for harvesting, sorting, and transporting of farm products.

Social qualities

- Farmers share tree-planting knowledge.
- More prestigious than subsistence cultivation.
- Property rights are strengthened.

Environmental benefits

- Improves biodiversity and environmental quality: bird habitat, fresh air, soil erosion control, protection of crops from wind.
- Acts as firebreak by supporting fire-prone grasses, and is also typhoon resistant.
- Supports ecotourism as an ornamental plant.

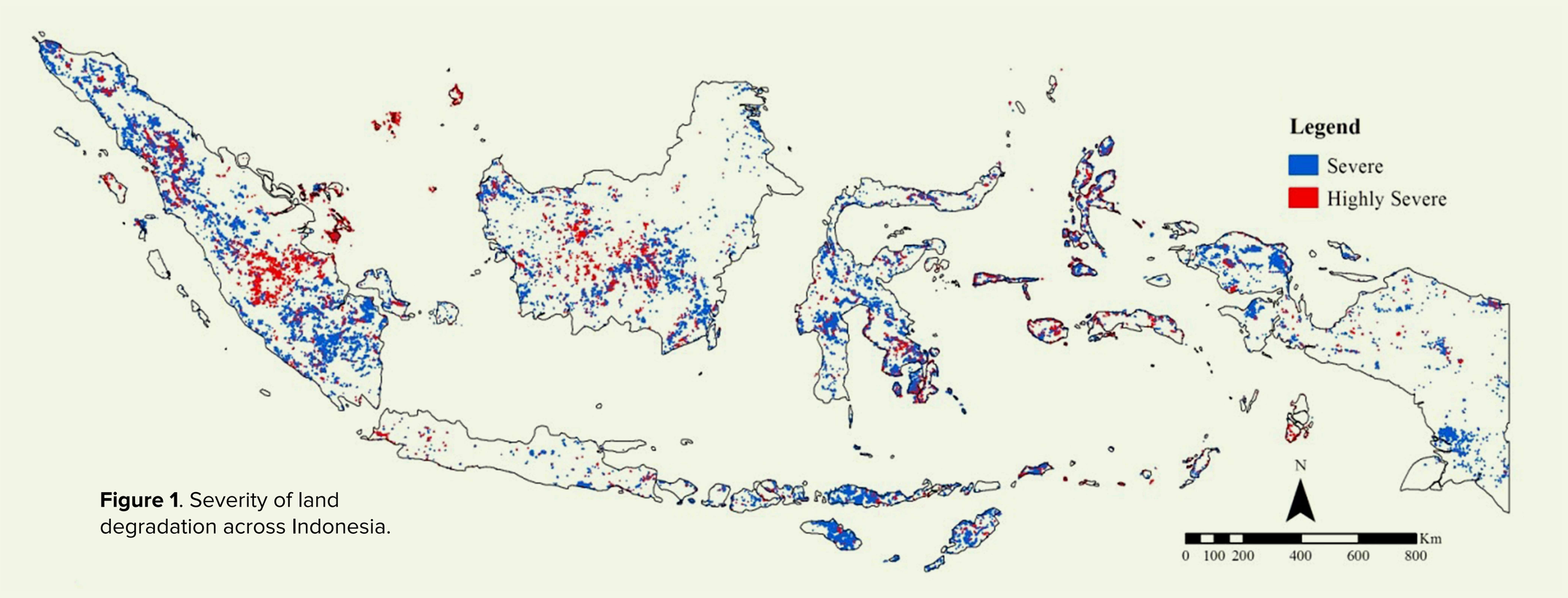


Figure 1. Severity of land degradation across Indonesia.

Figure 2. (a) Location of study site; (b) local nyamplung-based agroforestry system; (c) peanuts monoculture.

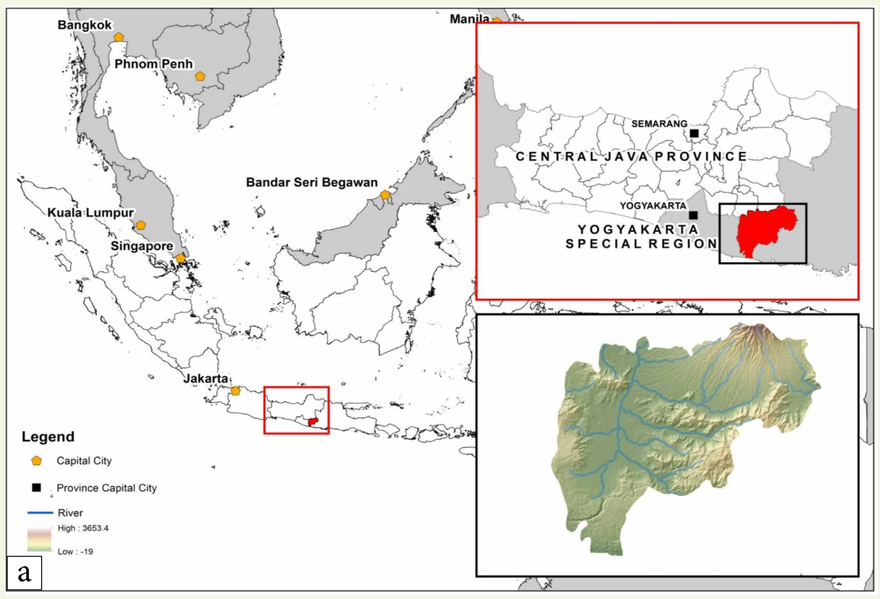


Table 1. Sensitivity of overall profitability (NPV in IDR ha-1) if decreases in production of nyamplung and four understory crops counting 35 years time horizon.

Decrease of production	Nyamplung	Nyamplung + integrated crop			
		Maize	Paddy	Peanuts	Honey
0%	87,111,478	90,073,056	66,206,227	62,570,818	**941,703,820**
10%	78,400,330	89,776,898	64,115,702	60,116,752	**856,244,586**
20%	69,689,183	89,480,741	62,025,177	57,662,686	**770,785,352**
30%	60,978,035	89,184,583	59,934,652	55,208,620	**685,326,118**
40%	52,266,887	88,888,425	57,844,127	52,754,554	**599,866,884**
50%	43,555,739	88,592,267	55,753,602	50,300,488	**514,407,650**
60%	34,844,591	88,296,110	53,663,077	47,846,422	**428,948,415**

Figure 3. NPV of monoculture of five popular crops in Wonogiri over a 35-year rotation period.

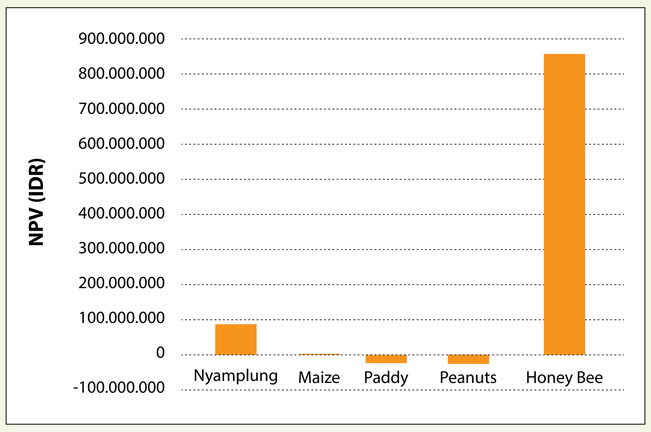
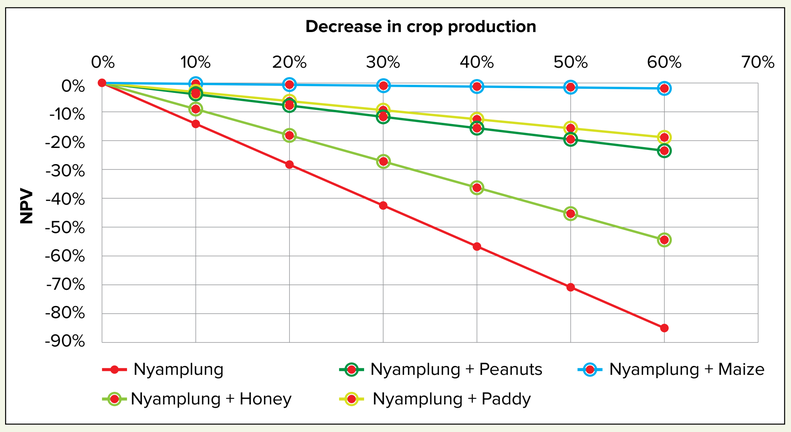


Figure 4. The proportional loss (%) of NPV with decreasing rates of crop production over a 35-year time horizon.



Recommendation

- More complex systems should be adopted, e.g. paddy + maize + nyamplung + honey, paddy + peanuts + nyamplung + honey, based on livelihood objectives.
- An effective implementation strategy is essential, as farmers' resources may be restricted.
- Further research needed to develop better bee husbandry.

Acknowledgments

This research is part of the CIFOR Bioenergy project funded by NIFoS (National Institute of Forest Science, South Korea), the CGIAR Research Program on Forests, Trees and Agroforestry (CRP-FTA) with financial support from donors to the CGIAR Fund.

This poster is based on: Rahman S. A., Baral H., Sharma R., Samsudin Y.B., Meyer M., Lo M., Artati Y., Simamora T.I., Andini S., Leksono B., Roshetko J.M., Lee S. M., Sunderland T., (2018). 'Integrating Bioenergy and Food Production on Degraded Landscapes in Indonesia for Improved Socio-economic and Environmental Outcomes'. Food and Energy Security (under consideration for publication).