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Linking plant community properties to ecosystem functions of tropical wetland forests

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with _____

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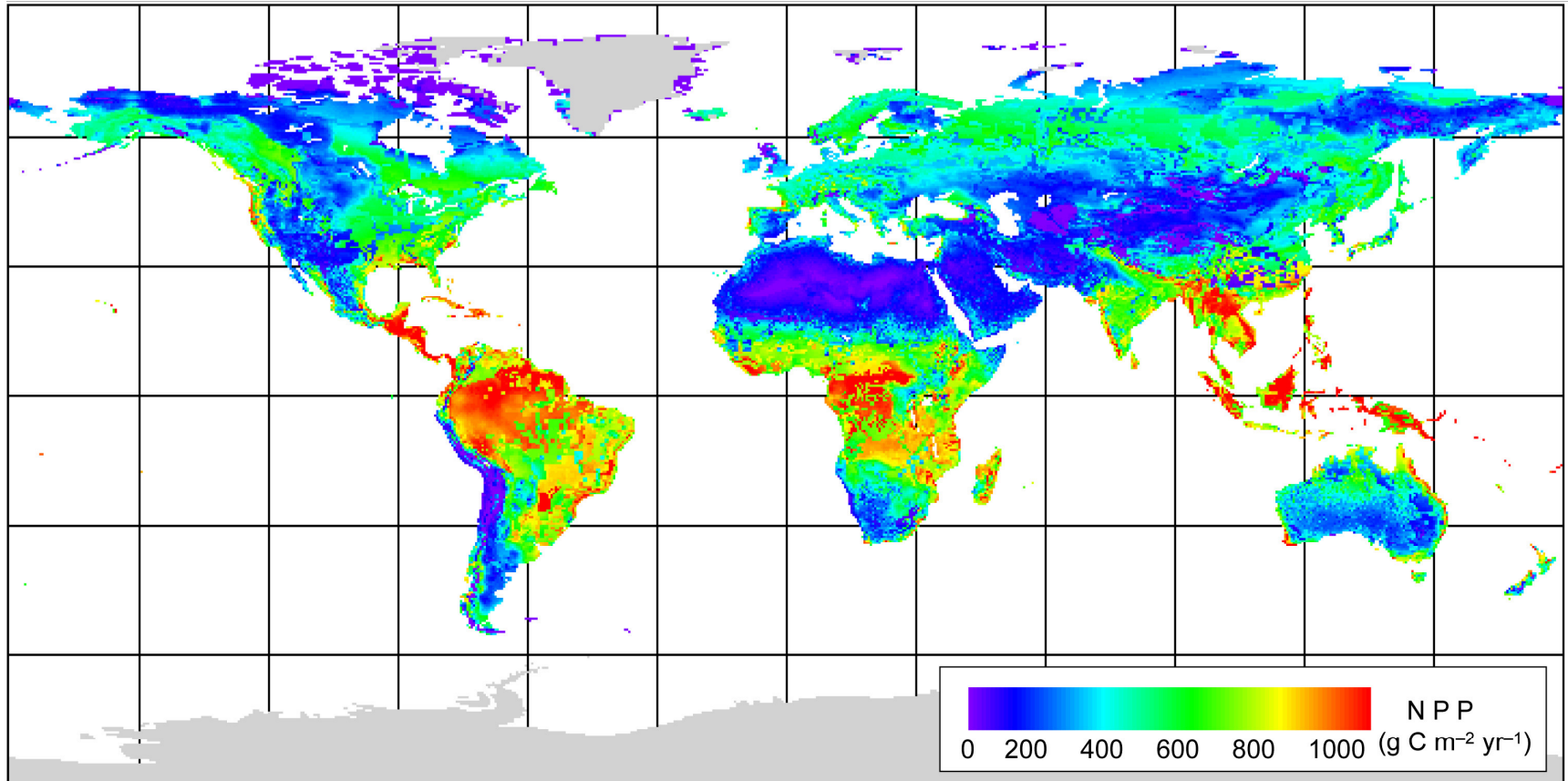
An aerial photograph of a vast, dense tropical forest. The forest is composed of numerous tall trees with lush green foliage, creating a textured canopy. In the background, rolling hills or mountains are visible under a hazy, overcast sky. The overall scene conveys a sense of a large, undisturbed natural environment.

**Tropical forests:
carbon sink. source, or neutral?**

Tropical forest is carbon neutral, as desert and ice sheet



Distribution of terrestrial carbon exchange: $NPP \sim Rh$



NPP = net primary productivity;
Rh = heterotroph respiration

(Ito et al.)

JSPS-LIPI Core University Program: 1997-2006

"Environmental Management of Wetland Ecosystems in Southeast Asia"

Hokkaido University: S. Tokura, N. Nishi, M. Ikeda, T. Iwakuma
Research Center for Biology, LIPI: H. Simbolon

Key concepts

Current situation of natural environment

Assessment of biodiversity

Estimation of human impact

Improvement of agricultural productivity

Management of water resource

Investigation of soft foundation

No rain and dense haze throughout
July-August 1997



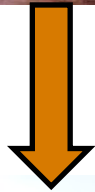
Submerged forest in
February 1998



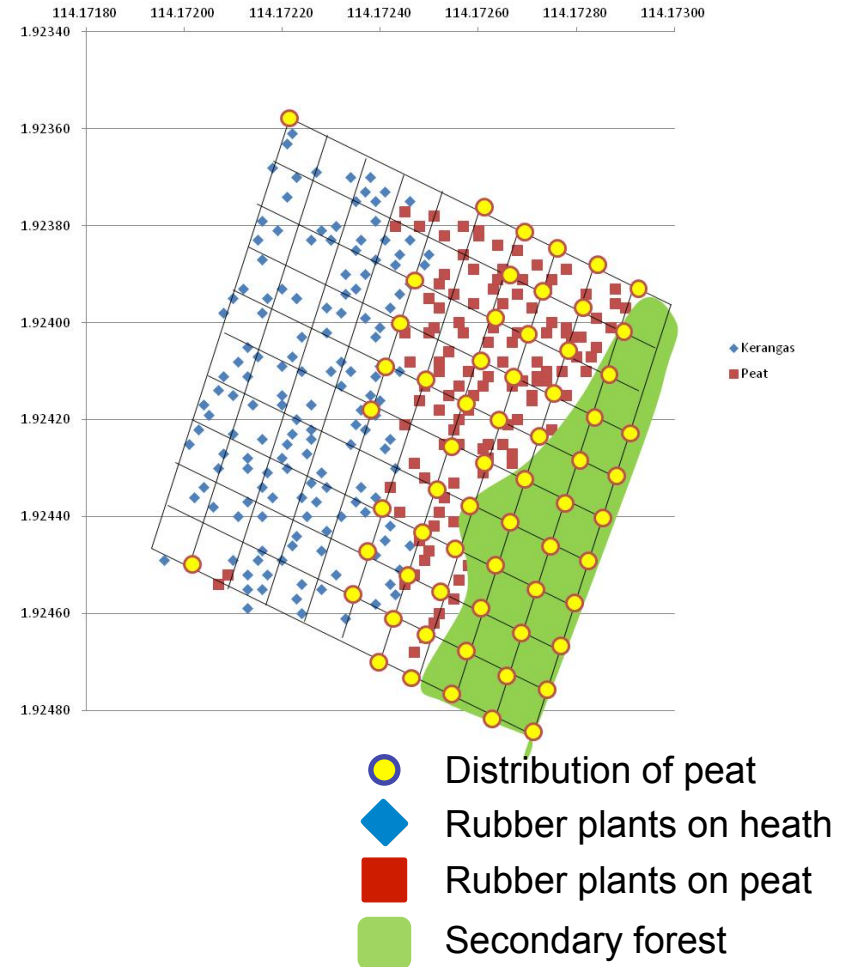
Chasing ecosystem change

(Haraguchi and Seino)

1997



2011



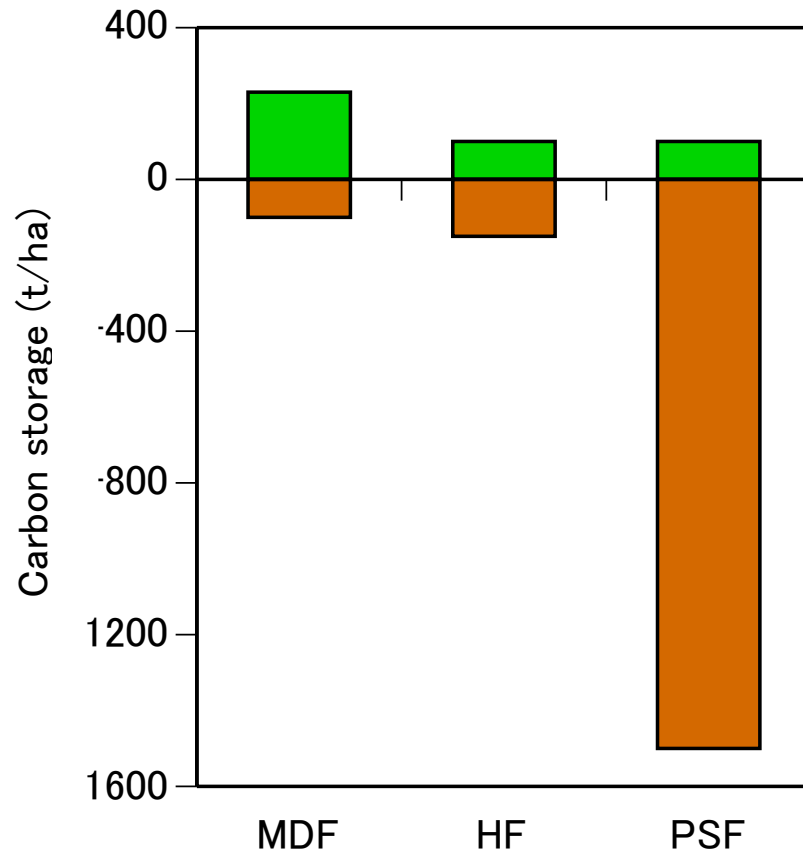
Typical forest types in lowland Kalimantan

Mixed dipterocarp forest (MDP): hilly dry land

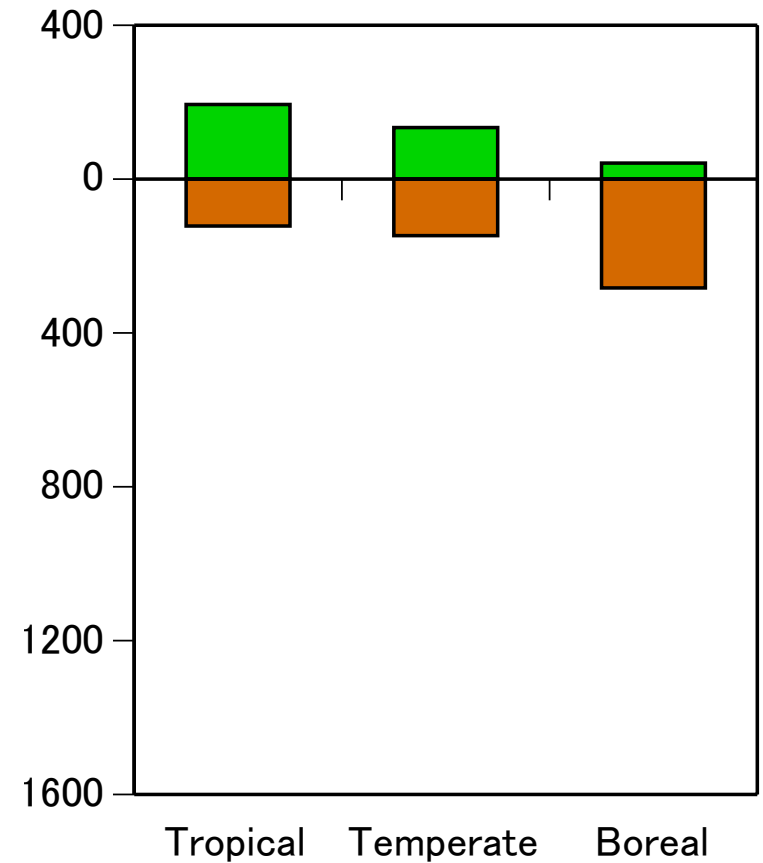
Peat swamp forest (PSF): wetland

Heath forest (HF): wet wetland

Above-ground vs. below-ground carbon pool



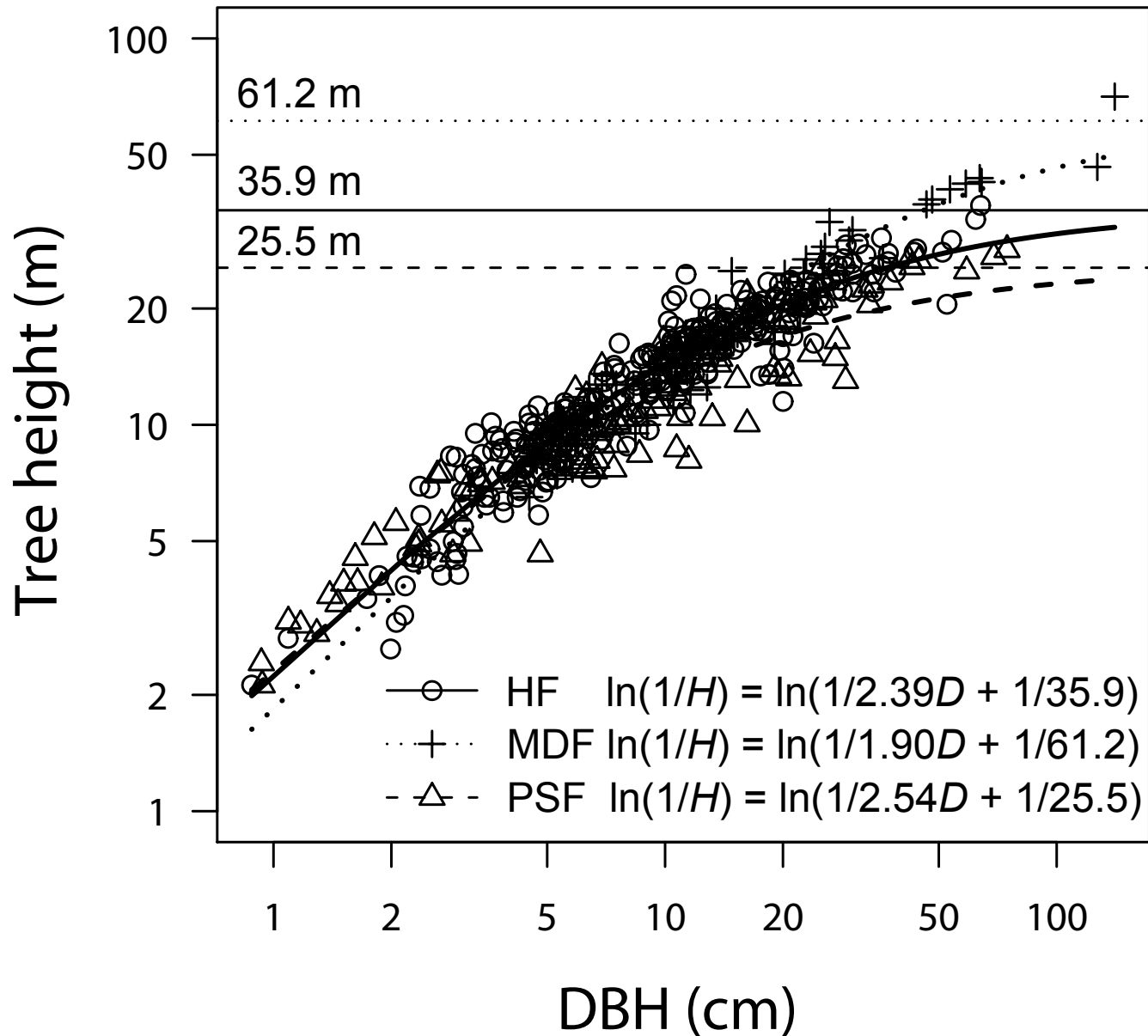
Anaerobic condition

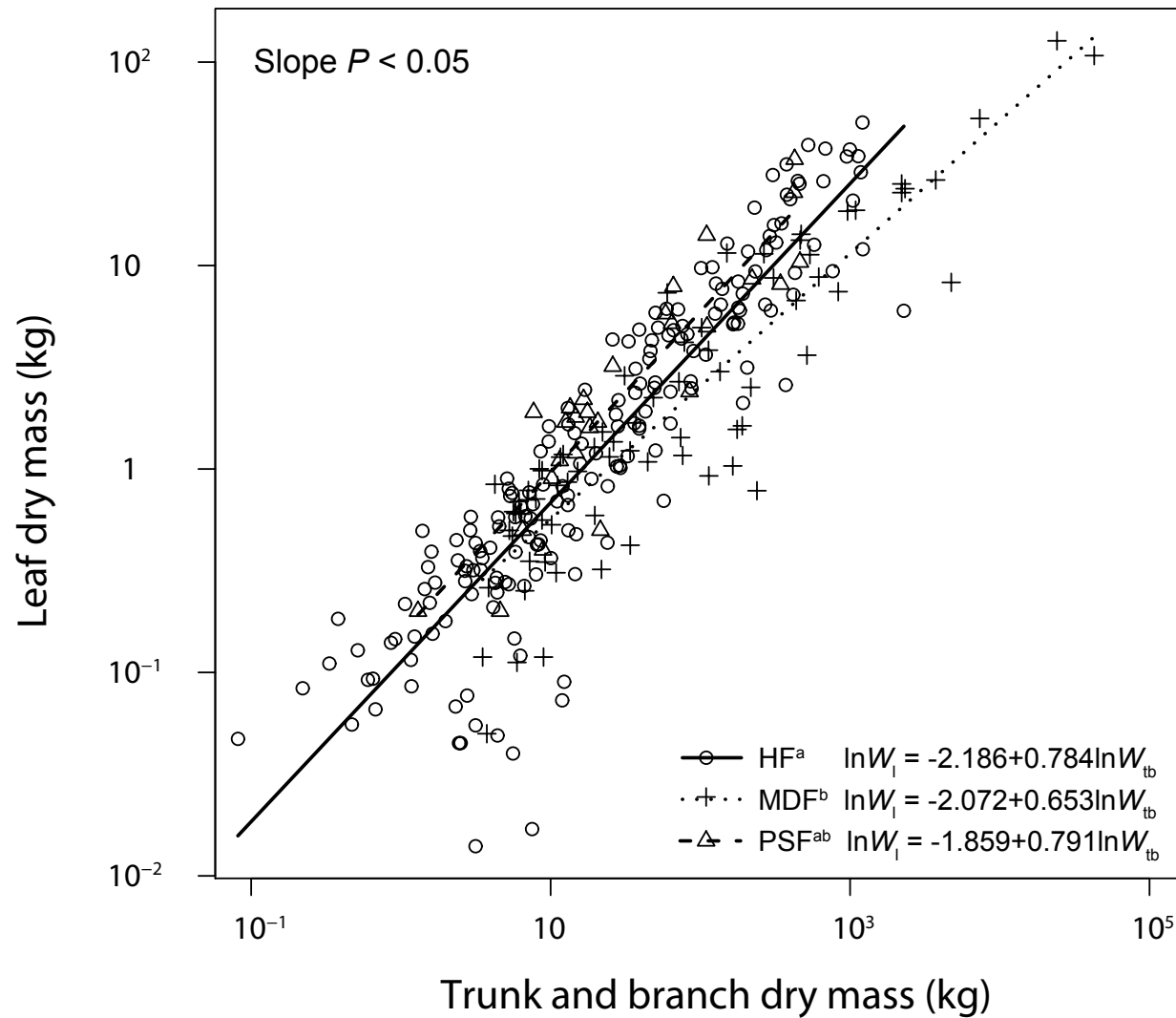


Low temperature

Allometries across forest types

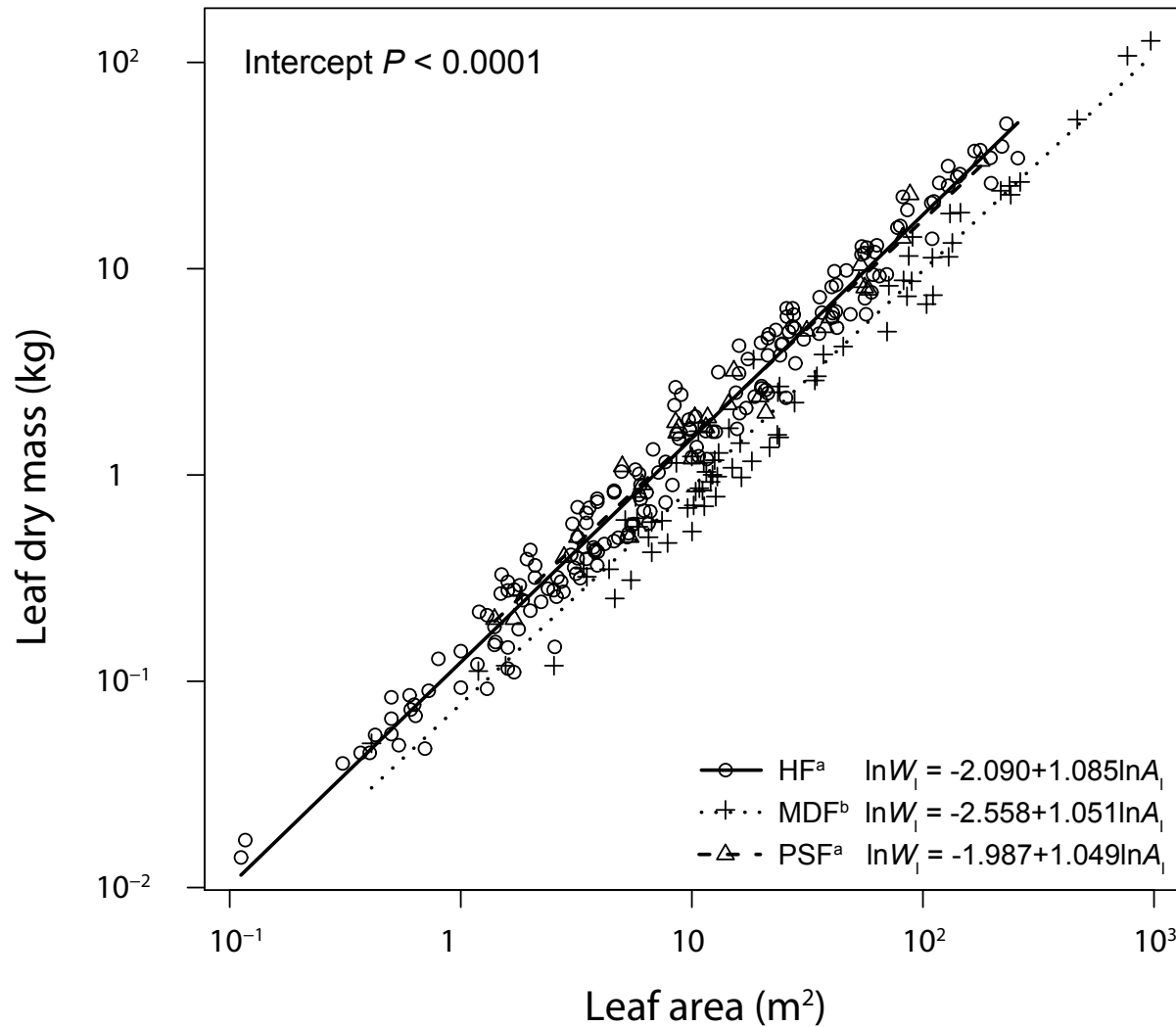
(Miyamoto et al.)





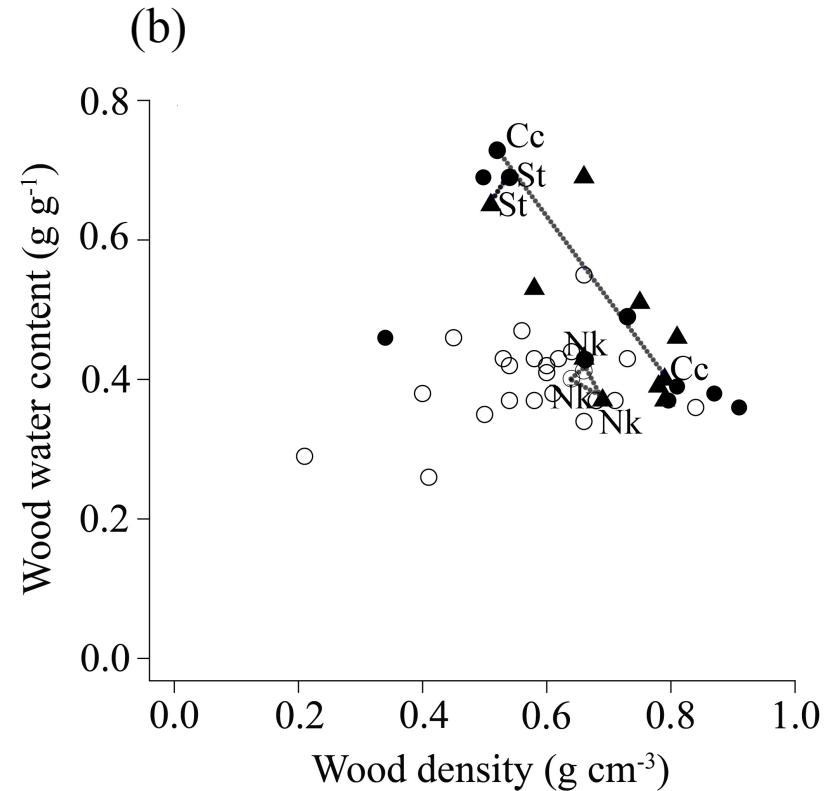
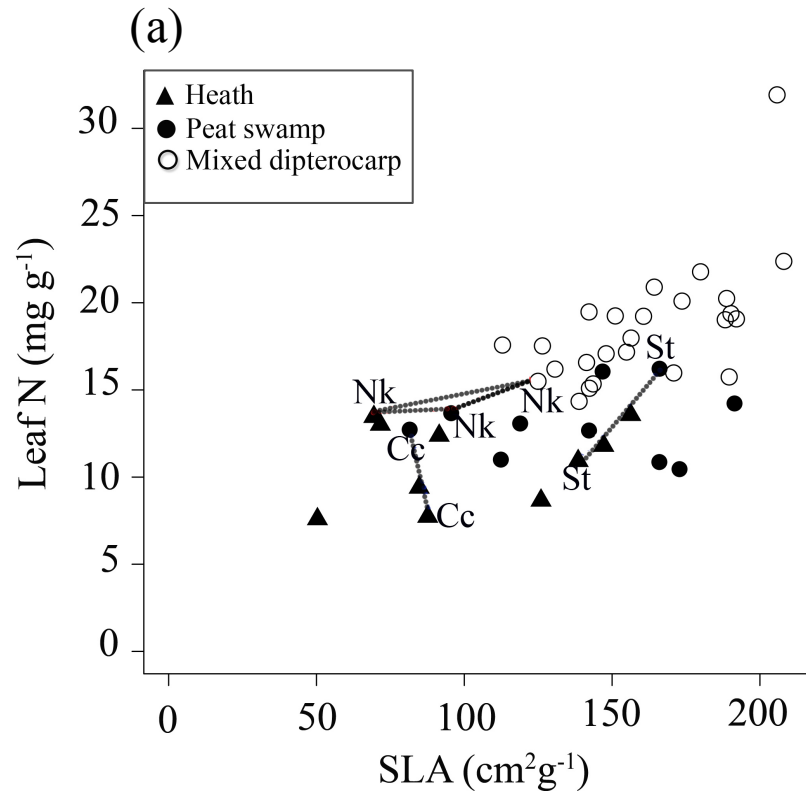
Wetland trees are more leafy

(Miyamoto et al.)



Wetland tree leaves are thicker

Functional traits at sapling stage are different across forest types

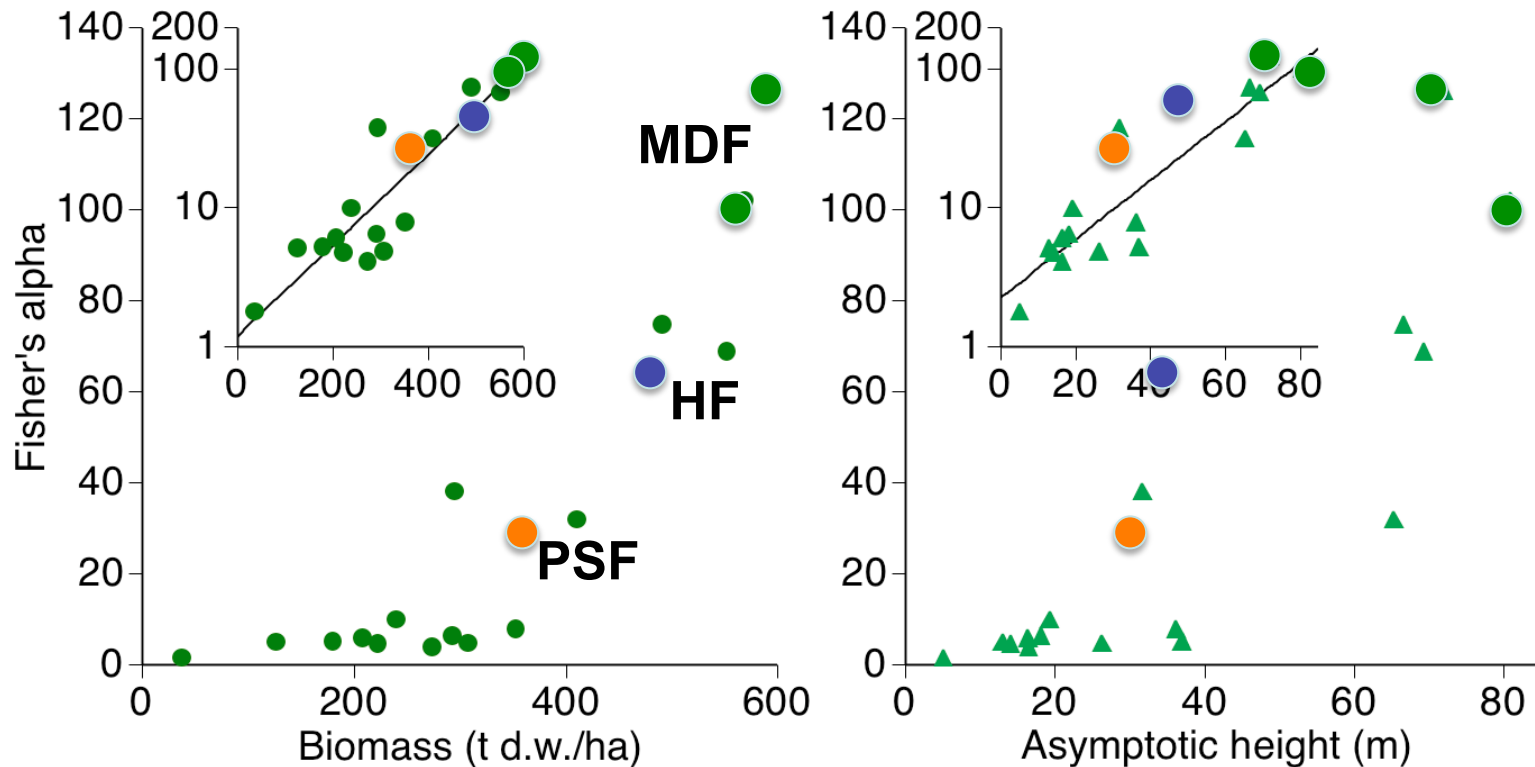


(Atikah et al.)

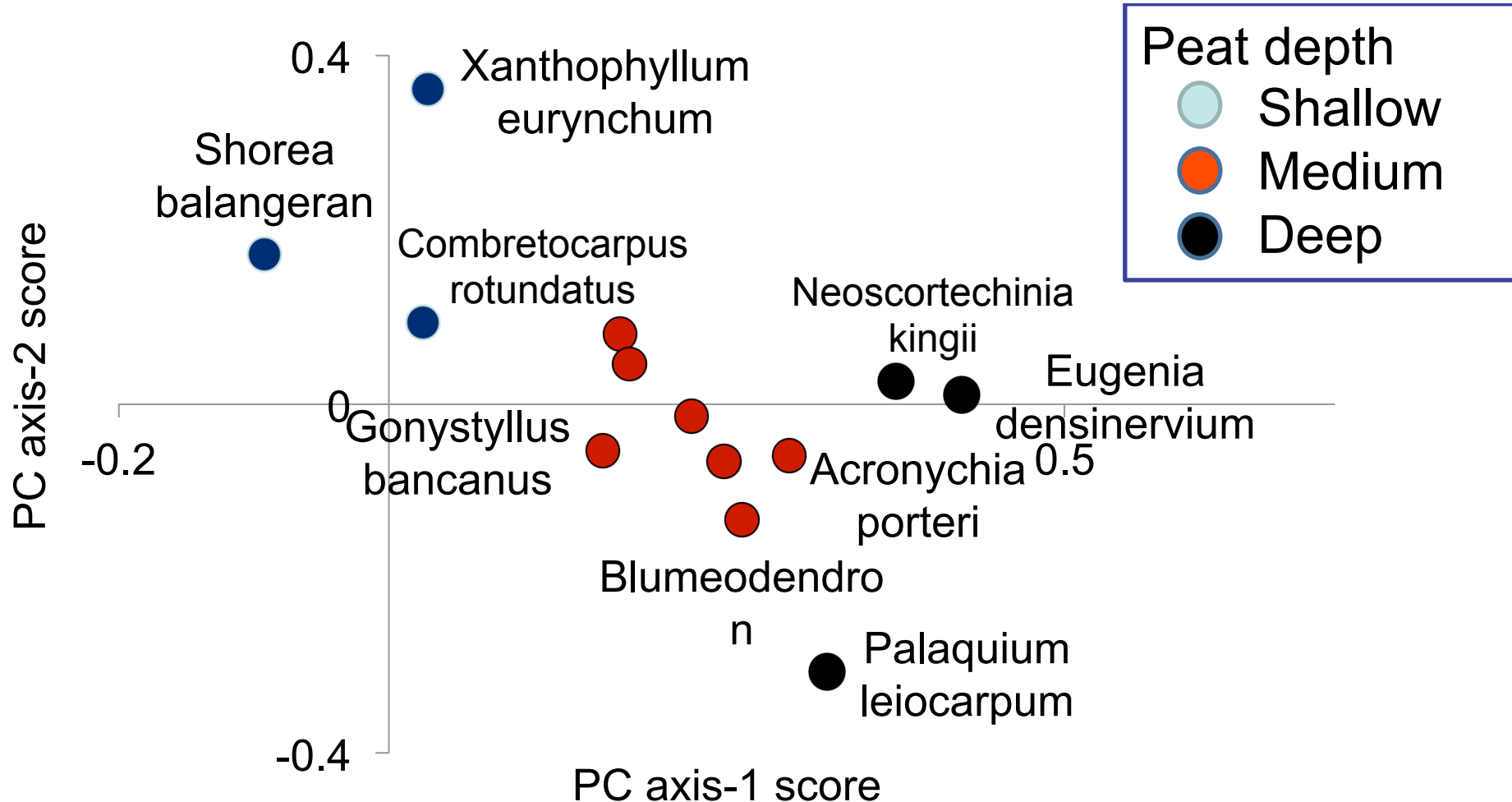
**Wetland tree saplings are low in leaf nitrogen,
and high in wood density**

Wetland forest is species-rich relative to their structure

(Kohyama et al.)



Distribution of species in peat swamp forest



Close to river  Away from river

(Mirmanto 2011)

Diversity of plant communities in peat land



Mixed swamp forest

Deep peat (7.5 m in Max)

Tall and closed crown

Shorea belangeri

***Buchanania* spp.**

***Semecarpus* spp.**



Kerapah shrub (Waterlogged heath)

Thin peat (only 0.2 m) and open crown with many bare branches

Cratogeomys glaucum, ***Combretocarpus rotundatus***,

Dactyloctenium aegyptium



Riparian forest

1 to 2 m deep peat and closed crown by dense trees

Combretocarpus rotundatus, ***Tristania obovata***,

Parastemon spicata



Riparian grassland

1 to 1.5 m deep peat

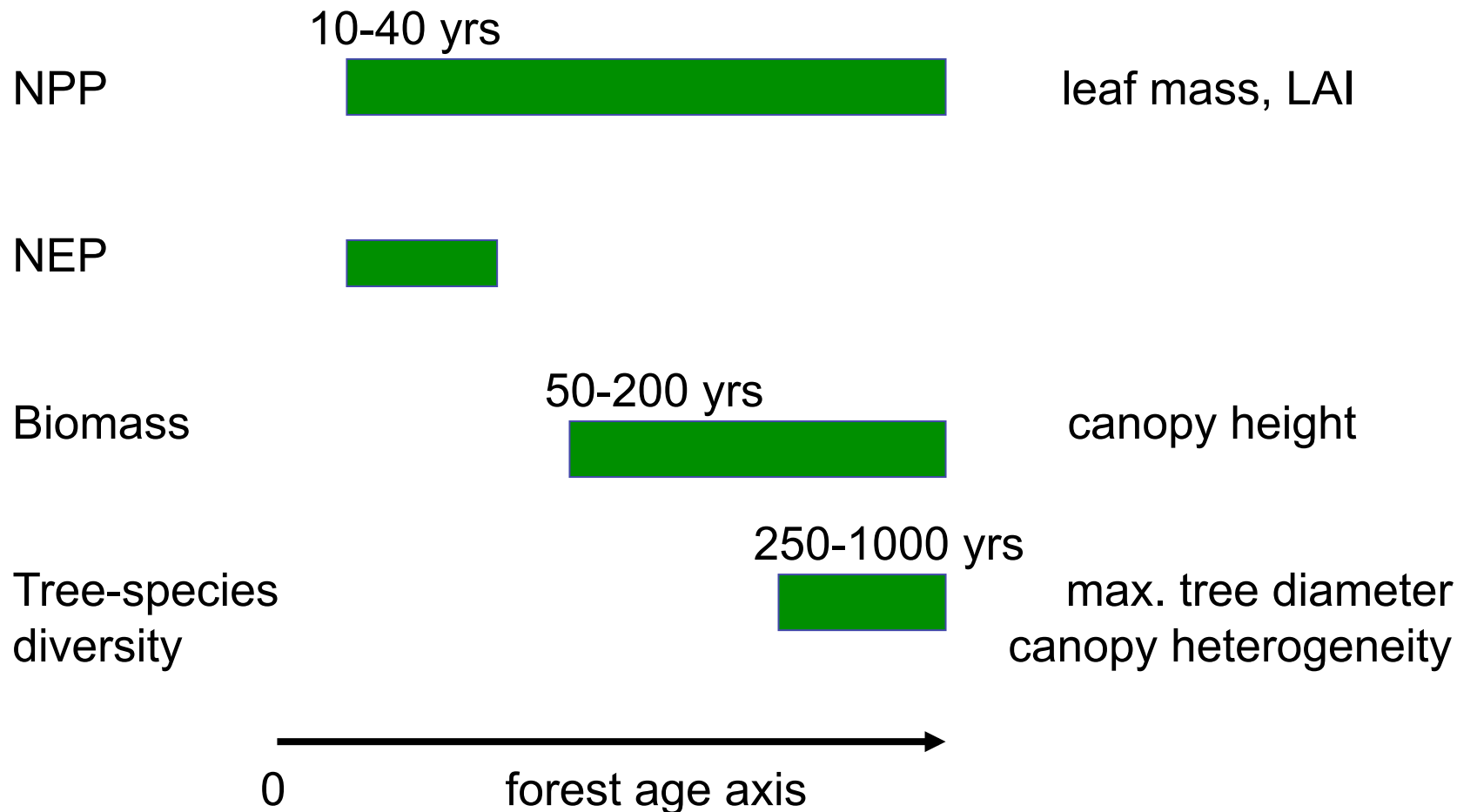
Gahnia* cf. *javanica

Scleria oblata

Recovery time is different across properties

Ecosystem attributes

Candidate measures



There is variation in recovery times in terms of ecosystem measures; which represent various aspects of ecosystem services

It takes several-times longer period for wetland forest recovery

