UNFCCC COP24 ITTO/FFPRI Side Event
"Restoring degraded tropical forests: reconciling carbon, biodiversity and community resilience"

How to evaluate forest degradation? A forest ecologist's view

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Why forest degradation is important?

- Although emission from forest degradation for 74 developing countries accounted for just a quarter of the total emission (deforestation and degradation), emission from forest degradation exceeded those from deforestation in 28 of 74 countries (Pearson et al. 2017).

- Compared to deforestation, forest degradation tends to difficult to detect using remote sensing data.

- Although technical difficulties, accurate and precise carbon accounting for forest degradation is indispensable for REDD project under national and sub-national scale.

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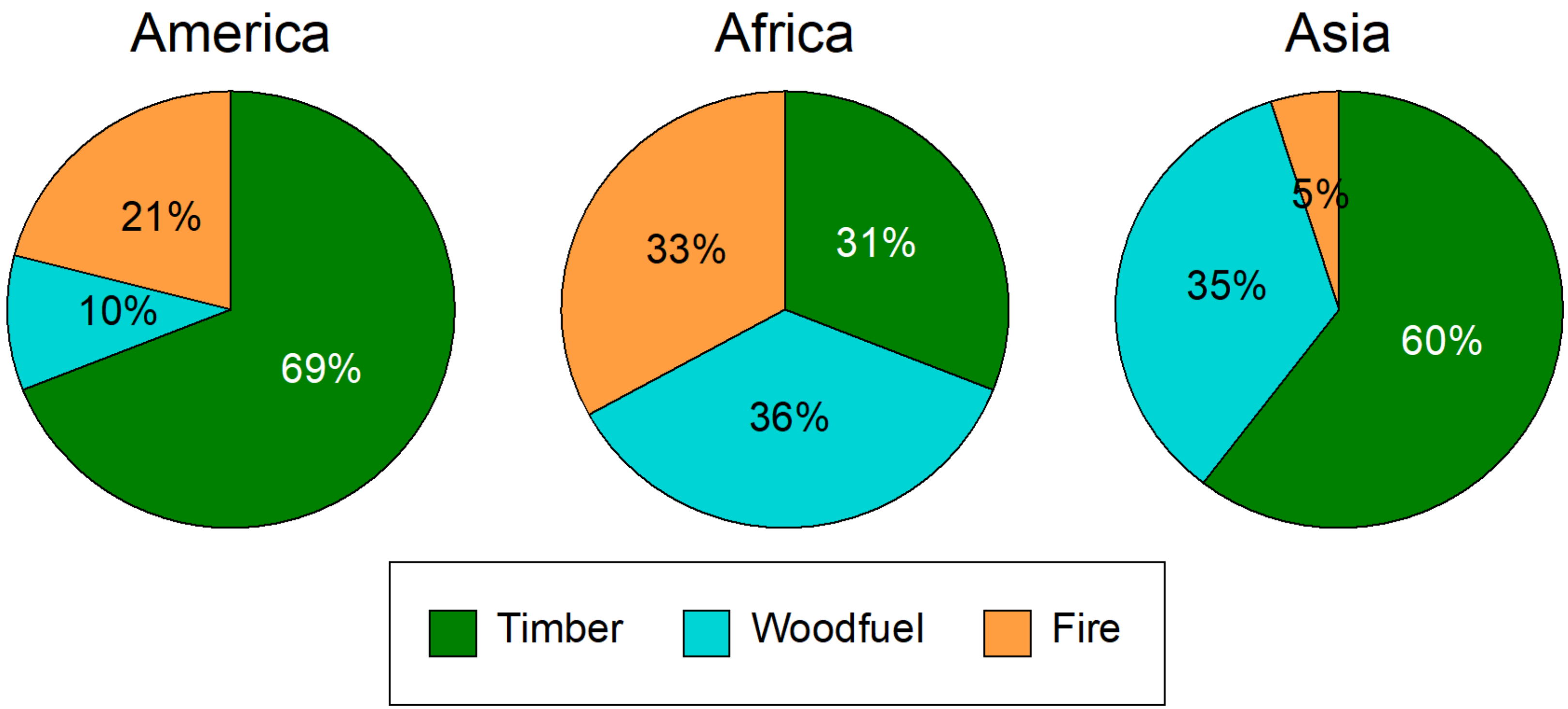
Forest degradation emissions by degrading activity



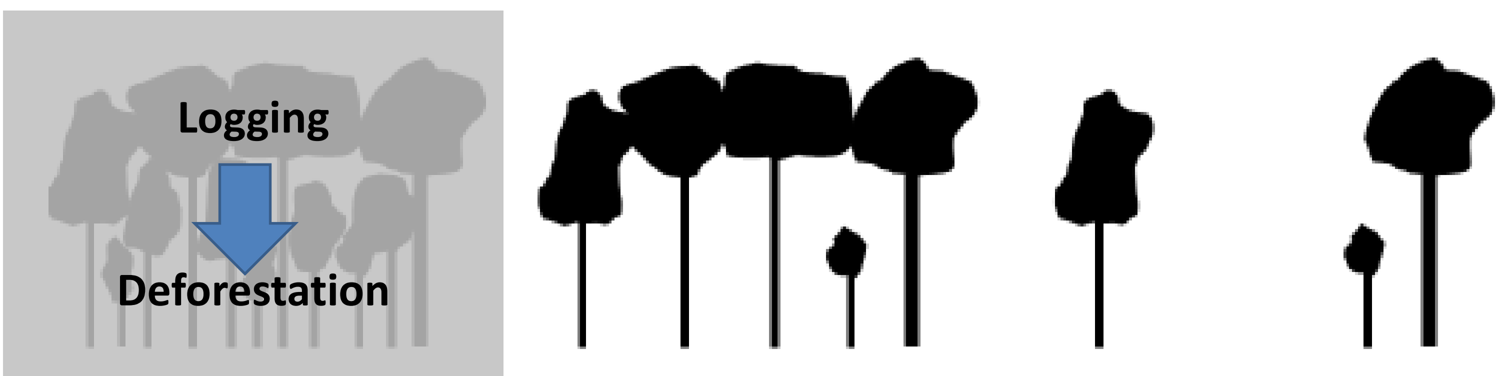
Pearson et al. 2017

Detect or not using RS data

Detectable deforestation by remote sensing imagery

Not detectable degradation by remote sensing imagery

Detectable degradation by remote sensing imagery



Biomass stock time1 | Biomass stock time 2 | Biomass stock time 3

Low ⟷ High

Magnitude of degradation

Referred from Köhl et al. (2009)

Degraded by forest fires

Palangkaraya, Indonesia

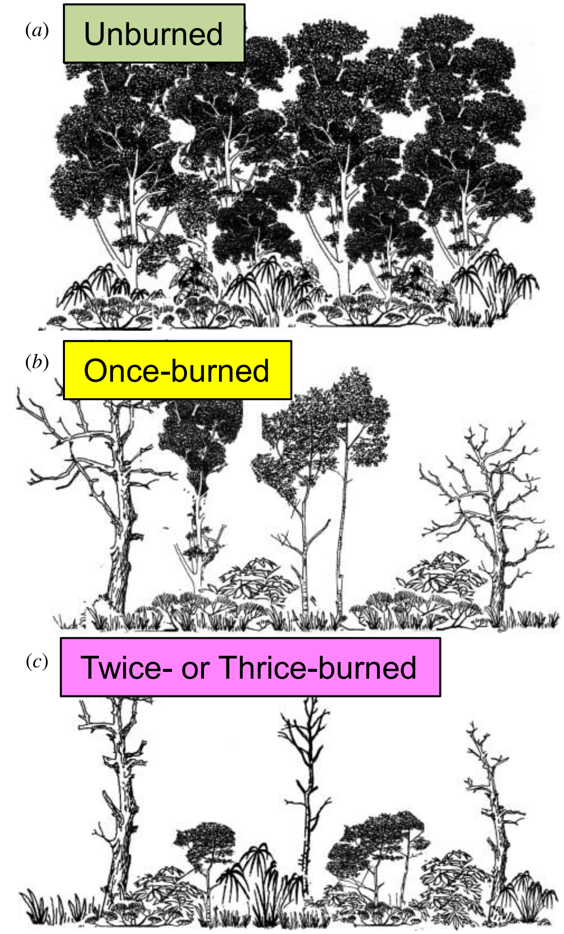
Kampong Thom, Cambodia

Degraded by forest fires

Table 1. Tree species and genera from the 10–20 cm DBH size class (and shrubs and saplings below 10 cm in DBH) which were most abundant in each burn treatment, showing a high degree of turnover in community composition with each additional burn. (All species (or genera) with a density greater than 10 trees ha^{-1} are shown for trees 10 cm and above in DBH, and the most abundant species in once-, twice- and thrice-burned forest plots are shown for saplings.)

species	family	forest type where most abundant	trees (10–20 cm in DBH) ha^{-1}			
			unburned	once-burned	twice-burned	thrice-burned
Protium and Tetragastris spp.	Burseraceae	unburned	69	15	2	2
Pouteria and others	Sapotaceae	unburned	17	13	0	0
Sclerolobium and Tachigali spp.	Fabaceae	unburned	17	4	0	0
Rinorea spp.	Violaceae	unburned	14	0	0	0
various genera	Lauraceae	unburned	12	2	4	0
Cecropia spp.	Cecropiaceae	once-burned	0	69	22	8
Jacaranda copaia	Bignoniaceae	once-burned	0	18	0	0
Pseudobombax sp.	Malvaceae	twice-burned	0	0	88	14
Inga spp.	Fabaceae	twice-burned	8	0	22	10
Tapirira sp.	Anacardiaceae	twice-burned	0	0	14	0
Cordia sp.	Boraginaceae	thrice-burned	1	2	0	30
			saplings (<10 cm in DBH) per 200 m^2			
Palicourea guianensis	Rubiaceae	once-burned	—	38	0	5
Aparisthmium cordatum	Euphorbiaceae	twice-burned	—	13	79	12
Cordia sp.	Boraginaceae	thrice-burned	—	4	5	30

Referred from Barlow & Peres 2008



- Species composition were changed after fires
- Difficult to recovery after repeated fires
- Forest carbon stock decreased simultaneously

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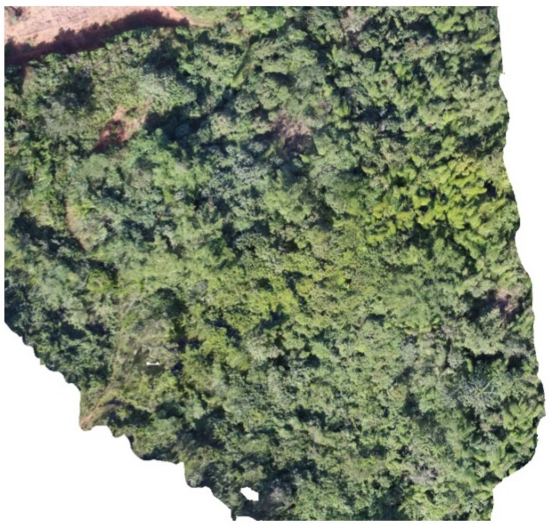
Forest fires facilitate bamboo dominance

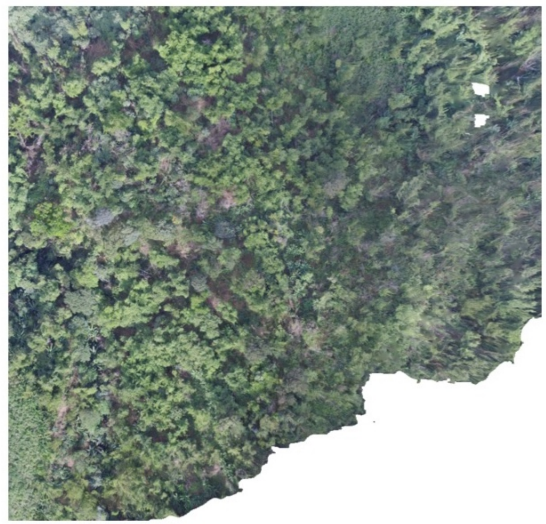
Case study in Myanmar

Open forest



Plot #3
Canopy coverage: 16%
(Bamboo coverage: 8%)
Tree biomass: 77.2 Mg/ha
Bamboo biomass: 58.6 Mg/ha

Closed forest (bamboo dominated)



Plot #14
Canopy coverage: 64%
(Bamboo coverage: 56%)
Tree biomass: 44.0 Mg/ha
Bamboo biomass: 37.6 Mg/ha

Closed forest (tree dominated)

Plot #5
Canopy coverage: 60%
(Bamboo coverage: 0%)
Tree biomass: 299.3 Mg/ha
Bamboo biomass: 3.8 Mg/ha

Aerial photos were taken by Asian Air Survey Co, Ltd

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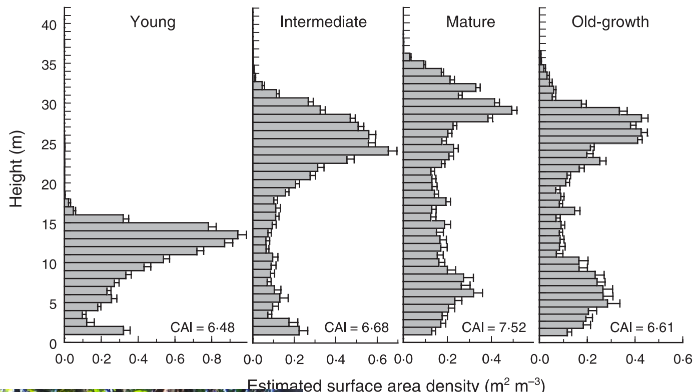
Forest structure reflects plant biodiversity

Young → Mature



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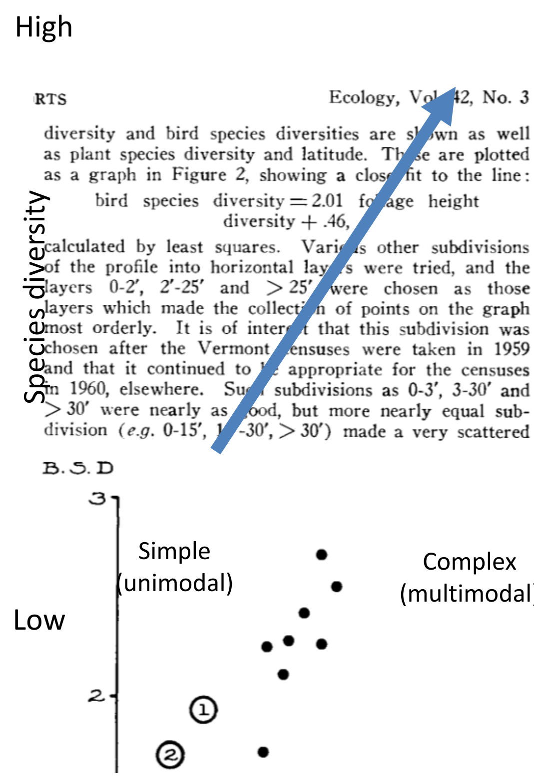
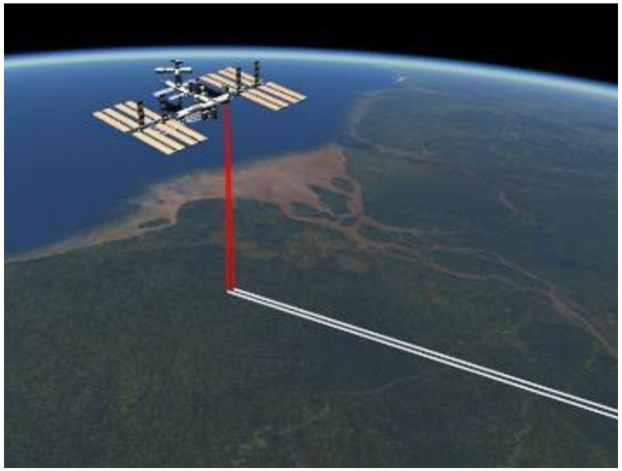
Species diversity correlated to heterogeneity of vertical forest structure.

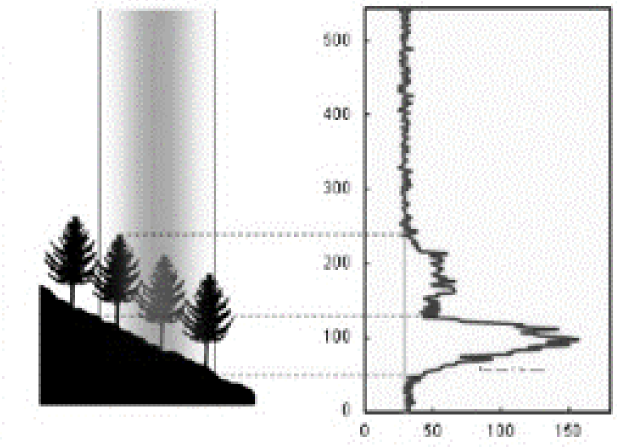


MacArthur & MacArthur (1961)

Reconciling carbon and biodiversity



Satellite-borne LiDAR
(Source from JAXA)



Canopy height and vertical structure would detect using LiDAR data.

Canopy height → Forest carbon stock

Vertical structure → Tree species diversity

The latest device would provide useful information to evaluate forest degradation including biodiversity.

Conclusions

- Changes in species composition occur through degradation progress. Evaluation of species compositions is also important as well as carbon stock estimation in degraded forests.
- The latest device (e.g. UAV and satellite-borne LiDAR) would provide useful information to evaluate forest degradation under various spatial scales.
- Ground-based inventory is indispensable to understand forest degradation and develop measures against degradation.