Cease and Disperse: The spatial distribution of deforestation

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Introduction

There is an urgent need for reliable and open information on deforestation. The dialogue on forest resources between government, industry, and environmental advocates is consistently characterized by defensive positioning, rather than productive collaboration. Much of the dissonance is a result of disparate and often conflicting data sources; each side claiming foul play in the reporting or monitoring of clearing activity. In the meantime, the deforestation rate is excessively high and accelerating: almost 15% of annual greenhouse gas emissions can be attributed to forest clearing activity. In addition, forest landscapes are becoming increasingly fragmented, threatening ecosystem reslience and biodiversity. Without viable oversight and enforcement, the rate and spatial distribution of deforestation will continue to be socially suboptimal. A *necessary*, though far from sufficient, condition for informed conservation policy is a common platform of information on forest clearing activity.

To date, a reliable monitoring system has not existed. Enforcement costs are relatively high.

Model

Let A_i be the amount of the forested land in pixel i, and let a_{it} indicate the proportion of the land that has been cleared by time t. The profit $\pi(a_i) = r(a_i) - c(a_i)$, where $r'' < 0$ and $c'' = 0$. We assume a relatively high fixed cost of clearing, so that $c(a_i) = F + \gamma a_i$ with γ constant in land cleared. Consider two separate plots such that $i \in \{1, 2\}$.

$$V(z) = \max_{x,\lambda} \{\pi(z - x) - g(\lambda) + \beta \mathbb{E}[V(x + \lambda\omega)]\}$$

Empirical strategy

Results

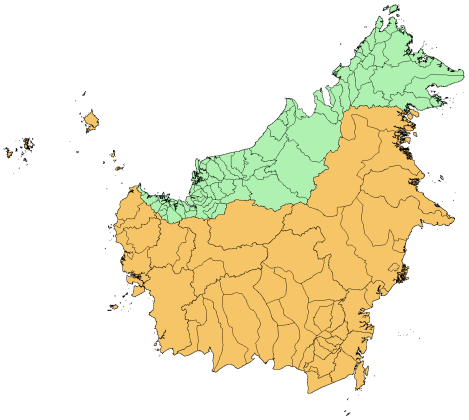


Figure 1: Sample area, Malaysia in green and Indonesia in orange. Borders indicate subprovinces.

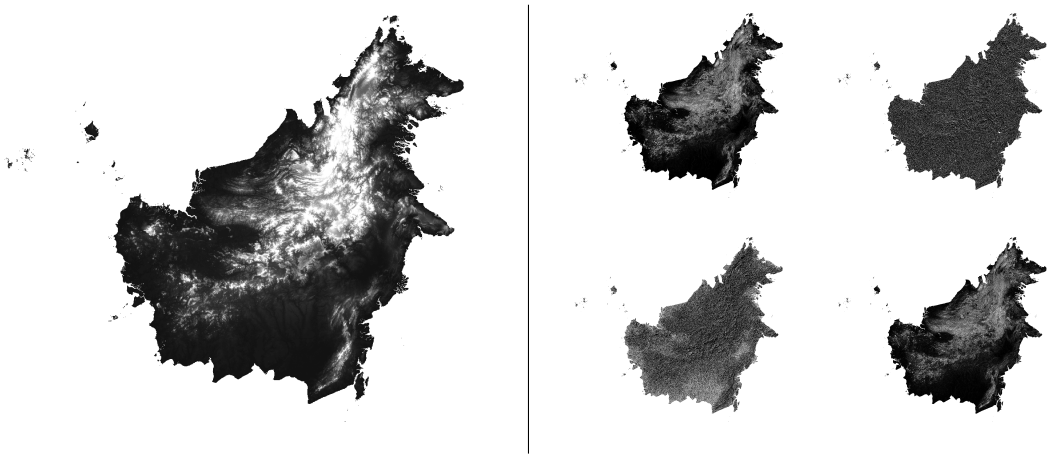
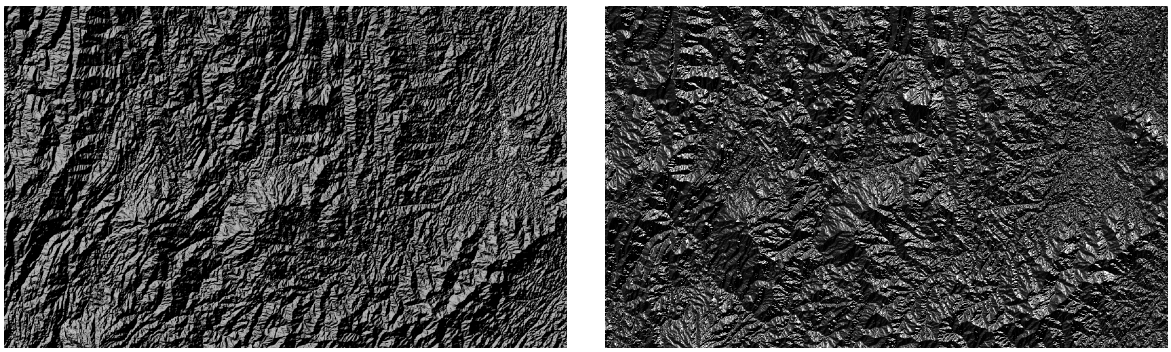


Figure 2: DEM elevation map (left) with derived data sets (right). Derived maps, clockwise from top left: slope, water flow direction, aspect, and maximum drop within each 90m pixel.



(a) Hillshade (b) Flow direction

Figure 3: Detailed images of two derived data sets for the same area.

	Model 1
(Intercept)	5.48*
	(2.88)
pd	0.00
	(0.04)
cid	13.50***
	(4.07)
mora	2.80
	(6.88)
pd:cid	−0.10*
	(0.05)
pd:mora	−0.02
	(0.06)
cid:mora	−37.27***
	(9.73)
pd:cid:mora	0.33***
	(0.09)
R^2	0.35
Adj. R^2	0.33
Num. obs.	202

$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$

Table 1: Statistical models