Forest Structure as Influenced by Different Types of Community Forestry

in a Lower Montane Rainforest of Central Sulawesi

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Background

- Many land use change studies analyze complete deforestation scenarios
- Forest protection policies advocate buffer zone management by low impact forest management
- Resulting changes in forest structure and related ecosystem functions are largely unknown

Background

Dietz et al.

Buffer Zonation

… With the incorporation of local wisdom, … the management of natural resources becomes tailored to … an area at a local scale …

… the zonation mandated by federal law would not be new to the people of Ngata Toro, who already have a zoning system …



Out on a limb

Local people are well-placed to develop zonation plans in Indonesia's Lore Lindu National Park

by Ir Helmi

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Indonesia

INDONESIA is a highly diverse country. From Sabang, at the western tip of Sumatra, to Merauke, on the eastern edge of Papua, its latitudinal breadth is similar to that of the Australian continent, and it contains more than 13 000 islands. The country's extraordinary diversity of traditions, customs and local languages is complemented by that of its species and habitats. There are countless examples of the interconnectedness of cultural and biological diversity, too: for example, the *uaro lucik* (*Manikara kauki*) tree has important religious meaning for the Javanese, while the courtship rituals of the *cendrawasih*, or bird of paradise, have inspired the dancing of the inhabitants of Papua Province. Equally, the biota has been influenced by its interactions with people over thousands of years, and the outcomes of these interactions give us what we know as Indonesia today.

But Indonesia is undergoing enormous social, economic, cultural and political change. Its population is still growing; numbering about 220 million now, it is expected to exceed 300 million by mid-century. The processes of growth, development and profound cultural change, coupled with recent dramatic political developments, are affecting the interrelation between mankind and nature; the two are becoming increasingly disconnected. This is worrying: a jump to the future is tough when the foundation is fragile. The loss of biological diversity that is accompanying these changes, if continued, will ultimately impoverish the nation.

Lore Lindu in central Sulawesi is one of 34 national parks in Indonesia; it covers an area of about 218 000 hectares. The cultural heritage of this park is huge. It contains, for example, large stone megaliths that date back to at least the 14th century of the present era. A 2001 inventory of artifacts left behind by our ancestors revealed 431 items scattered across 59 sites around the national park; undoubtedly thousands remain to be discovered.

These artifacts are 'silent witnesses' to the past and reinforce the notion that the past and present are linked. One example is the *ike*, which are still used by *ina-ina* (women) for making bark cloth. The nature of the *ike* varies. *Ike pohelia'i* has a coarse texture and is used to quickly break up the bark. *Ike pohero* is less coarse, while *Ike pohengka* has diagonal markings and is used to stretch out the processed material. *Ike papaapu* is smooth, with vertical markings, and is used to finish the process.

The harvesting of the raw materials for bark cloth shows the deep understanding that local people have of their natural environment. They use the leaves of harvestable trees (such as *beringin*, *wana*, *kuto*—*Ficus* spp, *teo*—*Artocarpus* spp and *mala*—*Brassiometia* spp) as indicators: if the leaves are too young or too old, the bark is fragile and difficult to separate from the bole. When the leaves are at an appropriate age, however, the bark is not only easily harvested but the fibers are also stronger.

Zoning out

Management of the national park is a work in progress, but progress has been slow. According to national law, the park should be managed through a zoning system which consists of a core zone, a utilization zone and other zones depending on necessity. Other laws specify the rights of *adat* (tribal/indigenous) communities, and others detail mechanisms for community involvement in the spatial planning of a region. And there are many other such regulations.

However, when the law (*de jure*) encounters the reality (*de facto*) in and around the Lore Lindu National Park, the picture is stark. Logging continues inside the park, and forests are cut to make way for plantations of coffee and cocoa; the harvesting of rattan goes on uncontrolled; rivers carve new paths; floods and landslides are frequent; land is bought and sold illegally; people demand removal of the established park boundary markers; in-migration from elsewhere in Indonesia swells the local population and increases the demand for land. The Lore Lindu National Park Authority has a vision for the park: a *sustainably managed Lore Lindu leads to a prosperous community*. The question is, how can we bring this to reality?

A participative approach

The Lore Lindu National Park is designated in the Provincial Land-use Plan of Central Sulawesi as a protected area, while adjoining villages are designated as cultivation areas. Under an 'old-style' approach to conservation, the national park and the village are perceived as two

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Objectives

- Assess structural characteristics of differently managed forest stands:
  - Stem Density
  - Diameter Distribution
  - Basal Area
  - Stand Heights
  - Leaf Area Index
  - Canopy Openness
- Creating a data base for relating structural characteristics to ecosystem functions

Forest Use Practices

Ngata Toro



Forest Use Practices

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- (A) Natural forest ***Wana***
  - Rattan partially extracted



Forest Use Practices

Ngata Toro

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- (B) Small timber extraction — ***Pangale I***
  - Understorey partially logged



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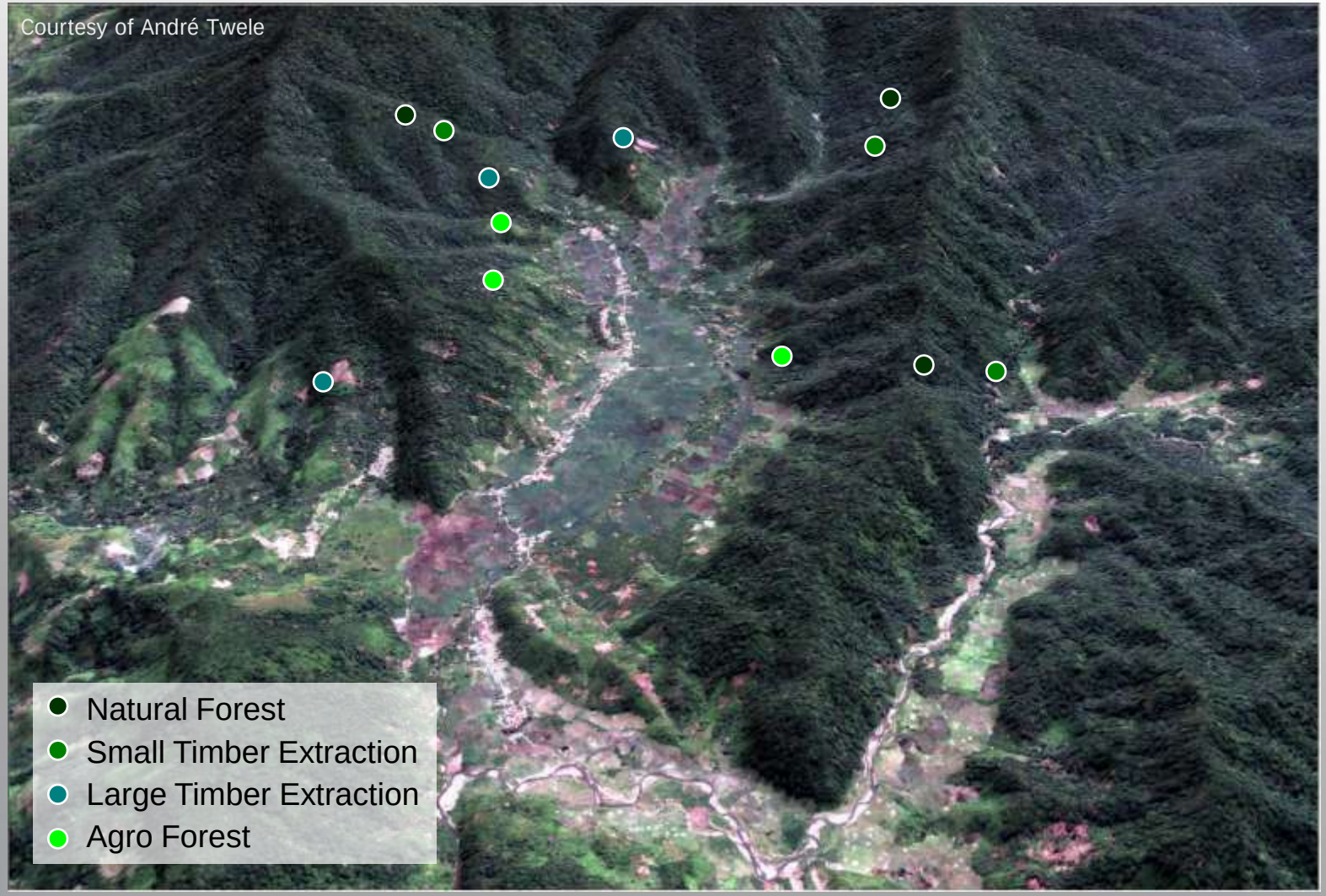
- (C) Large timber extraction — ***Pangale II***
  - Selectively logged
- (D) Agro Forest — ***Pahawa Pongko***
  - Few large trees remain from natural forest
  - Understorey cacao



Location

Research Sites in Ngata Toro



Methods

- 12 research plots of 1500 m^2 belonging to 4 forest use types
- Census of all stems > 10 cm DBH
- Three subplots per plot for all stems > 2 m in height
- DBH and height measurements



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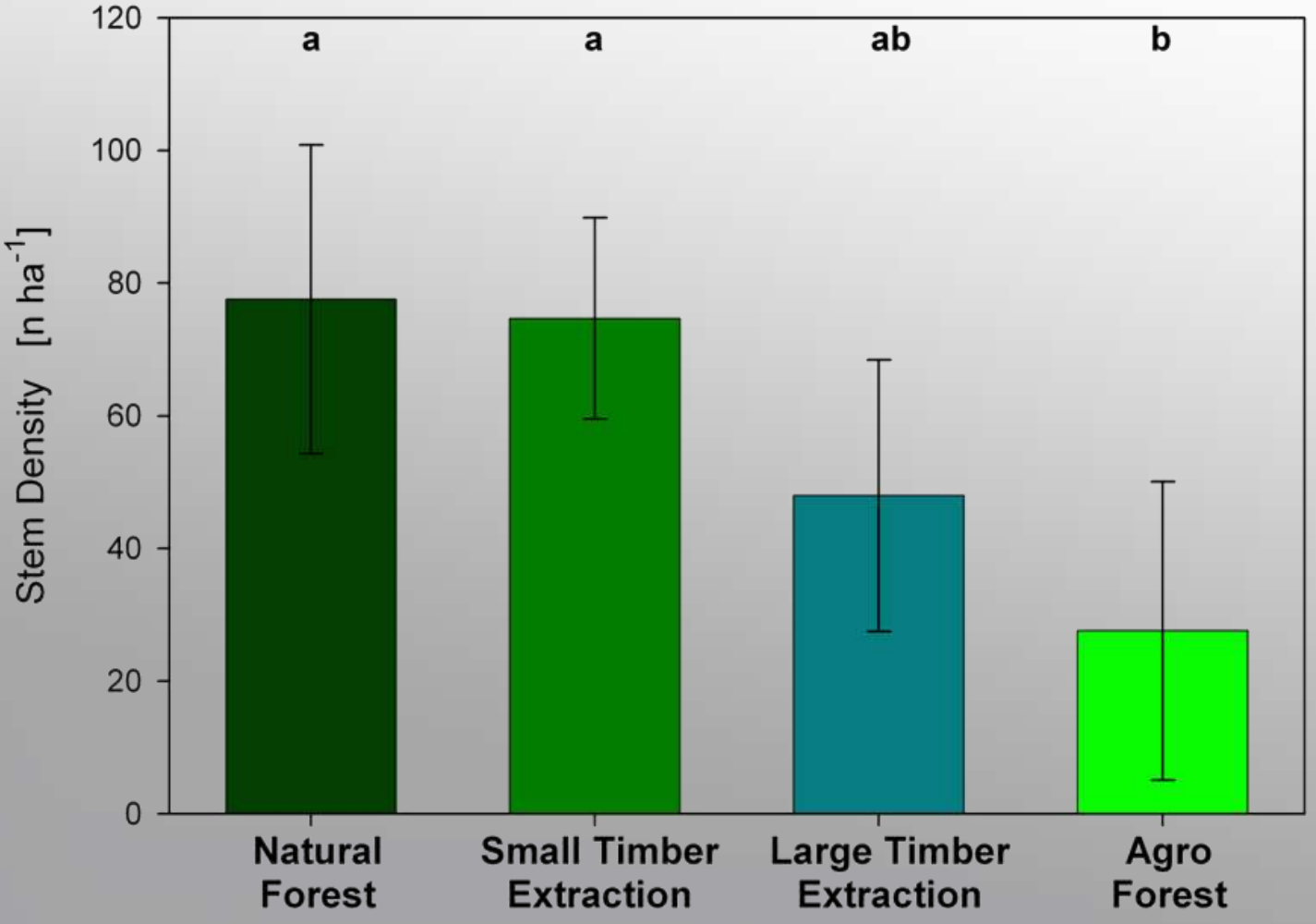
- Three subplots per plot for all stems > 2 m in height
- DBH and height measurements
- 30 hemispherical photographs per plot and campaign
- Analysis of digital images using WinScanopy and CanEye software



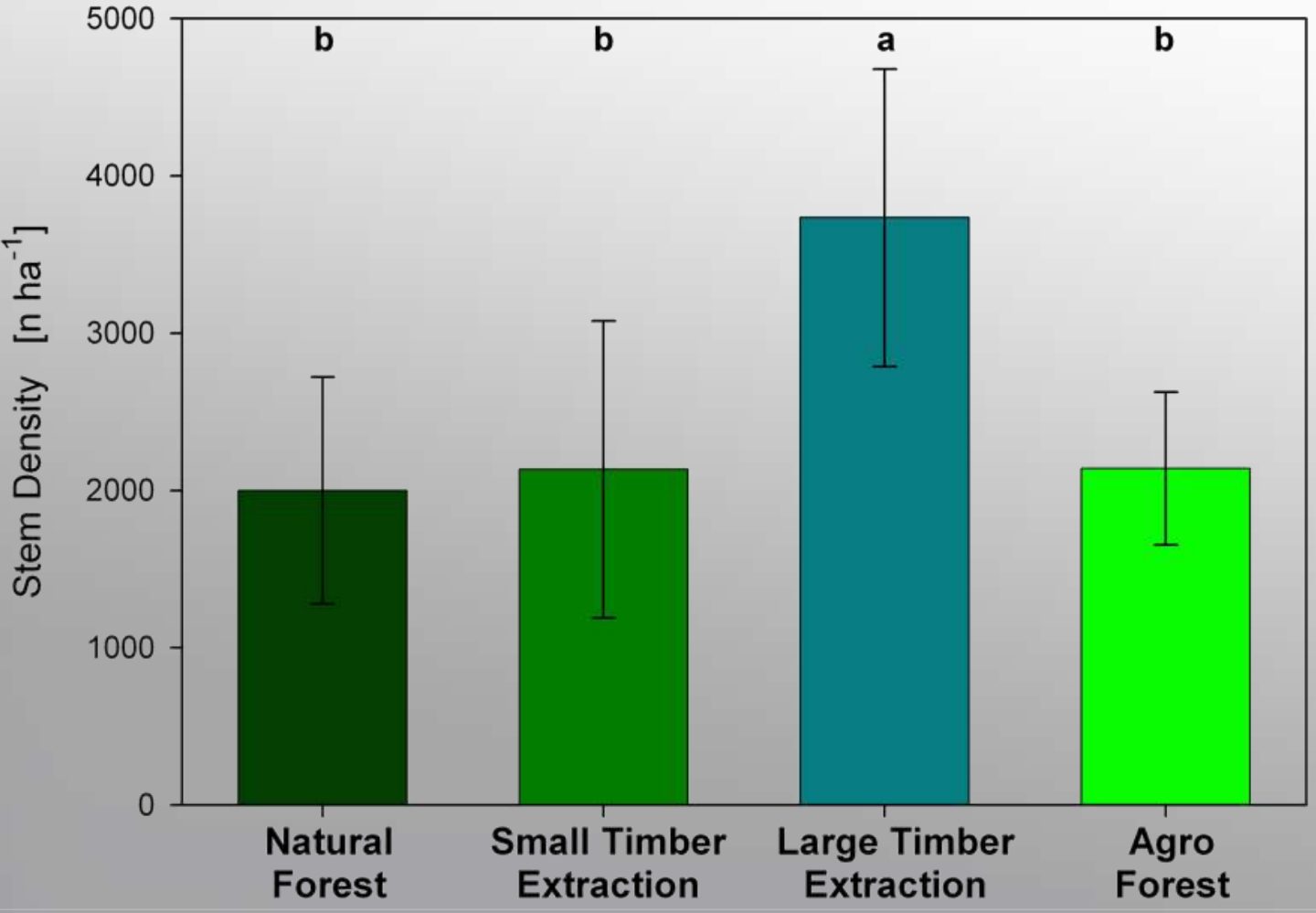
Stem Density

Stems DBH > 50 cm



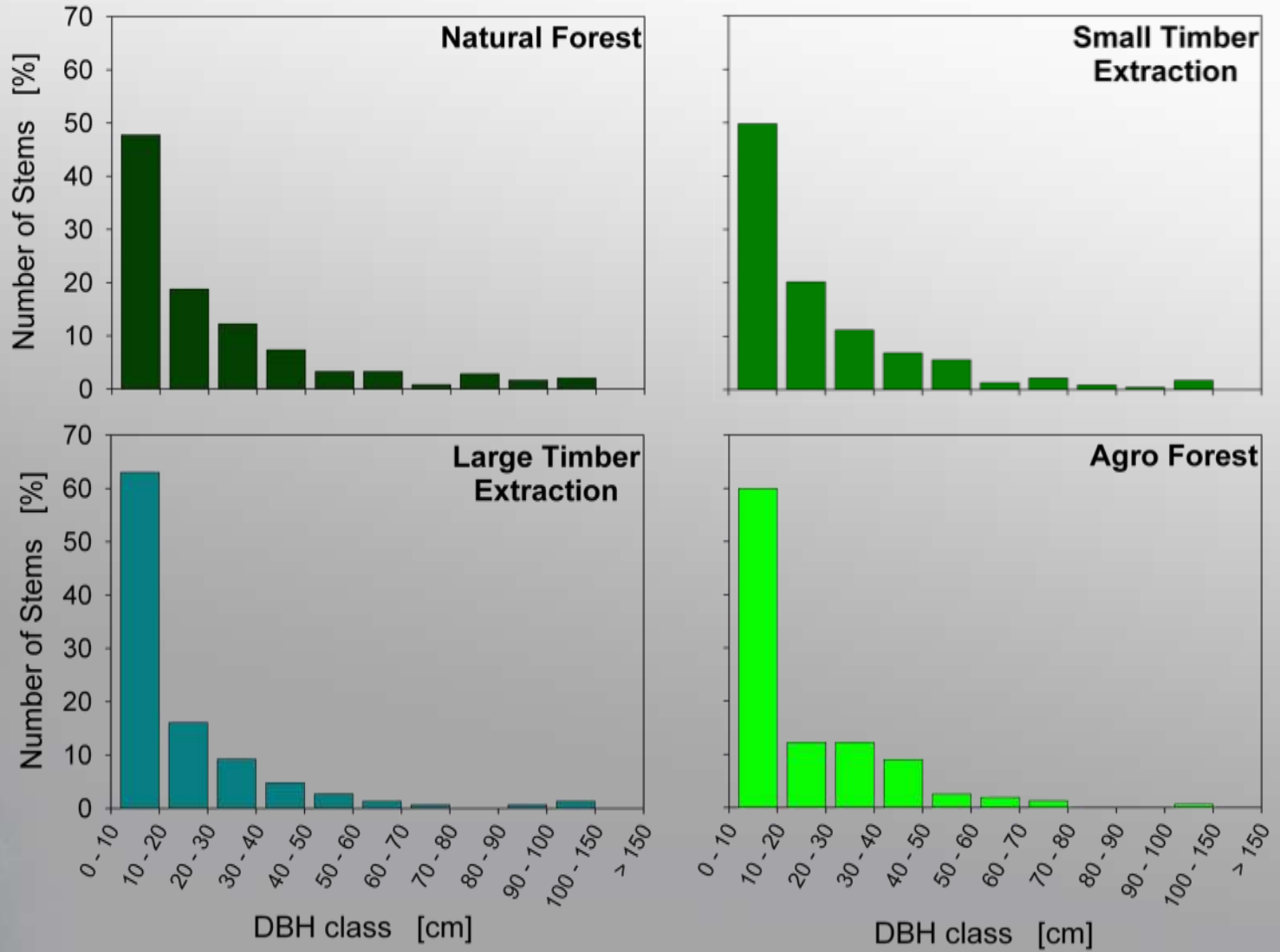
Stem Density

Stems DBH < 10 cm



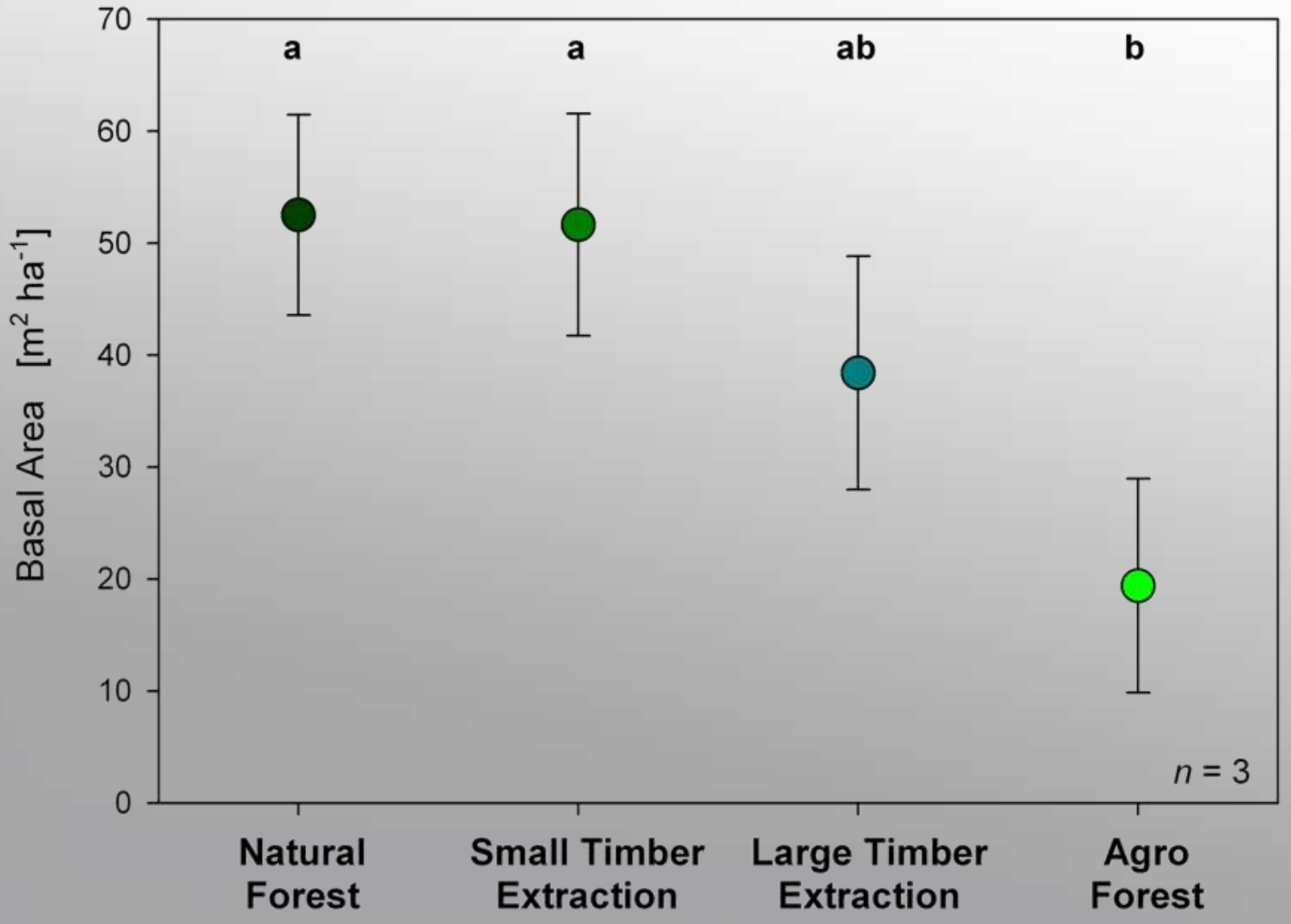
Diameter Distribution

Stems DBH > 10 cm



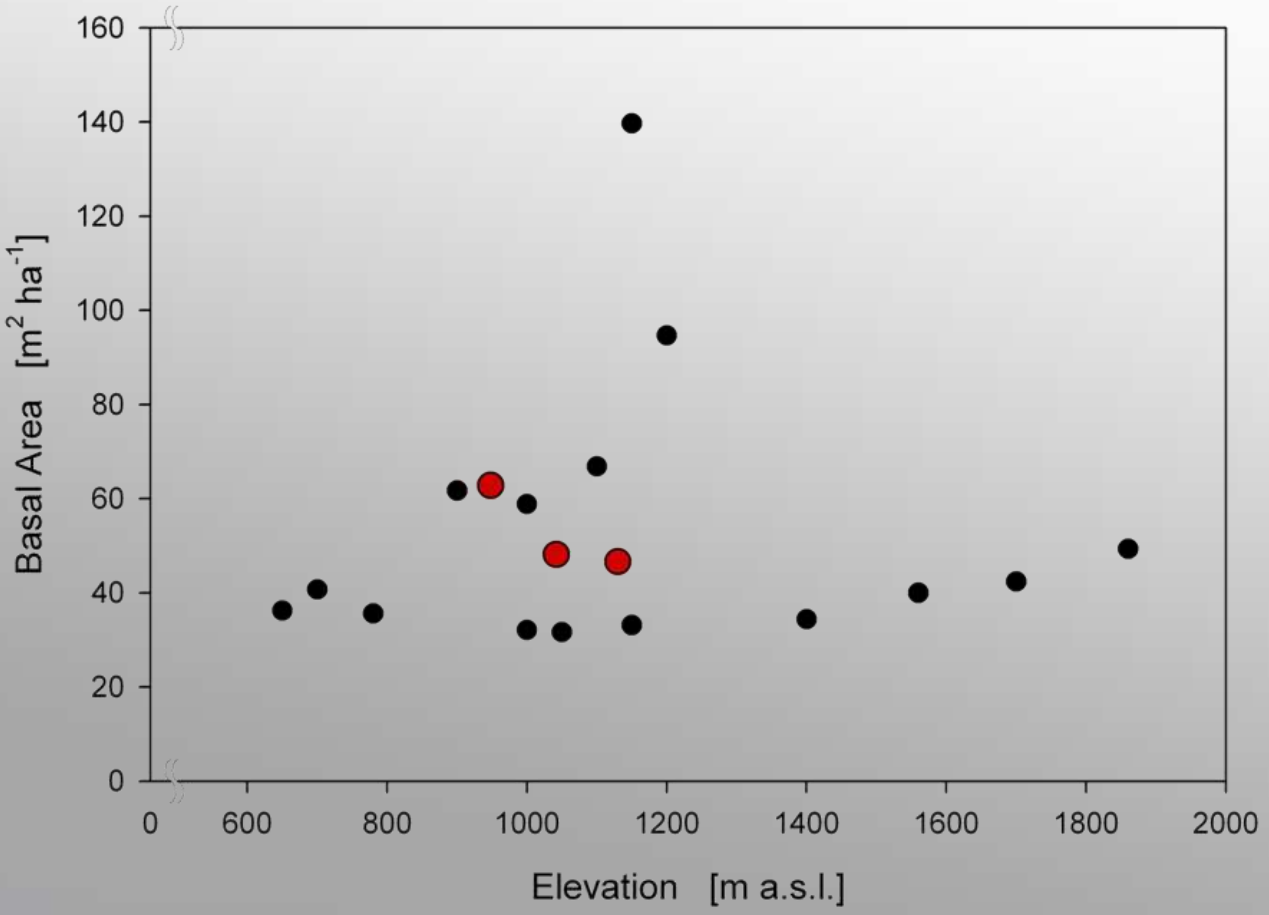
Basal Area

Stems DBH > 10 cm



Basal Area

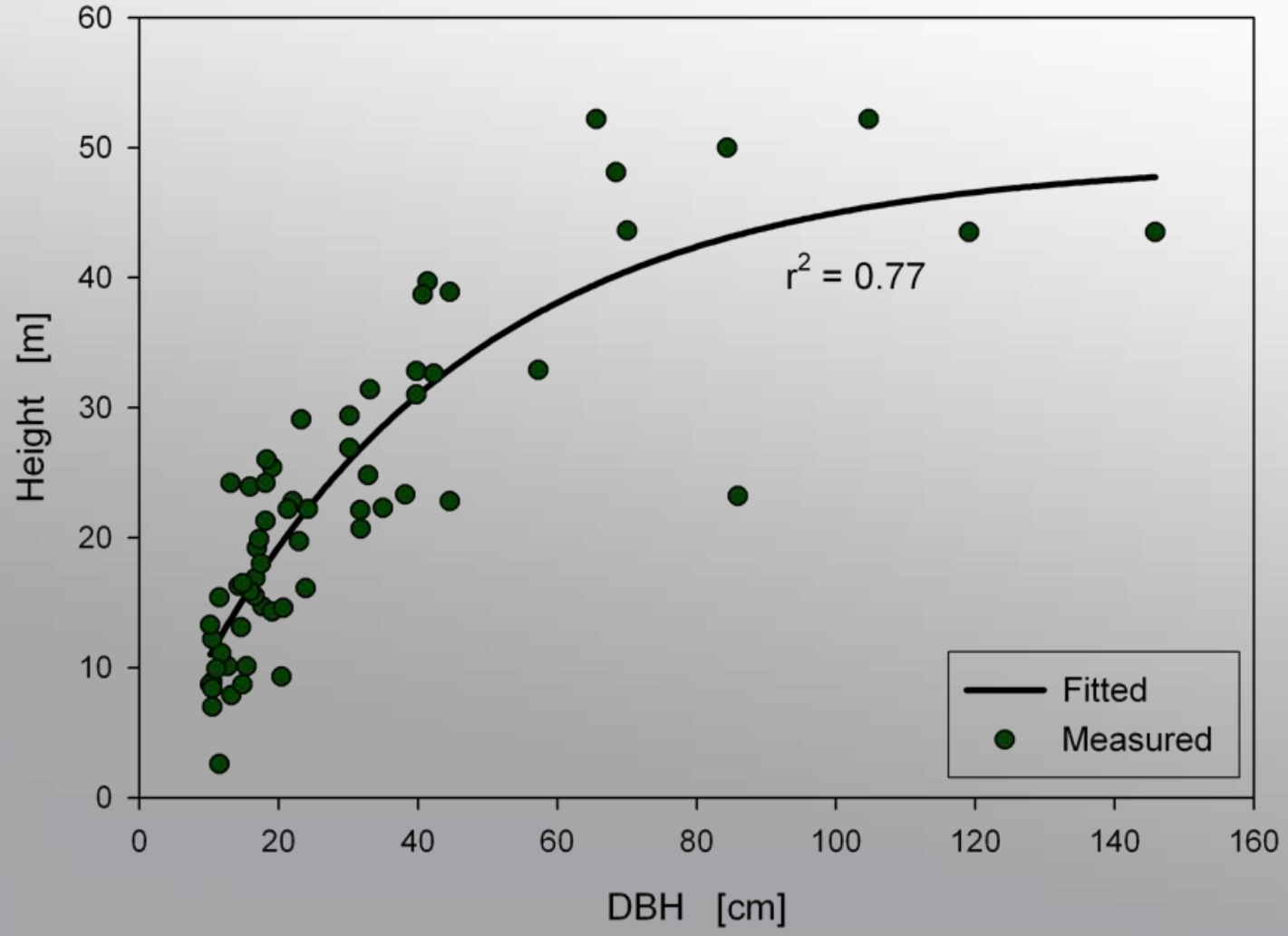
Natural Montane Rain Forests in South East Asia



Aiba & Kitayama 2002, Brodbeck 2004, Dietz et al. unpublished data, Hamann et al. 1999, Kessler et al. in press, Kitamura 2005, Parthasarathy 1999, Sri-Gernyuang 2003

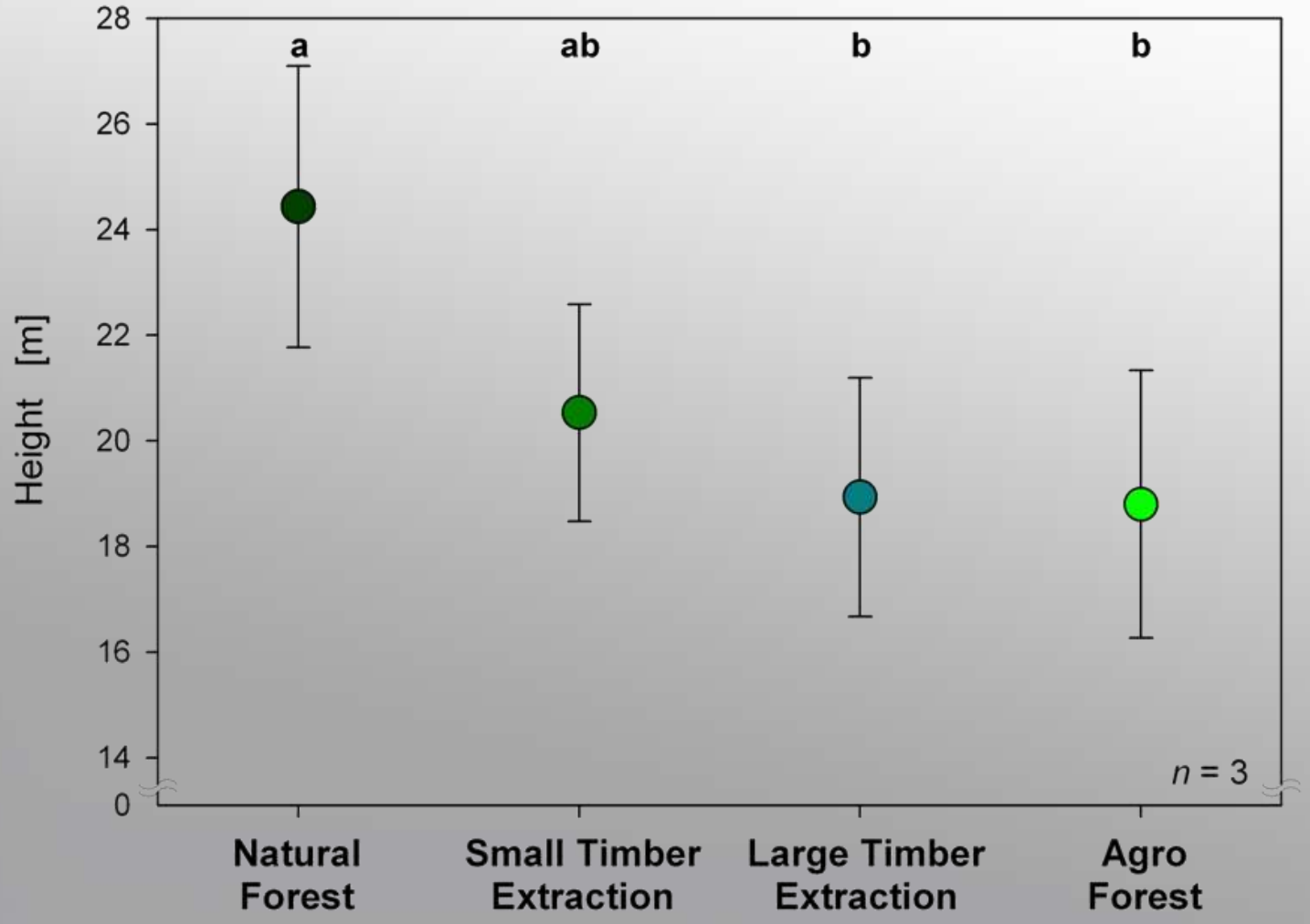
Stand Height

Height Curve – Natural Forest



Stand Mid Height

Mean Diameter

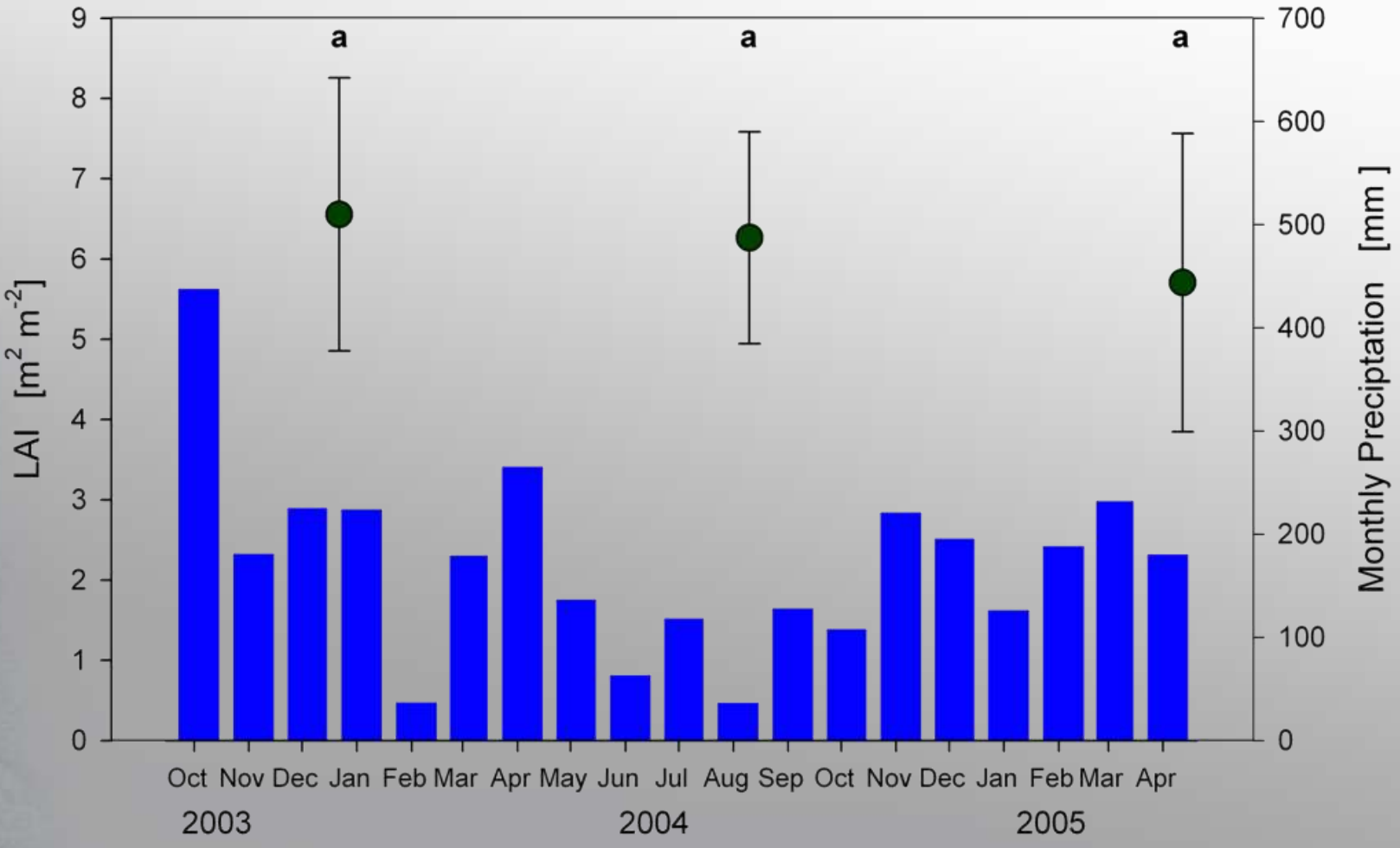


Leaf Area Index

Dietz et al.

Canopy Structure

Seasonality – Natural Forest



Leaf Area Index

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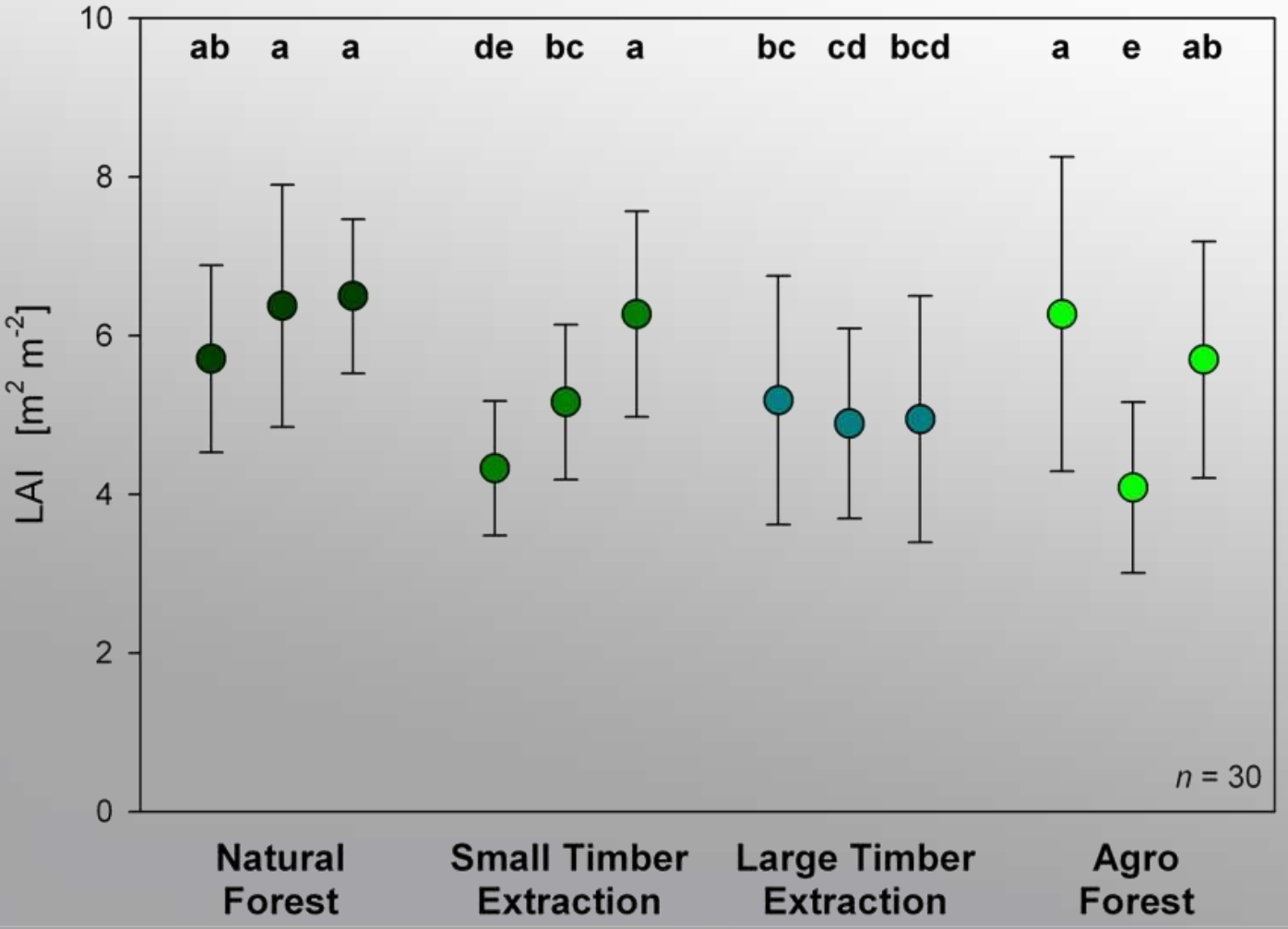
Canopy Structure

Per Research Plot



Canopy Openness

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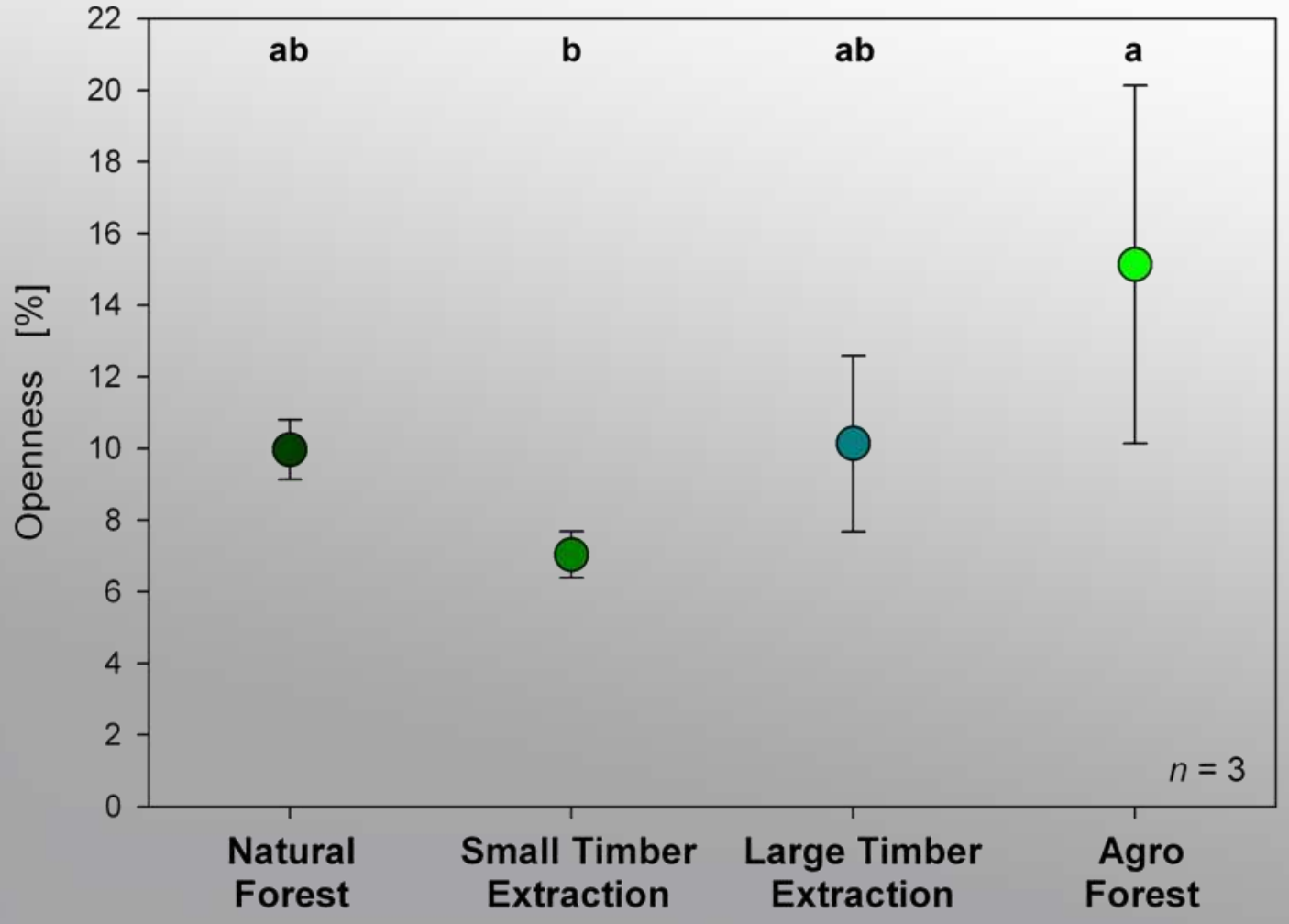
Canopy Structure

Opening Angle 30°



Summary

- Stem Density
  - Small stems most abundant after large timber extraction
- Basal Area
  - Relatively high
  - Use effects evident after large timber extraction and in agro forest
- Stand Height
  - Decreases steadily with forest use intensity
- Canopy Structure
  - Canopy openness is highest in agro forest
  - LAI values are relatively high
  - LAI varies little among use types
    - Quick recovery of LAI after disturbance
    - High leaf area of cacao

Outlook

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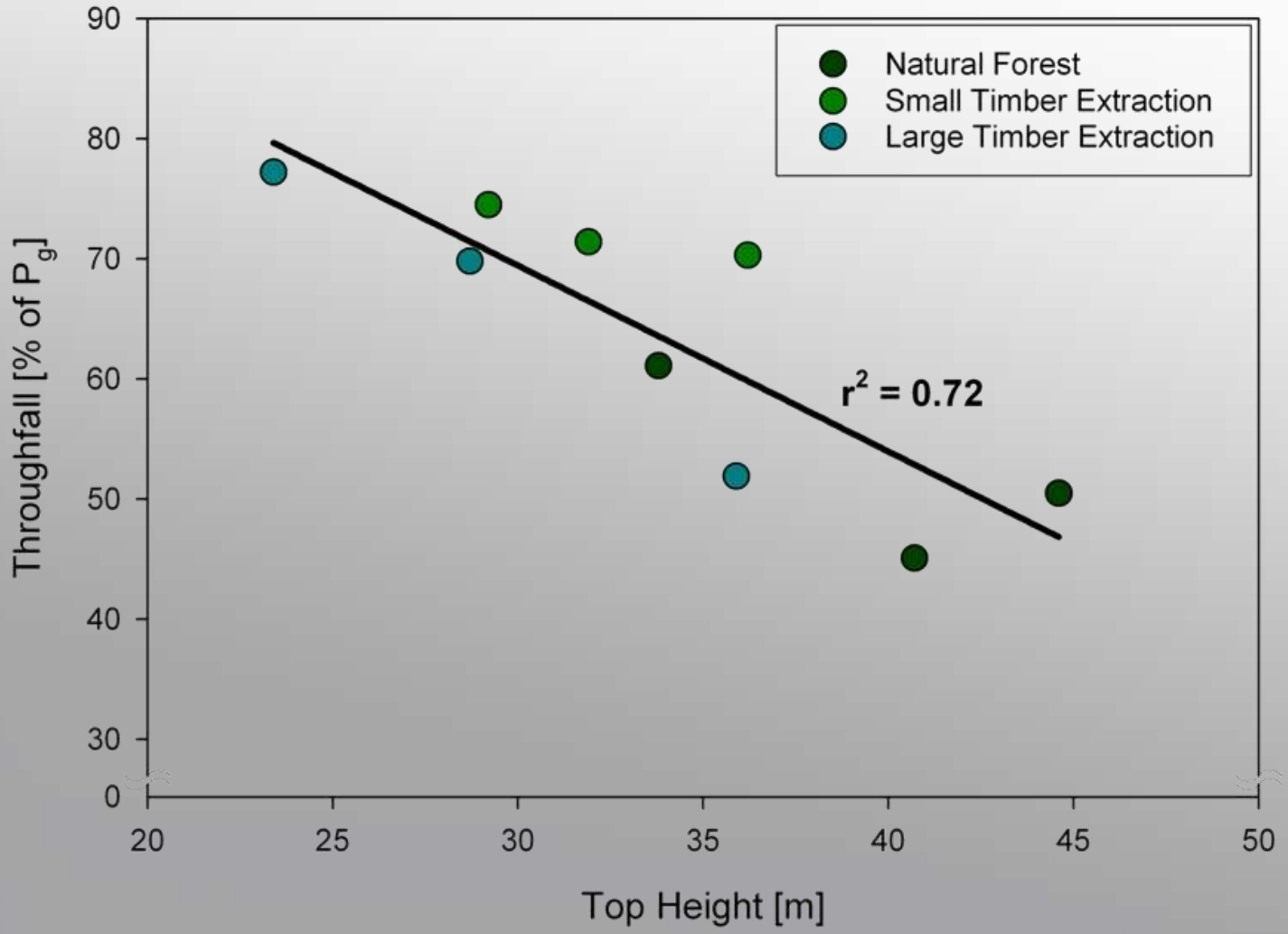
Structure & Net Precipitation



Thank You!

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