

A photograph of a dirt road in a tropical forest. The road is heavily eroded and has a large pile of logs on the right side. A dark blue SUV is driving away from the camera on the road. The forest is dense with tall trees and green foliage.

Can REDD+ promote RIL in Malaysian tropical forests?

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Our talk

- 1 What is forest carbon?
- 2 Does REDD+ promote RIL (Reduced Impact Logging)?

earnings of logging (amount of logs per unit area)

Malaysian conventional logging (MCL) $>$ RIL

earnings from REDD+ (forest carbon per unit area)

Malaysian conventional logging (MCL) $<$ RIL

Can REDD balance the RIL's reduction of earnings by logging?

- 3 Can RIL protect mammalian biodiversity?

1 What is forest carbon?

Every carbon stocked in a forest (Gibbs et al. 2007),
which consists of...

Carbon in biomass
in living trees

Above-
ground parts
= stem,
leaves,
branches

Below-
ground parts
= roots

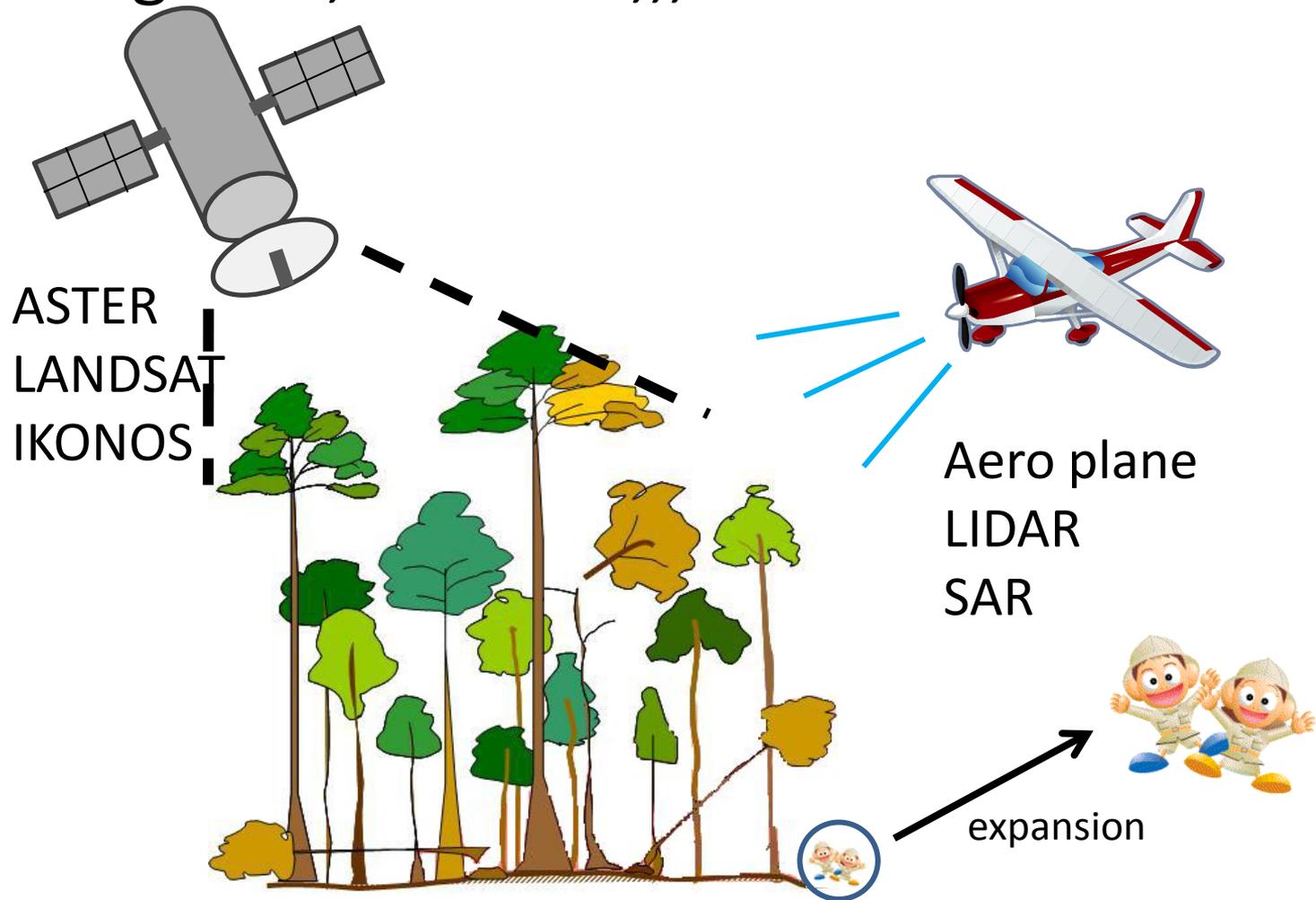
Carbon in biomass in
dead trees = debris

Above-
ground
parts

Below-
ground
parts

Carbon in soil

We may be able to estimate forest carbon in above-ground biomass in living trees by remote sensing or field investigation, however,,



Lets we clarify the amount of carbon in above-ground biomass, below-ground biomass and soil carbon using Pasoh forest data, Malaysia.

Methods for the estimation of forest carbon

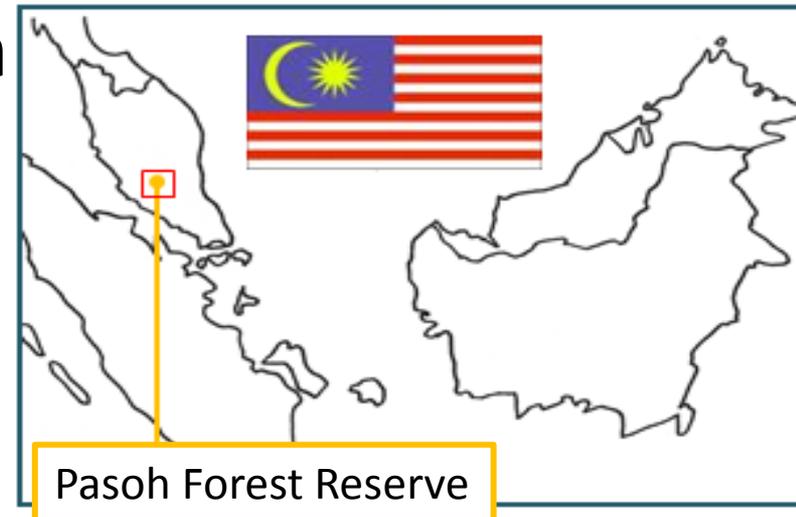
Data source The Pasoh Forest Reserve, Malaysia

Above ground biomass Based on forest inventory data using allometric equations by Kato et al. (1978)

Root biomass Based on forest inventory data using allometric equations by Niiyama et al. (2010)

Biomass was converted to carbon

Soil organic carbon Based on measurement of soil organic carbon in primary and secondary forests by Adachi (2006)



Carbon in above-ground biomass of living trees accounts for only about 60% of total forest carbon

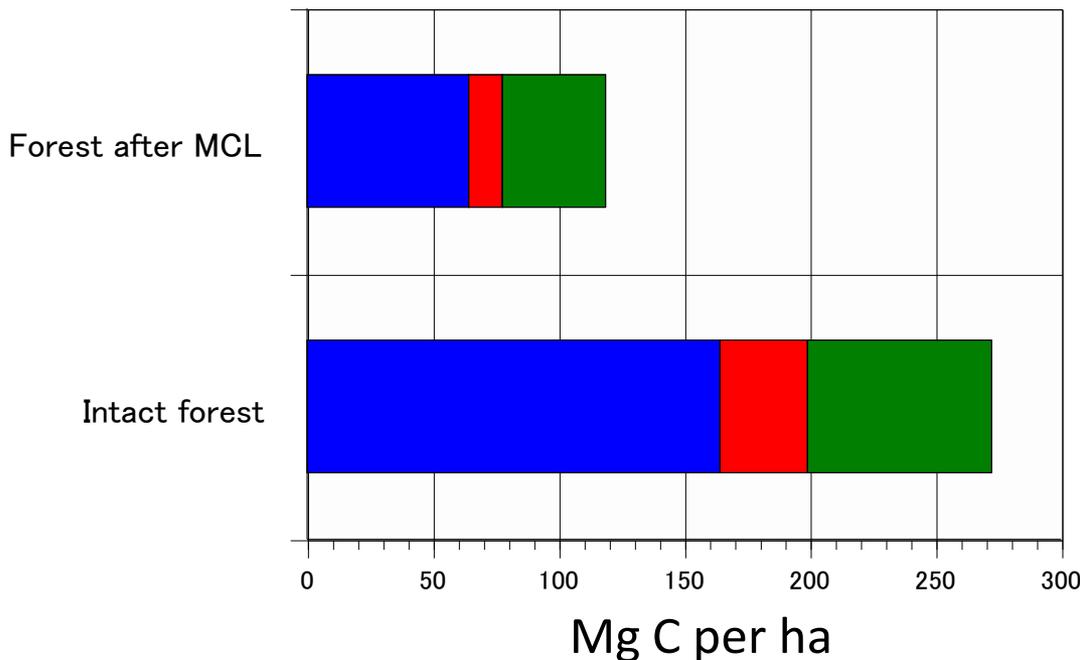
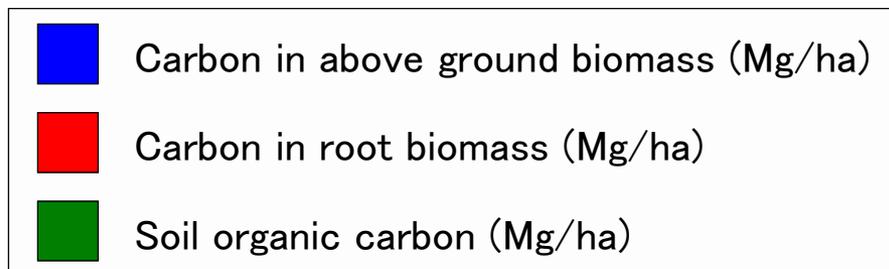


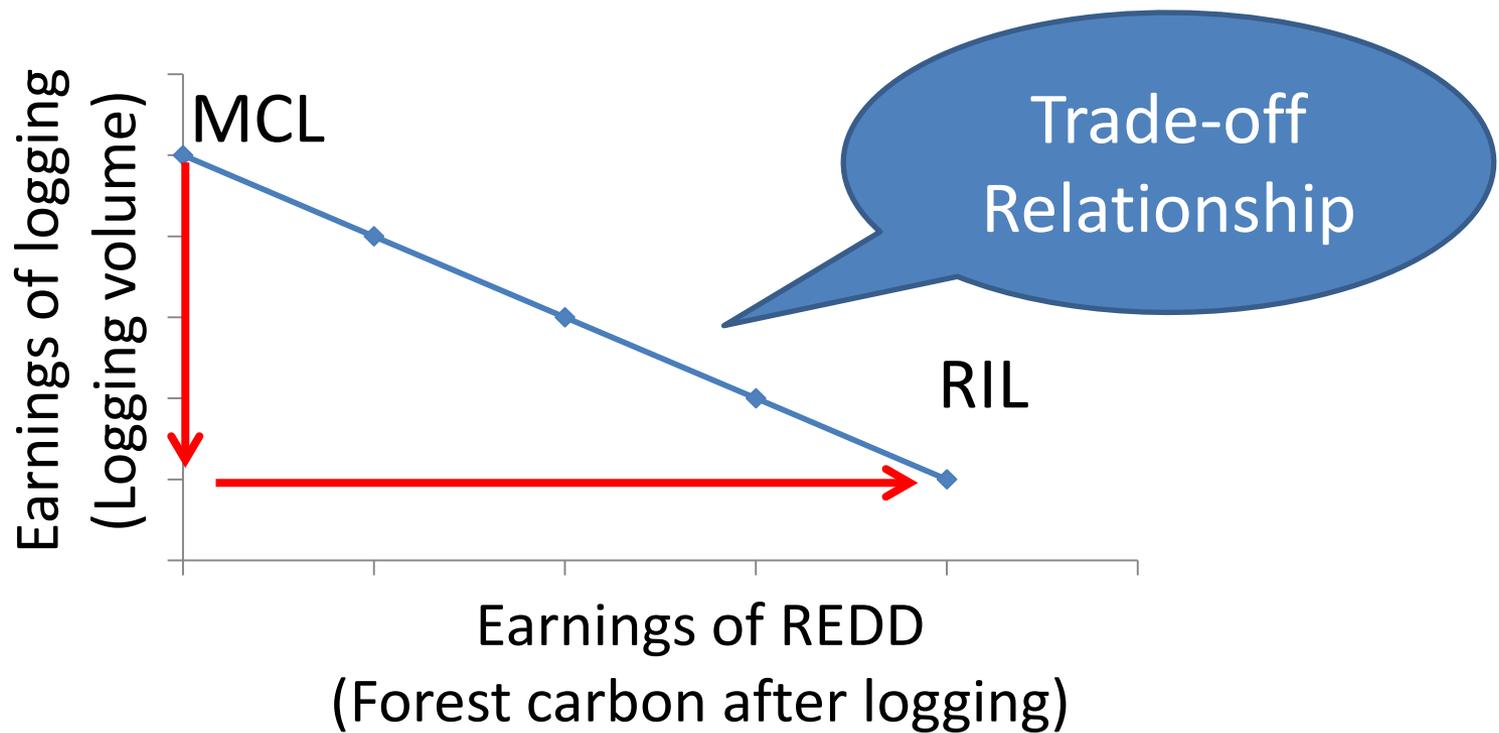
Figure. Amount (Mg/ha) of carbon in above-ground biomass and below-ground biomass and soil organic carbon in a tropical rain forest. Estimated based on data from the Pasoh forest, Malaysia.

We have to count all parts of forest carbon not to underestimate “forest carbon”.

2 Does REDD+ promote RIL (Reduced Impact Logging) ?

To answer the question,

- 1 We use the actual forest data from the Pasoh FR, Malaysia.
- 2 We count the “forest carbon (earnings by REDD+)” and “logging volume (earnings by logging)” in the cases practicing Malaysian conventional logging (MCL) and RIL.
- 3 Finally we compare them between MCL and RIL.



Sematic diagram



Malaysian conventional logging system (MCL)

	MCL criterion	Our MCL
Cutting limit size	60,50 or 45 cm in DBH depending on the species	50cm in DBH
Trees remaining	>32 trees in 30-45 cm size class	All trees smaller than 50 cm in DBH
Logging road	40 m / ha	40 m / ha
Skid trail	40 m / ha	40 m / ha



Introduction of our RILs

conventional



RIL



	Our MCL	RIL 1	RIL 2	RIL 3
No of logged trees (/ha)	All trees (= 125)	100 trees	25 trees	6 trees
Cutting limit size	over 50cm in DBH	Same as MCL	Same as MCL	Same as MCL
Trees remaining	All trees below 50 cm in DBH	Same as MCL	Same as MCL	Same as MCL
Logging road	40 m / ha	Same as MCL	Same as MCL	Same as MCL
Skid trail	40 m / ha	Same as MCL	Same as MCL	Same as MCL

Drop in earnings of logging from MCL to RIL

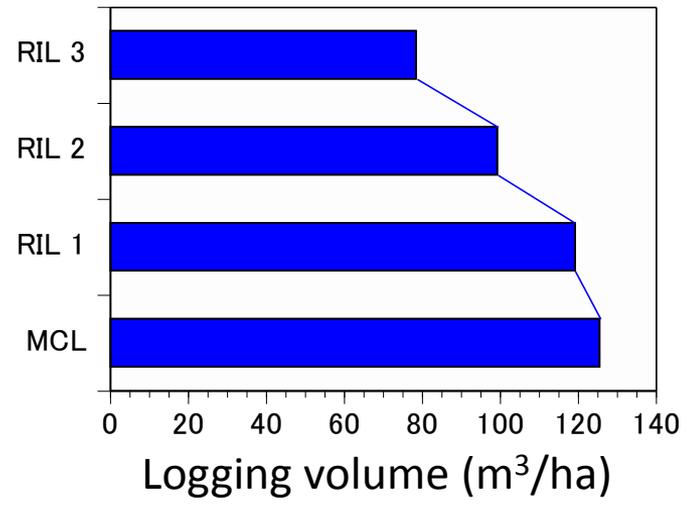


Figure. Logging volume of MCL and RILs.



These volumes are converted to earnings of logging.

The earnings of logging of MCL was estimated as US\$11,856 per ha.

Table. The drop in the earnings of logging from MCL to RIL (US\$/ha).

RIL 1	RIL 2	RIL 3
617	2479	4435





Increase in forest carbon from MCL to RIL

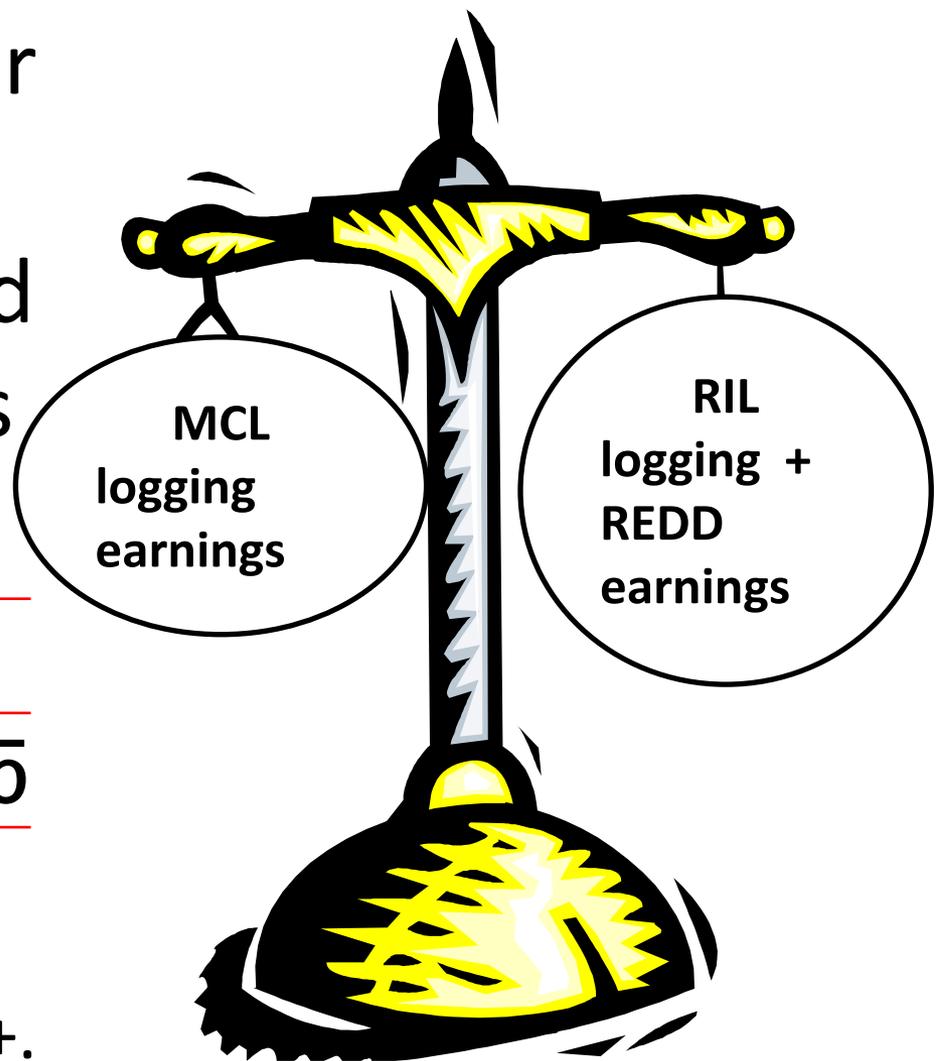
Forest types	Carbon in AGB (Mg/ha)	Carbon in BGB (Mg/ha)	soil organic carbon (Mg/ha)	total forest carbon (Mg/ha)	Increase in carbon over MCL (Mg/ha)	Increase in CO ₂ over MCL (Mg/ha)
Intact forest	164.2	35.0	73.0	272.2		
forest after MCL	64.1	13.2	40.9	118.3		
forest after RIL 1	72.0	15.0	40.9	127.9	9.6	35.3
forest after RIL 2	91.8	19.3	40.9	152.1	33.8	123.9
forest after RIL 3	108.0	23.1	40.9	172.0	53.7	197.1

What price of CO₂ do we need to balance the reduction of earnings from logging.

Table. The prices (US\$ per Mg of CO₂)* which are necessary to be balanced the reduction of earnings of logging.

RIL 1	RIL 2	RIL 3
17.8	20.0	22.5

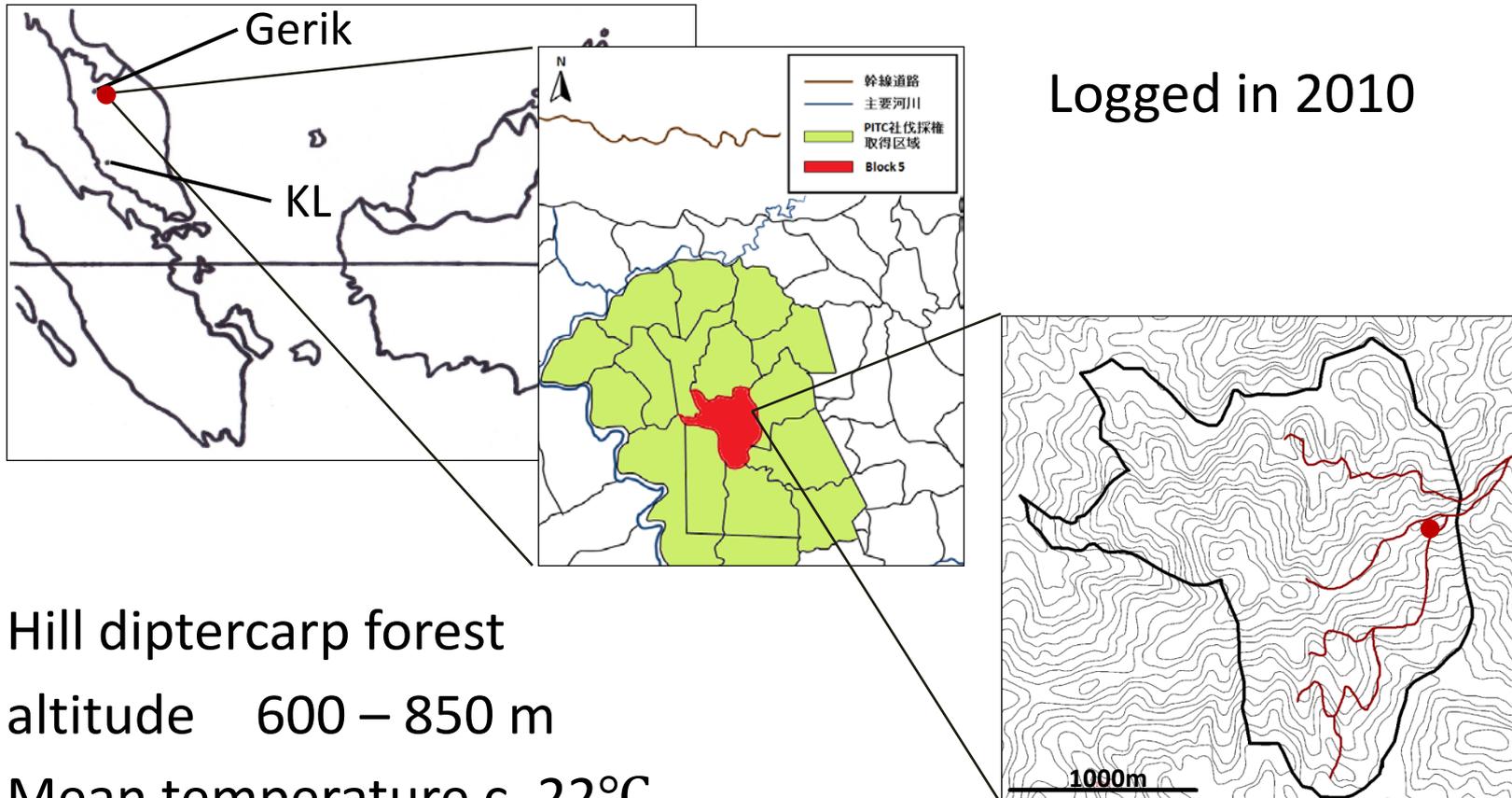
*This does not include implementation costs for REDD+.



3. Can RIL protect mammalian biodiversity?

Study site

Block 5, Temengor Forest Reserve, Malaysia (5°31'N, 101°36'E)



Logged in 2010

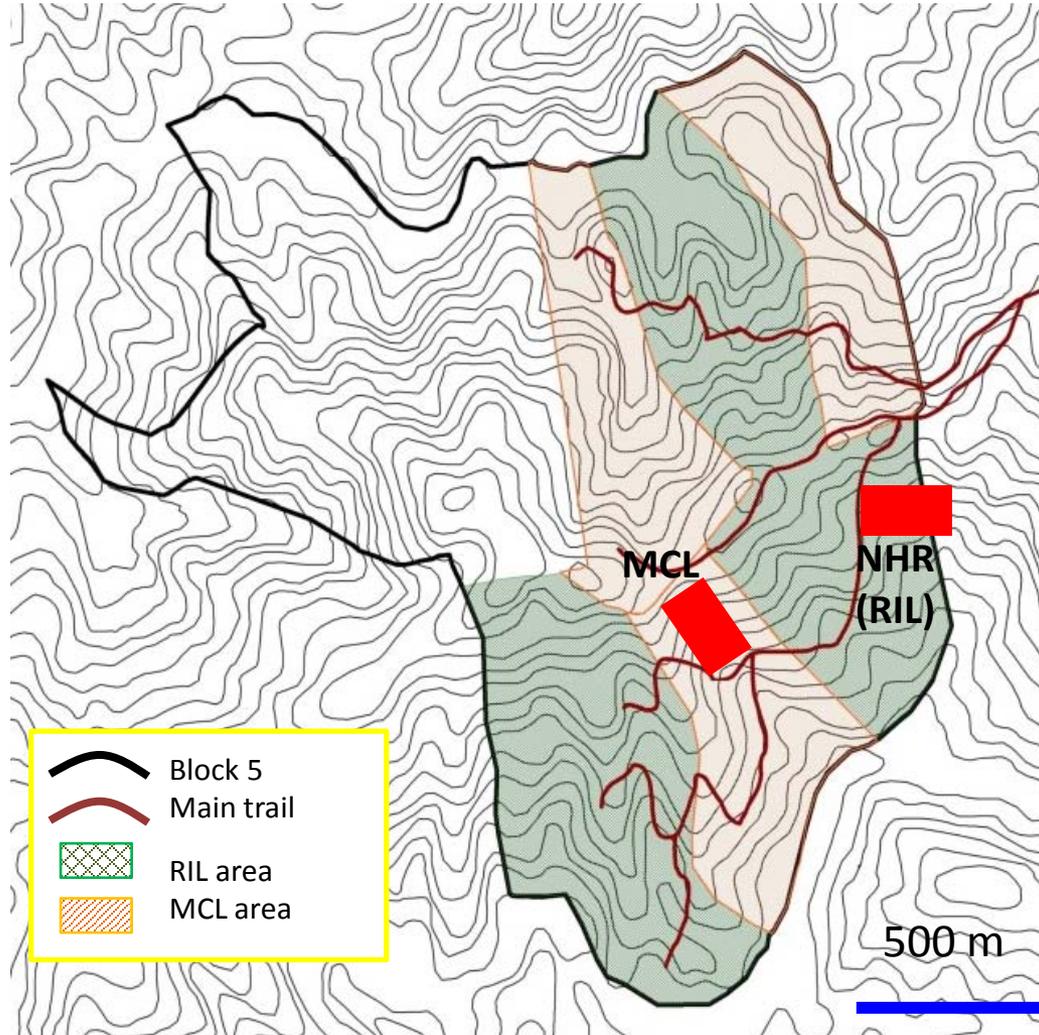
Hill dipterocarp forest

altitude 600 – 850 m

Mean temperature c. 22°C

Mean annual participation c. 2200 mm (@Gerik)

MCL and NHR (RIL in Temengor)



SMS (Malaysian
Conventional
Logging)

New Harvesting
Regime of FRIM;
NHR (RIL)

Minimum
cutting limit
Dipterocarp >45
cm
Others >50 cm

Minimum
cutting limit =
30cm; selected
trees are 20-30
m apart each
other



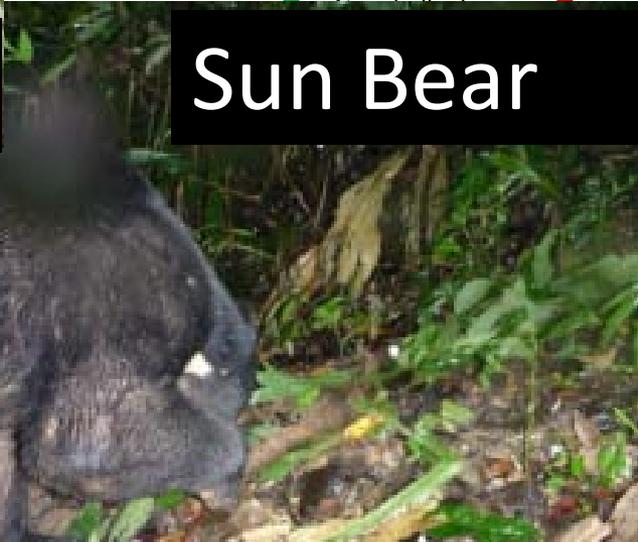
Camera trapping
30 cameras for 2 wks in each of the
forests

Difference in mammalian fauna between MCL and RIL

found in MCL area



Asian Tapir



Sun Bear



Asian Elephant



Pig-macaque



Three-striped Ground Squirrel



Rattus sp.



Civet



Palm



Common Tupai



Large Rat (Undentified)

Mammals found in RIL area

Large mammals (Elephant, Bear, Tapir) avoided MCL area.

RIL can preserve higher biodiversity.->How do we incorporate biodiversity into REDD+?

Messages

1. Carbon in above-ground biomass of living trees accounts for only about 60% of total forest carbon.
We need to estimate other parts of forest carbon such as soil organic carbon or below ground biomass not to underestimate forest carbon.
2. REDD potentially can promote RIL (Reduced Impact Logging) .



Messages (cont.)

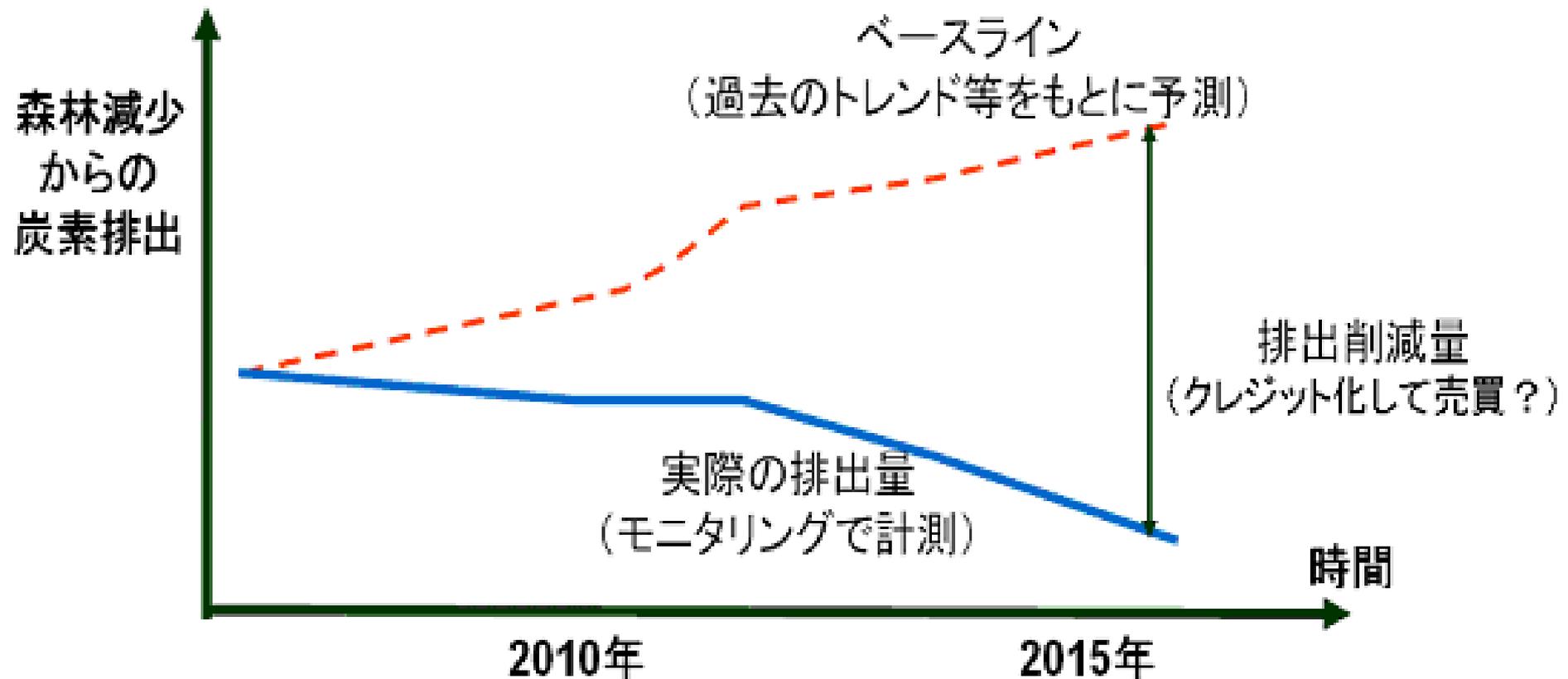
3. Our investigation on animal fauna implied that RIL can preserve higher biodiversity.



Thank you very much!

REDD

- 森林炭素量を適正に推定することが必要



伐採された幹以外にも次のバイオマ スが失われる

- 伐採道路として2%が失われる
- 排出道路として1.6%が失われる
- 巻き添え倒木として伐採した地上部バイオマスの25%相当の地上部バイオマスが減少する
- 巻き添えにより失われるバイオマスの18%相当のバイオマスが地下部から失われる

Estimation of logging earnings

logging volume (V, m^3)

- Volume (V, m^3) was estimated from dbh(cm) and L(m) using

$$V = \frac{\pi \times dbh^2 \times L \times f}{4 \times 10000}$$

Where L is merchantable height (m, table).

F=0.65.

Dbh (cm)	merchantable height (m)
50-60	10
60-75	15
75-	20

Wood price

- We refer to maskayu(1996)in (Rm/m³).
- We used average value of 23 species.
- maskayu(1996) is FOB price so we deduced 30% from the price.
- Cost is 78RM/1 m³

