



Pasoh Forest Reserve

~ Biodiversity, Carbon Cycle & Ecological Service ~

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Wellcome to the Pasoh Forest Reserve



Photo: Daito/NIES

Pasoh is in the state of Negeri Sembilan, about 70 km southeast of Kuala Lumpur, Peninsular Malaysia

(2°58'N, 102°18'E; elev 75~150m)

Pasoh Forest Reserve comprises a core area of 650 ha of lowland primary dipterocarp forest, surrounded by a 2000 ha buffer zone of regenerating forest, portions of which were selectively logged during 1954 and 1963

Towers & Canopy-walkway

Pasoh Forest Reserve view towards WEST (from research tower)

Google earth

© 2011 Ches/Spot Image
© 2011 Mapit

2° 58'56.44" N 102° 18'21.37" E 標高 123 市

高度 6.88 km

Current Facilities



- Seminar room (30 pax)
- Hostel rooms (30 pax)
- Camping ground
- Electric and water supply
- Computer and internet



Our Vision, Our Mission

Vision:

To become a centre of excellence for Tropical Forest Ecology Research

Mission

- To develop Pasoh FRS as a center for research and education on forest ecology and ecosystem
- To develop Pasoh FRS as a eco-tourism and eco-education center of global standards
- To provide services and training among the public on the importance of forest to the environment and human life



History of Pasoh



1969 – First project:
Royal Society of England & Malaysian
government under the International Biological
Programme (a UNESCO initiative).

History of Pasoh

1970~1978: Intensive research on lowland rain forest ecology and dynamics under a joint research project between the University of Malaya (UM) and the International Biological Programme (IBP), the Man and Biosphere (MAB) Programme and the joint Rainforest Research Project of UM and the University of Aberdeen, U.K. (http://www.frim.gov.my/?page_id=2286)



IBP in 1970s



History of Pasoh

- ➡ **Pasoh has been declared an International Biosphere Reserve under the MAB Programme since 1970.**
- ➡ **The Pasoh Forest Reserve has been managed by the Forest Research Institute of Malaysia (FRIM) since 1977.**

High Carbon Stock of Primary Forest at Pasoh

Biomass = $\sim 350 \text{ tC ha}^{-1}$
NPP = $14 \sim 16 \text{ tC ha}^{-1} \text{ y}^{-1}$

Kira 1978
Yoneda 2010

High Productivity of Southeast Asian Forests

	Pasoh	Manaus
Location	2°59'N, 102°08'E	2°35'S, 60°06'W
Mean Temp (°C)	25.7	25.6
Precipitation	2050	2200
Aboveground biomass	430~600	300~350
LAI	6.25	5~6
Fine litter (t ha⁻¹)	10.8	6.9~7.3
NPP (tC ha⁻¹ y⁻¹)	13.9 (Kira 1978) (Khao Chong: 15.5)	10.7 (Malhi et al. 2004)

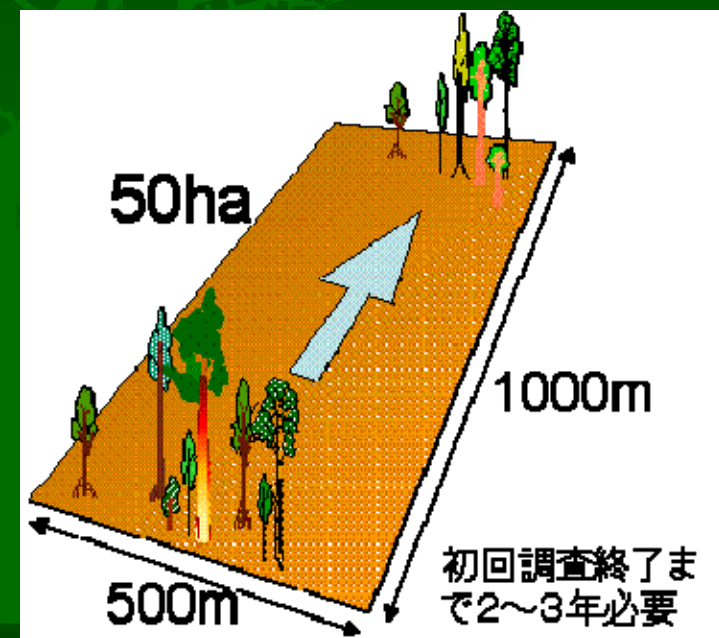
50-ha Plot

- ➡ In 1985, 50-ha Plot of Pasoh, the second Forest Dynamics Plot in peninsular Malaysia, was initiated by FRIM in collaboration with the National Science Foundation and the CTFS of Harvard University.
- ➡ Since the project's initiation, the National Institute for Environmental Studies (NIES) of Japan has become a project partner.
- ➡ http://www.frim.gov.my/?page_id=2286
- ➡ <http://www.ctfs.si.edu/site/Pasoh/>

Tree Census at the 50-ha Plot

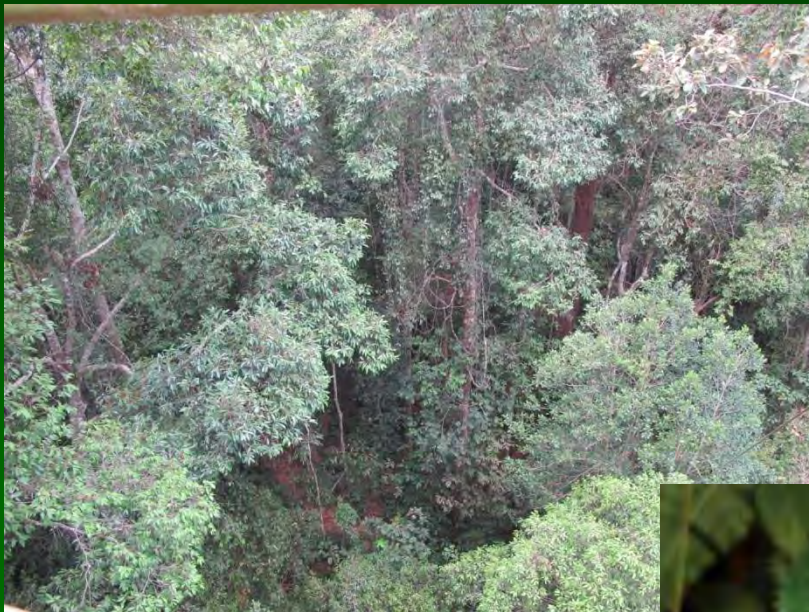
- ✓ The first census (all tree species 1 cm dbh and above in diameter) was completed in 1989, and four recencuses have been completed since then.
- ✓ This plot contains more than 800 species and approximately 340,000 trees.
- ✓ Many of the plot's species are commercially important and are the focus of intensive demographic study.
- ✓ Furthermore, analyses of the human uses of the Pasoh forest and economic valuations of forest resources based on Pasoh FDP data have been conducted.

✓ <http://www.ctfs.si.edu/site/Pasoh/>

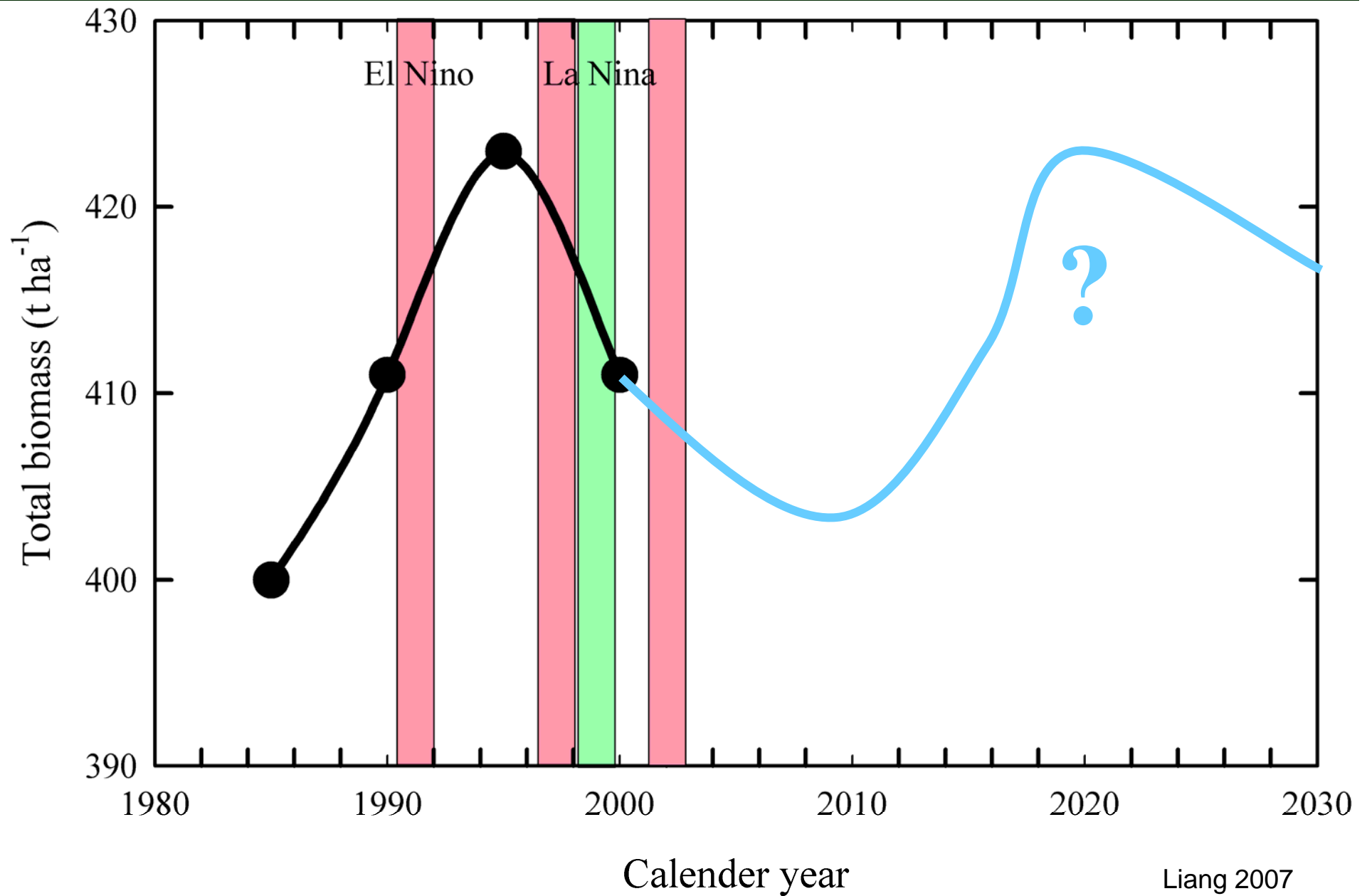


Diversity

- **340,000 trees** (≥ 1 cm diameter at breast height) consisting of **814 species** (Pasoh 50 ha) - 25% of the tree species in Peninsular Malaysia
- $\frac{1}{4}$ of all palm species in Peninsular Malaysia



Biomass vs. Climate Change



NIES has been partly funding the four 50-ha plots in Southeast Asia since 1998



- NIES-Smithsonian
- Smithsonian and/or others



NIES-FRIM-UPM

Since 1991

joint Research Project

Japanese Office
in FRIM

- 👉 **NIES:** National Institute for Environmental Studies, Japan
- 👉 **FRIM:** Forest Research Institute Malaysia
- 👉 **UPM:** University Putra Malaysia

NIES-FRIM-UPM Joint Research Project



- ☞ In 1991, the NIES-FRIM-UPM Joint Research Project was launched in the Pasoh Forest Reserve.
- ☞ This joint research project between the Japanese and Malaysian governments embraces the fields such as ecology, forestry, meteorology and hydrology to focus upon issues pertaining to biodiversity, sustainable use and management of tropical rain forests.
- ☞ (<http://www.nies.go.jp/biology/pasoh/English/index.html>)

Biodiversity



Flowers of Dipterocarpaceae Family (From Nishimura's database)



Shorea bracteolata



Shorea pauciflora



Shorea parviflora



Shorea maxwelliana



Shorea lepidota



Shorea macroptera



Shorea acuminata



Shorea leprosula



Neobalanocarpus heimii



Dipterocarpus sublamellatus

実と種 (西村千データベースより)

Fruits and seeds (From Nishimura's database)



Lithocarpus rassa



Castanopsis megacarpa



Baccaurea racemosa



Scaphium macropodum



Pterocymbium javanicum



Xerospermum noronhianum



Koompassia malaccensis



Cynometra malaccensis



Vatica bella



Shorea ovalis

ほ乳類 (MAMMALS)



トゲネズミ
Maxomys Sarifer



タイガーシベット
Hemigalus derbyanus



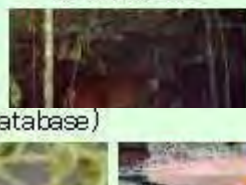
マレー ヤマアラシ
Hystrix brachyura



コモンツバイ
Tupaia glis



マレー バク
Tapirus indicus



アメリカ
avanicus



かちくろし
Bos indicus



マレーシベット
Vierra tangalunga



ザル
mestrina



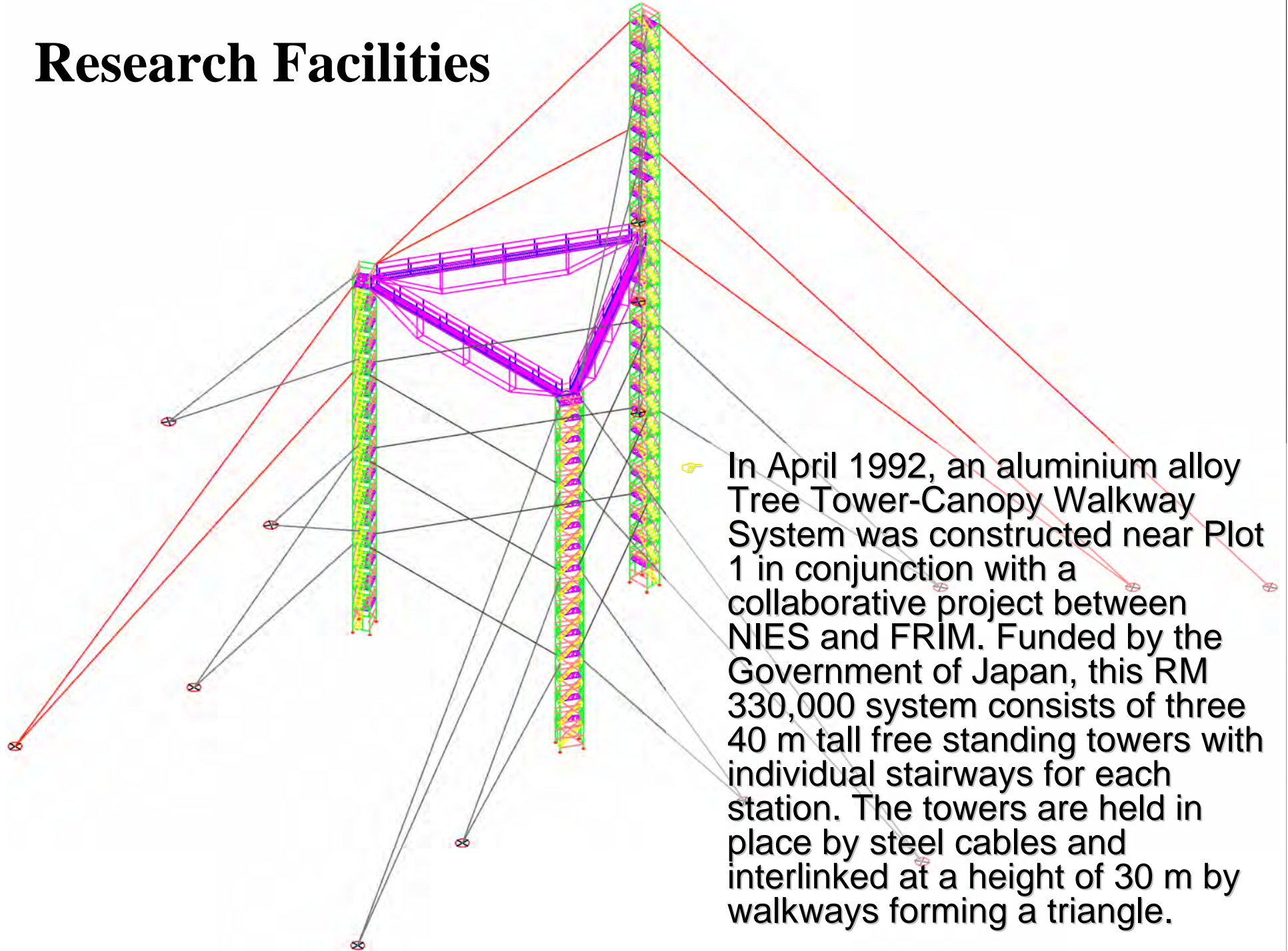
クロカンムリリーフモン
キー



マレー センザンコウ
Manis javanica

☞ http://www.nies.go.jp/biology/pasoh/English/E_topics/plant.html

Research Facilities



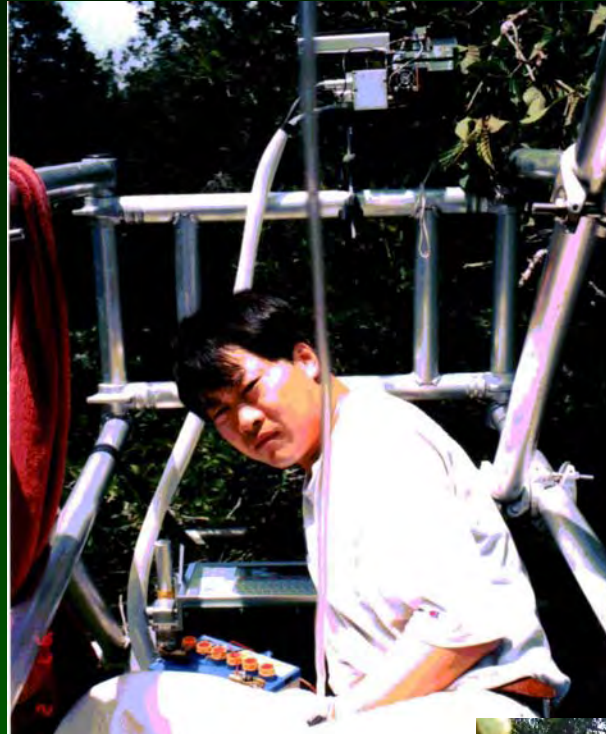
This is the Pasoh meteorological tower



Canopy Walkway System



Photo: Daito/NIES



The towers facilitate microclimatic and physiological studies at various heights of the forest canopy while the walkways provide convenient access to the canopy for phenological observations and faunal studies.



Meteorological Tower

In early 1995 the height of one of the towers was extended by another 12 m to allow measurements of CO₂ flux above the canopy level.



Agricultural and Forest Meteorology 114 (2003) 235–244

AGRICULTURAL
AND
FOREST
METEOROLOGY

www.elsevier.com/locate/agrformet

Measurement of CO₂ flux above a tropical rain forest at Pasoh in Peninsular Malaysia

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Received 17 April 2002; accepted 23 August 2002

In May of 1998, CO₂ flux was initially measured by a closed-path system with a collaboration among NIES, FFPRI & FRIM.

CO₂ Flux

A new EC system has been adopted for continuous observation of CO₂ flux since September 2002, leading by the Kyoto Univ. (<http://www.bluemoon.kais.kyoto-u.ac.jp/pasoh/index.html>).



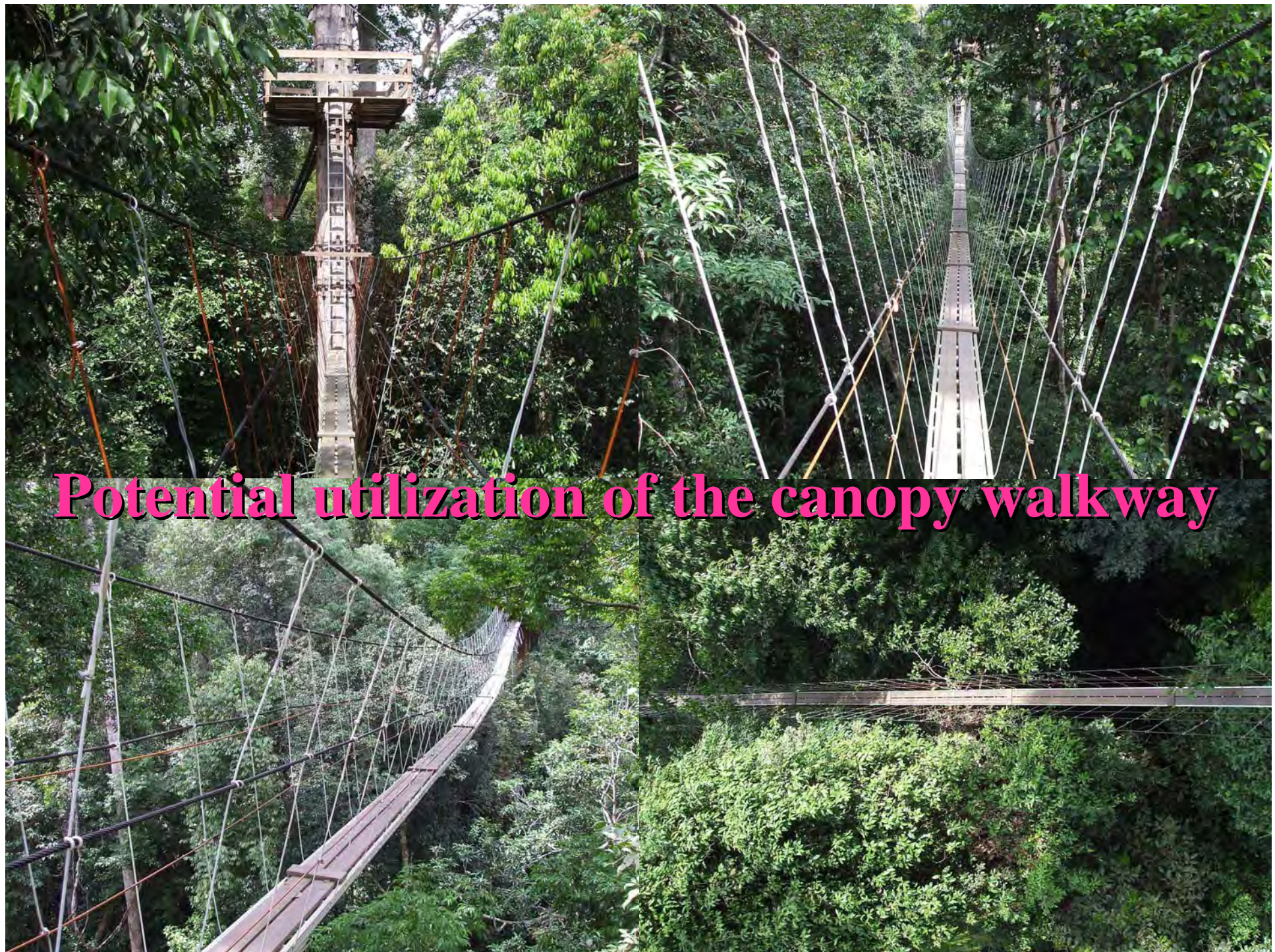
Canopy Walkway

- In 2005, NIES funded a new canopy walkway system, which was built at a cost of JPY 15,000,000 (RM 501,000). The new canopy walkway system is connected to the existing aluminum tower.
- The new walkway system, which spans 490.62 m consists of 18 suspended sections at varying height from 15 m to 28 m, 15 platforms (average measurement at about $1.5 \times 1.5\text{m}$), and 3 larger observation platforms ($3 \times 3\text{m}$).
- At two of the platforms and one of the observation platform, access ladders are built to access to the tree canopy.
- Furthermore, a 45 m height wooden tower is built at the edge of the final walkway. This new system is expected to provide a more convenient access to the upper canopy of the forest for phenological observations and flora and fauna studies in the future studies.



Canopy walkway





Potential utilization of the canopy walkway

1 Nov. 2011

Biodiversity, Carbon Cycle &

Phenology

~ Mast Flowering ~



http://www.nies.go.jp/biology/pasoh/English/E_topics/plant.html



Koompassia sp.

Koompassia sp.

Fruits of Dipterocarpus sp.



D. cornutus



D. cornutus
(floser bed and fruit)



D. costulatus



D. crinitus



D. crinitus
(floser bed and fruit)



Dipterocarpus sp.



D. kunstleri



D. sublamellatus
(floser bed and fruit)



D. sublamellatus



Dipterocarpus sp.

Fruits of Shorea sp.



Sacuminata



Sacuminata



Sacuminata



Sacuminata



Sacuminata



Dipterocarpus sp.



Dipterocarpus sp.



Dipterocarpus sp.



D. crinitus



D. crinitus

Flowers of Hopea sp



H. dryobalanoides

Flowers of Neobalanocarpus sp



N. heimii



N. heimii



N. heimii

Flowers of Shorea sp



S. acuminata



S. bracteolata



S. bracteolata



S. lepidota



S. leprosula



S. leprosula



S. leprosula



S. leprosula (flower bud)



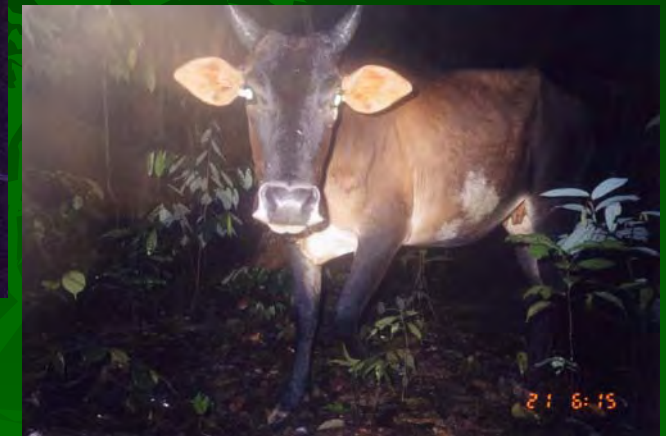
S. macroptera



S. maxwelliana

Diversity

- **112** species of mammals representing 56% of the total mammal species in Peninsular Malaysia
- **413** moth species including 40 new records to Peninsular Malaysia previously known only from Borneo



Diversity

- **233** species of birds
- **75** species of herpetofauna: 26 amphibians, 24 tortoises, turtles and lizards and 25 species of snakes
- **57** species of termites and 9 species of stingless bees



New Japanese House on Pasoh



FRIM Provides a house can be used for living & experiment only for the Japanese researchers

FRIM Provides a laboratory for NIES-FRIM-UPM



Local assistants

The 21st Steering Committee Meeting of NIES-FRIM-UPM Joint Project FRIM, 21st Sep 2011



Current Projects

1. **Soil carbon dynamic (PI: Liang/NIES)**
 - 1) **To detect the effect of climate change on tropical forest carbon cycle (funded by NIES);**
 - 2) **To improve the REDD mechanism through improving forest management (timber harvest and/or logging) (funded by the Ministry of the Environment (MOE), Japan);**
 - 3) **To evaluate the effects of LULUC on degradation of tropical ecosystems (funded by NIES)**

16 automated chambers (65cm*50cm*50cm, L*W*H)



Chamber campaign



http://www.nies.go.jp/biology/pasoh/project_outline/activity20101218.html

Research Team



Measuring soil CO₂ efflux with a portable automated system

Pasoh:

1. Primary forest – 2 plot
2. logged sites: 1 plots (logged during 2002)

Temengor:

1. Primary forest – 1 plot
2. logged sites: 2 plots (logged during May 2010)

http://www.nies.go.jp/biology/pasoh/project_outline/activity20101218.html





Logging site



Logging site

Decomposition of harvest residue

Monitor & control by mobile phone



Measuring soil CO₂ efflux at the secondary forest



Photo: Daito/NIES

Land use change vs. soil degradation



Measuring soil CO₂ efflux at the rubber plantation



Photo: Daito/NIES

Measuring soil CO₂ efflux at the rubber plantation



Let's go to the oil palm plantation



Photo: Daito/NIES

Measuring soil CO₂ efflux at the oil palm plantation



Photo: Daito/NIES

Let's move to the other site



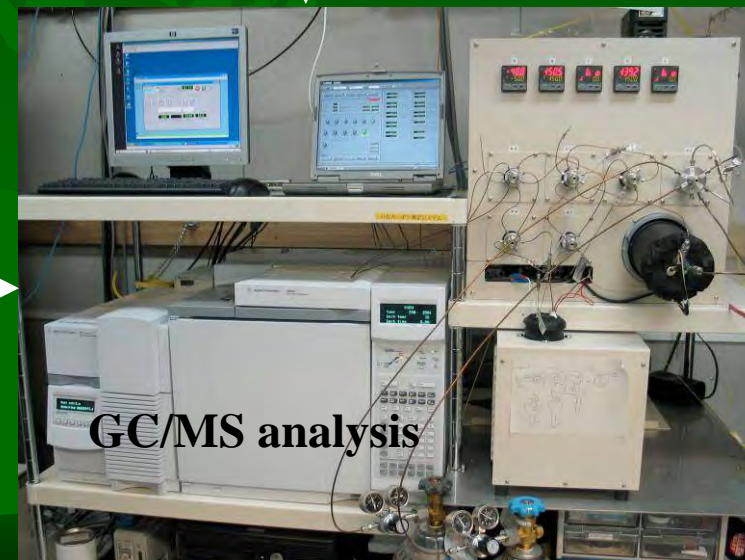
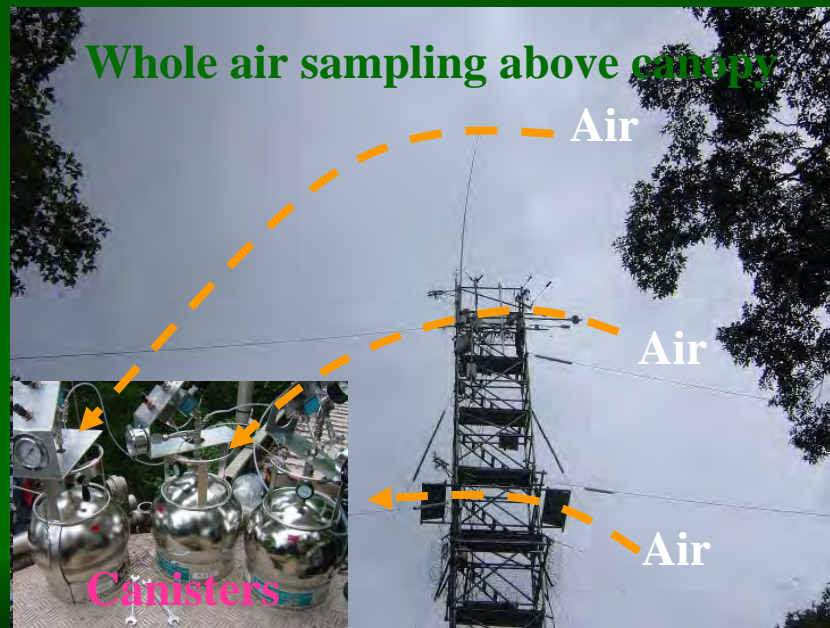
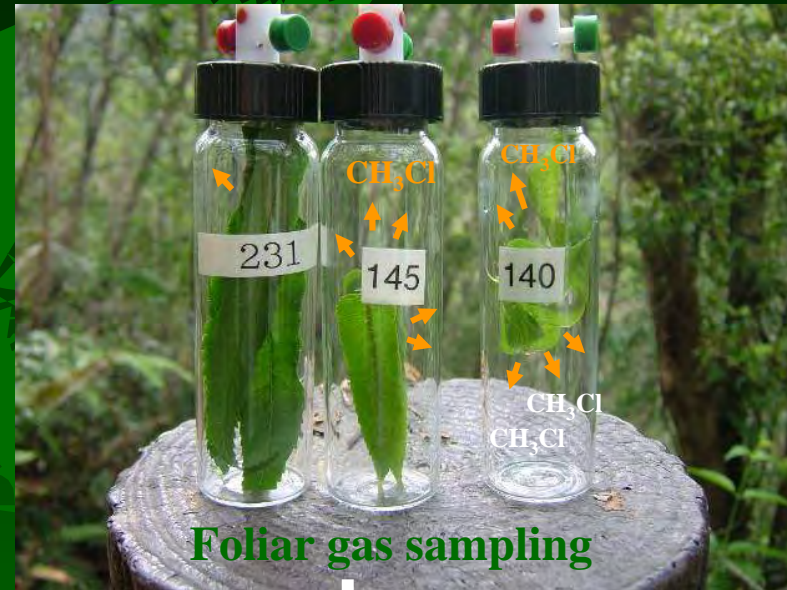
Photo: Daito/NIES

Methyl halide emission measurements

PI: Saito & Yokouchi (NIES), funded by JSPS & NIES

Methyl halides (methyl chloride & methyl bromide):

- Carrier of **ozone-destroying** chlorine and bromine into the stratosphere
- Tropical forests are the **largest** sources of CH_3Cl (and CH_3Br)?



Methyl halide emission

Yokouchi & Saito (NIES)



Modeling deforestation and carbon cycle

Adachi & Ito (NIES), funded by the MOE

VISIT (Vegetation Integrative Simulator for Trace gases) model was a process-based terrestrial biogeochemical model, based on Sim-CYCLE (Ito and Oikawa, 2002)

Scale: point to global

Time scale: 30min/ 1day/ 1year

Biome type: 18 type

Disturbance type: 3type

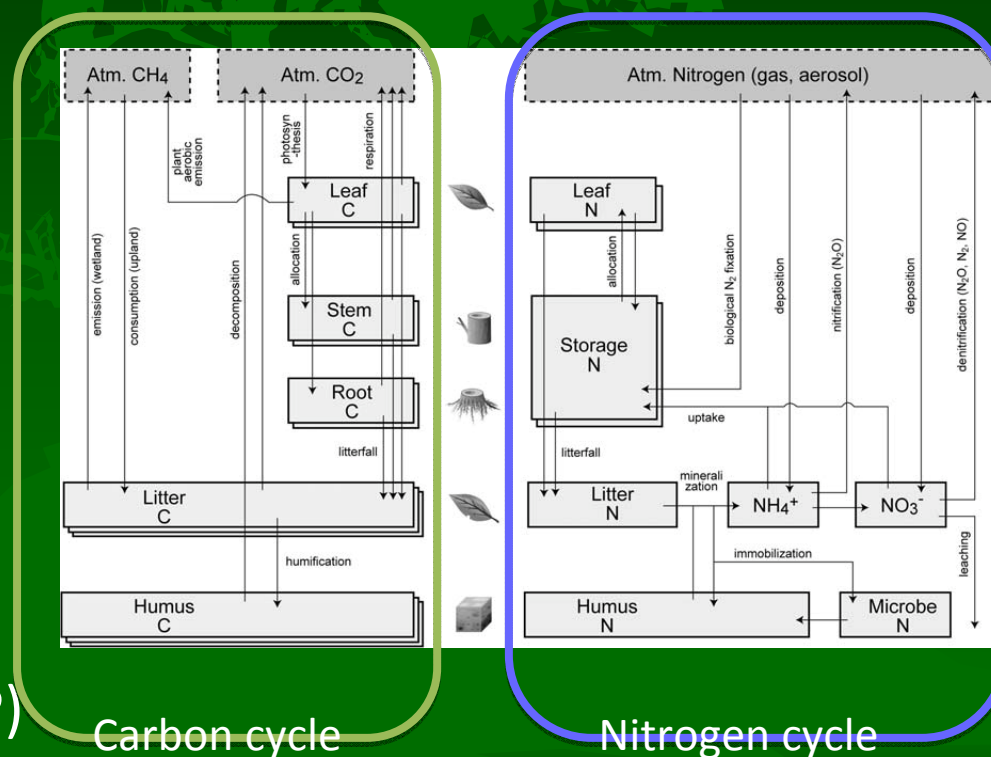
Out put:

Greenhouse gases flux
(CO_2 , CH_4 , N_2O)

Net primary production (NPP)

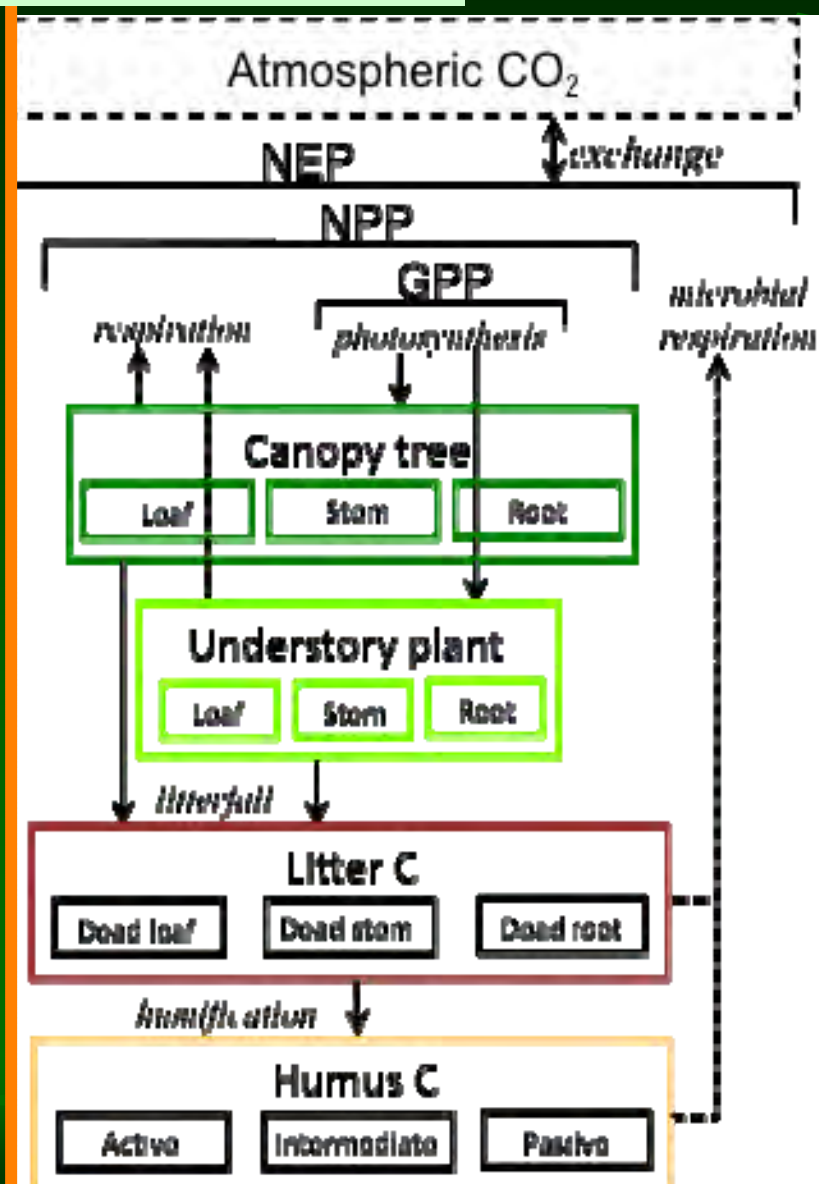
Net ecosystem production (NEP)

Soil organic carbon (Litter + Humus)

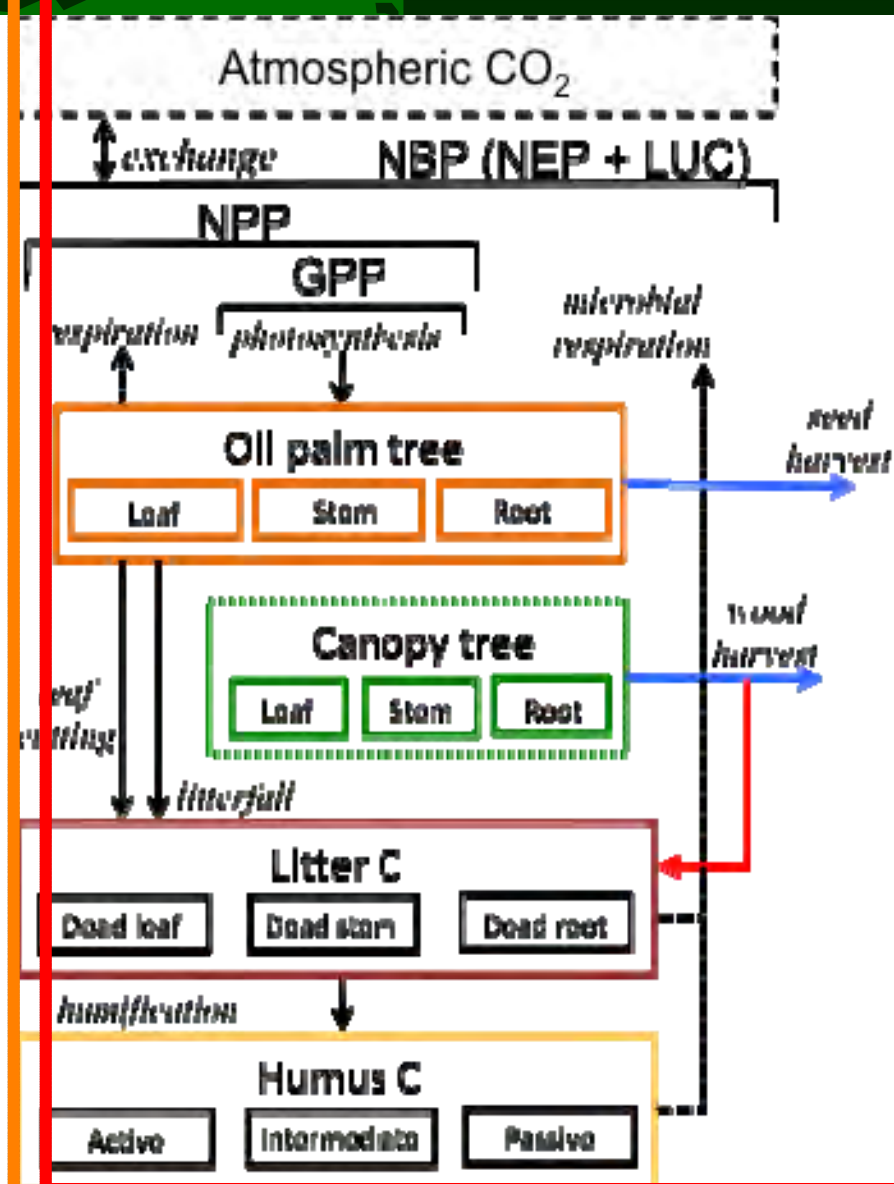


Overview of the VISIT model

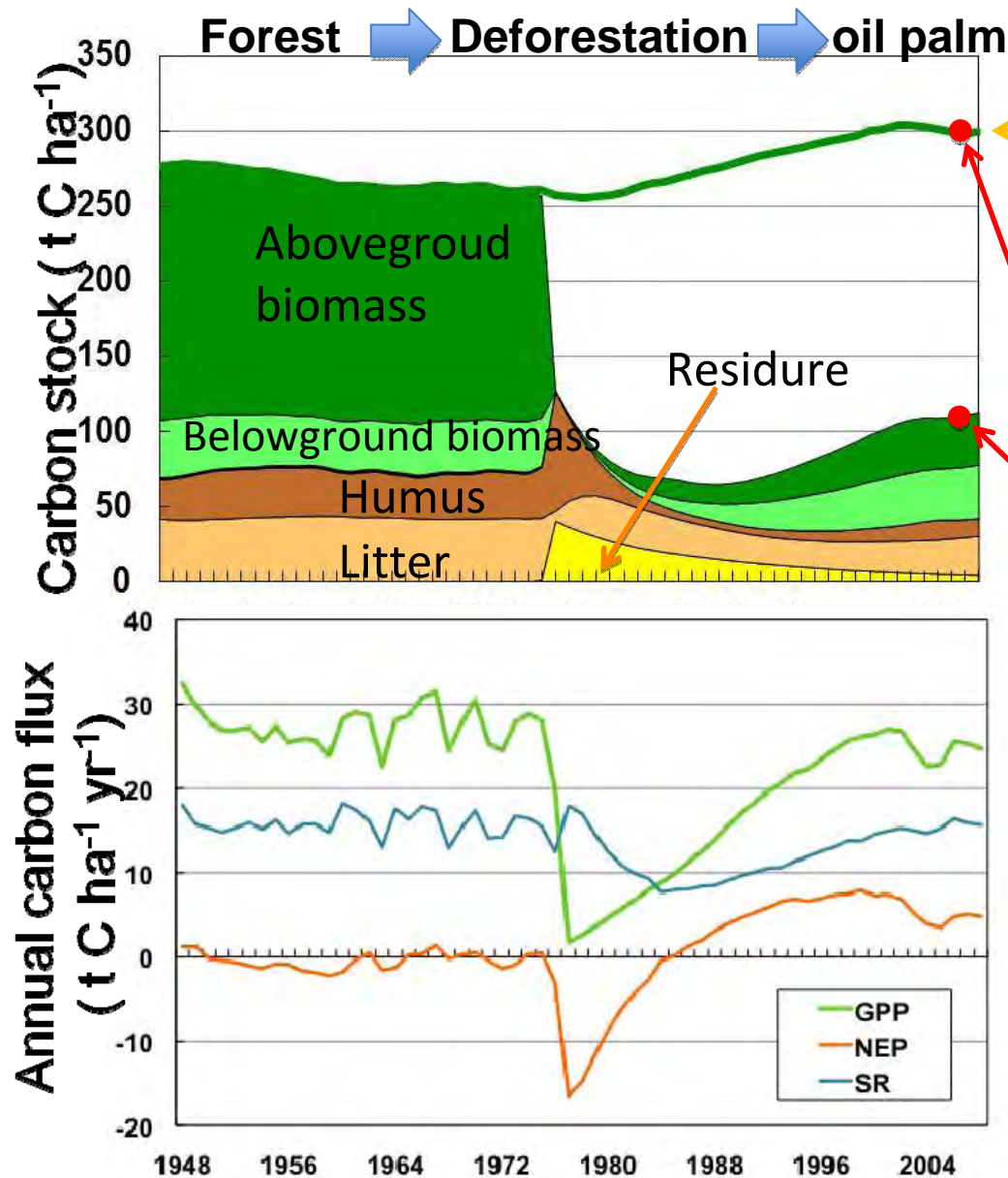
(a) Primary forest



(b) Land-use change + oil palm



Carbon stock in oil palm plantation



- Case of No disturbance
- Disturbance year was 1976.

- Total carbon stock in 2006:
Forest: 299.7 tC ha⁻¹
Oil palm : 104.3 tC ha⁻¹

Oil palm at 30 years old
= 35% of forest !

Field observation for validation of VISIT model

Soil respiration rate



Soil sampling



Soil porosity



Biodiversity (funded by MOE)

PI: Toshinori OKUDA of Hiroshima Univ



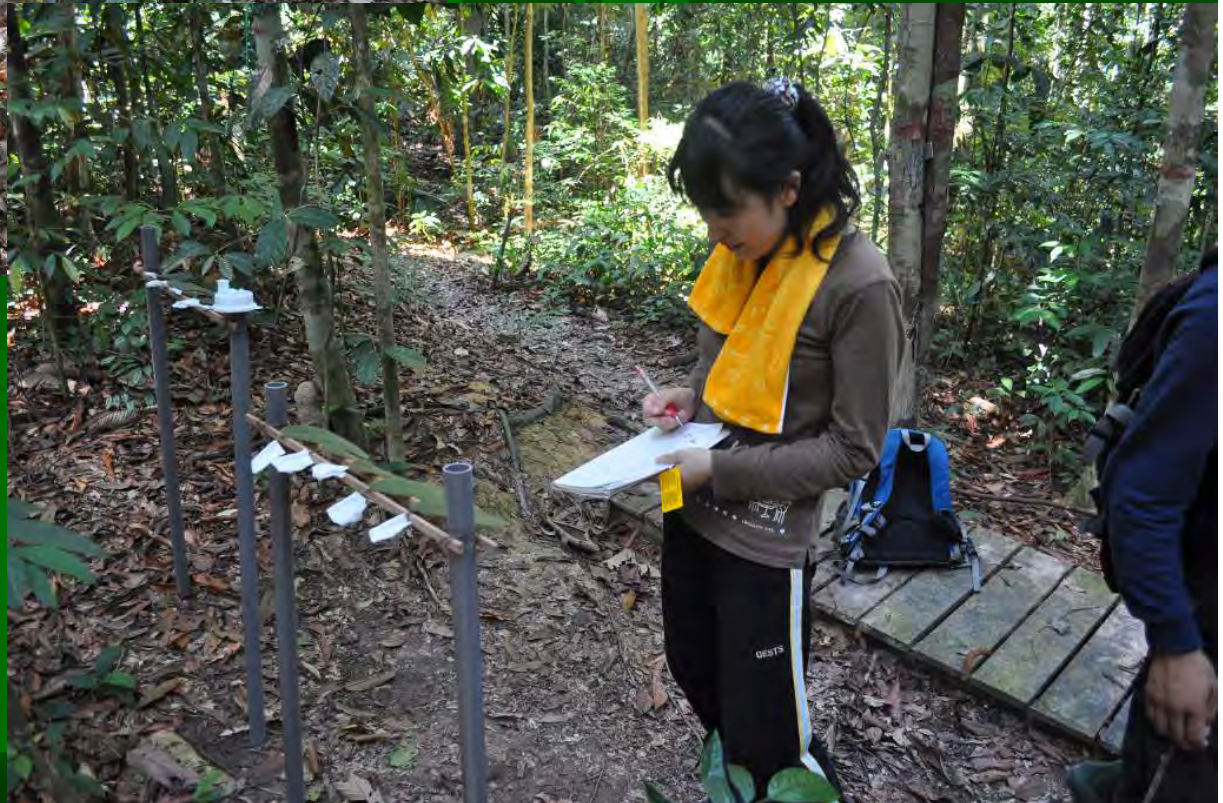
👉 Tree planting ceremony with Director general,
Forest department in Negeri Sembilan

Leaf morphology and functions

Study of Leaf morphology and functions of canopy forming species.



Ecological functions of drip tips



Animals at Pasoh



Camera trapping for the study of small and medium size mammals

Environment vs. Leaf Morphology

Leaf surface
temperature



Light intensity



Soil respiration study



forest structure

terrestrial Lidar
system



Canopy mapping





Canopy mapping study

Plant and ants study





Other studies (funded by MOE)



Current Research Collaboration

FRIM/STRI/CTFS-AA Joint Research Project

Centre for Tropical Forest Sciences (CTFS)-Smithsonian Tropical Research Institute/Harvard University-Arnold Arboretum - USA

Carbon Initiative and Plant
Functional Traits – since 2007

50-ha Tree Dynamic Plot – since 1985



Current Research Collaboration

FRIM/STRI/CTFS-Dong Hwa Univ (Taiwan) Research Project:
Seed and seedling dynamic long term monitoring – since 2001





Regular Exchange Visiting between NIES & FRIM

1 Nov. 2011

Conference & Seminar



The Deputy Minister of Natural Resources and the Environment of Malaysia, Y. B. Dato' S. Sothnathan and Mr. Ryuutaro Ohtsuka was proud



Prof. Dr. Peter Ashton from Harvard University performed a keynote speech on 'Ecosystem Approaches for Forestry: The secret is in the Canopy.'

http://www.nies.go.jp/biology/pasoh/English/E_topics/plant.html



Dr. Laing Nai Shen from NIES gave a talk on 'Carbon Cycle of Tropics Forests'



memorable session of souvenir-exchange between the Directors from FRIM and NIES.



Our session attracted many audiences and was said to be very successful. The organizing committee would like to express our deepest gratitude to especially FRIM, our participants and all the audiences for their contributions and supports.

November 2005.

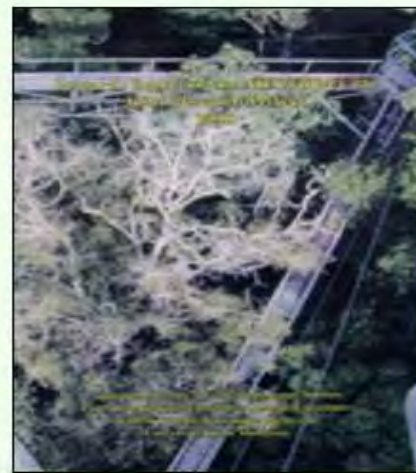
Annual Report of the

NIES/FRIM/UPM Joint Research Project on Tropical Ecology and Biodiversity

http://www.nies.go.jp/biology/pasoh/English/E_topics/plant.html



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YEAR1999
CONTENTS [\[PDF\]](#)



YEAR2000
CONTENTS [\[PDF\]](#)



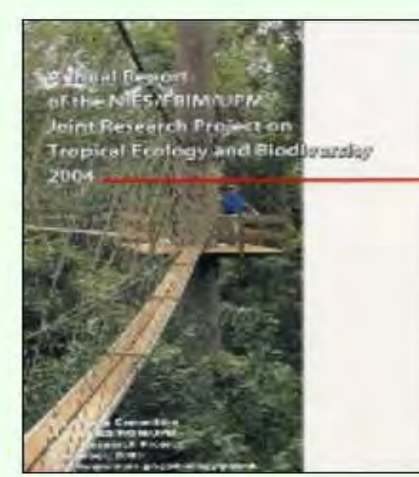
YEAR2001
CONTENTS [\[PDF\]](#)



YEAR2002



YEAR2003



YEAR2004

Achievements

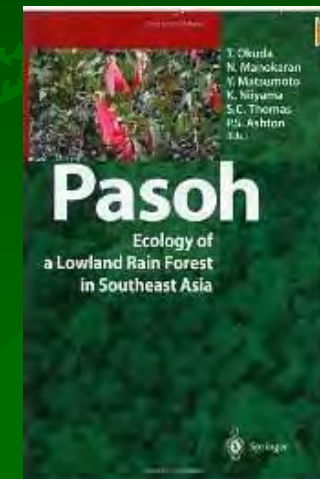
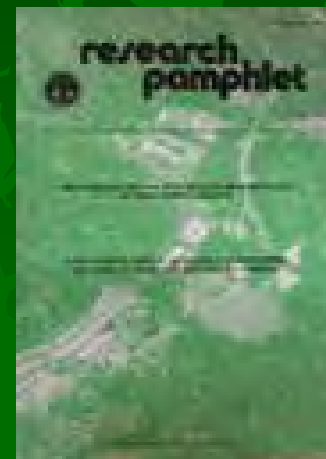
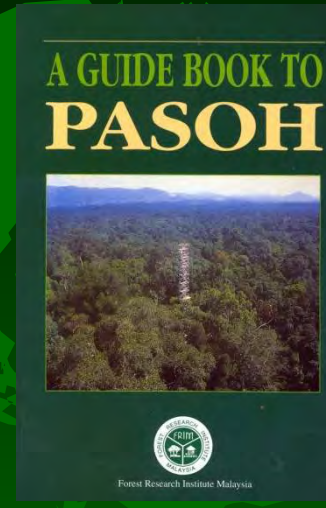
RESEARCH: Global recognition for tropical ecology research since 1970s



CAPACITY BUILDING: At least 10 graduate thesis



SERVICES: Venue for annual local & international forest ecology/biology courses



KNOWLEDGE: Over 400 publications; journals, books, articles

Appendix: Maintenance of the facilities



Repairing of the Aluminum Towers

In March 2010, part of the aluminium tower structure, including the forest canopy walkway, was damaged due to strong winds and fallen trees.

The tower system was repaired in December 2010, at a cost of RM 798,200.

MEGA ACCESS

No.19, Jalan TS 6/2, Subang Industrial Park, 47510 Subang Jaya, Selangor. Tel: 03-5636 7687 & 03-5637 7687 Fax: 03 - 5638 7687
Contact person : Chris Chin (H/P: 019-367 2379) Email: chrischin3@gmail.com or chris.chin@superb-access.com

CUSTOMER SERVICE REPORT

Customer : National Institute Of Environmental Studies (NIES)

Date: 25 March 2011

Address : Onogawa 16-2, Tsukuba,
Ibaraki 305-8506, Japan.

CSR No.

Pages: 1/13

Prepared by Chris Chin

Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Nature of Problem

- 1) On 23rd March 2010 NIES Invited us to excess the situation of Pasoh Research Canopy Tower due to fallen tree hit one of the 46m tower guy wire on tower A and caused the tower tilted position.



The fallen tree hit one of the guy at tower A.

- 2) The top section of **Tower A** has been strongly pulled by the 46m guy wire that hit by the tree and seriously made the said tower tilted position.



Tower A tilt position.

- 3) The force has caused the walk thru frame bended seriously at **Tower A - Level 0**.



- 4) Guy Wire damaged at **Tower A** - 46m as hit by the fallen tree.

Note: To remove the fallen tree from the guy wire is not a easy job because all stability of the triple towers is depend on guy wire.



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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

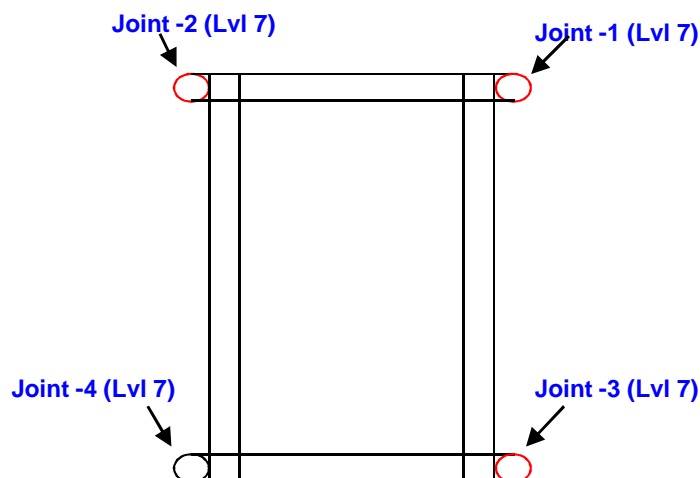
- 5) One side of the top section of **Tower B** has badly damaged.



- 5.1) The force pulled until some of the frame areas crack and bended seriously.
(Tower B - Top section)



- 5) There 3 joints at **Tower B - Level 7** had detached from the frame. It may cause copllase any time as the integrity of the Tower have been badly stress by the fallen tree.
It require a massive work to restore back to the former condition or position.



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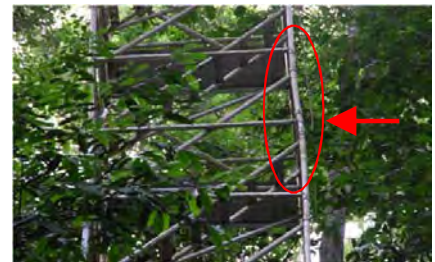
Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

- 6) The **Tower B** further leaned to left after the 1st visit dated 23 March 2010. Due to this current condition have made us difficulty to repair it.

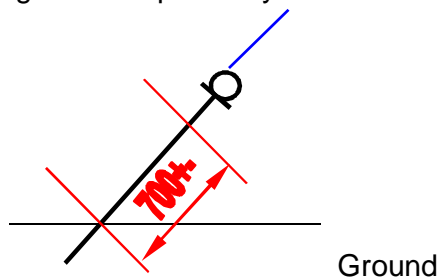
- It may involve a massive work to dismantle the entire triple towers and the existing research instruments in order to restore back to the former condition or position.



- 6.1) - The position of **Tower B** has seriously tilted until more than 5 degree toward Tower A.



- 7) One of the anchor point at **Tower B** has came out from the ground as pulled by the force.



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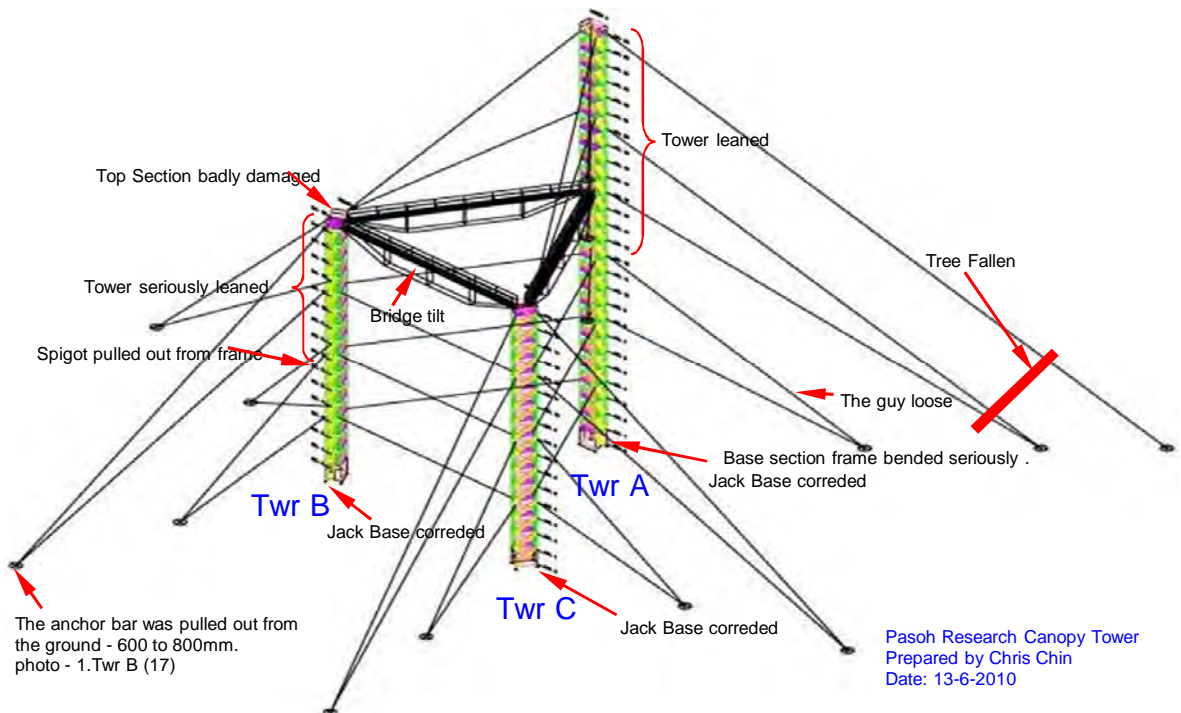
Prepared by Chris Chin

Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

- 8) They have 1 joints at **Tower C - Level 2** had detached from the frame.



- 9) The Jack base of the Towers is corroded.



Pasoh Research Canopy Tower
Prepared by Chris Chin
Date: 13-6-2010

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Address : Onogawa 16-2, Tsukuba,
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Date: 25 March 2011

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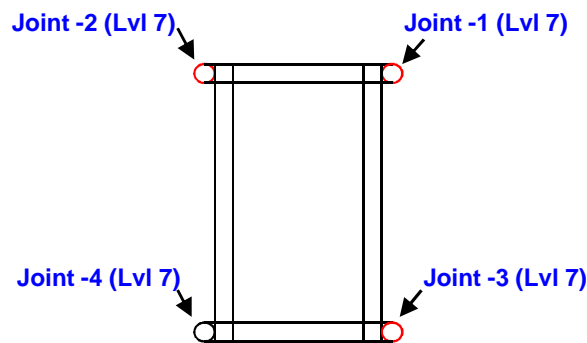
Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Action taken before the Confirmation:

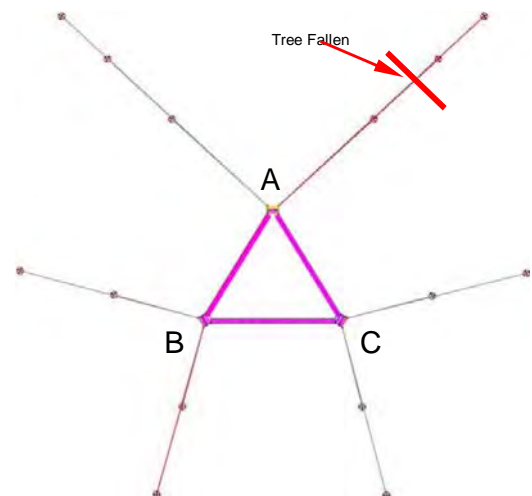
- a) On 11th Jun 2010 Mega Access has constructed a temporary reinforcement tube towards the critical area at tower (A) level 0 to prevent it from further bending to the tower frame.



- b) On 21th July 2010 we have been informed by the FRIM Pasoh personnel that the Tower (B) further lean as due to the level (7) the spigots joint detached from the frame.
Mega Access has carried the immediately reinforcement towards said area 24th Jul 2010 by adding the tube & coupler for temporary reinforcement.



- c) Check and tighten all the guy wire which have been loose at all the anchor points to prevent the tower further lean.



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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Proposal to repair the Canopy Tower

After survey the site condition of the tower on March 2010. We have submitted all the site report and photos to our Engineer from Instant UpRight (Dublin Ireland) to produce engineering solution to resolve this rare condition.

Base on the critical condition on the said towers, we have requested our UpRight Engineering dept to chip in their time to study the report and photos in order to come out best solution to resolve the problem as soon as possible as the towers in a critical condition. After spending a long engineering man-hours and expertise, we have came out a three proposal solution for NIES budget for the repair.

On 16th Aug 2010, we have received an email from Tani san regard the confirmation to repair the towers on option B.

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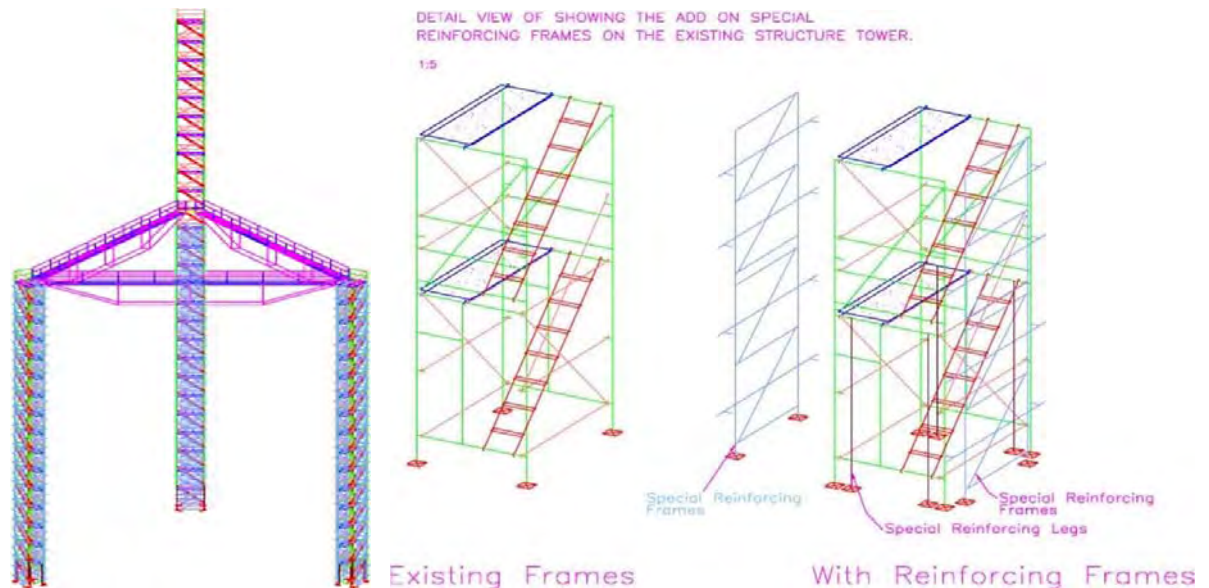
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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**
Drawing of Reinforcing the Triple Towers



The Option B

The principal of the FIX plan design will not require any of the Towers to be dismantled but instead will reinforce all the existing system. There are some serious dented frames within the towers, the thought of dismantling the towers & rebuilding them would take a long time, create a logistical "nightmare" and could result in some of the existing Japanese research instrument becoming damaged and would causes un-collect research data for a month of time or even more. So, we have worked out the best possible solution to resolve every aspects of the problem arise. The towers will be reinforcement by the **Special Reinforcing Frames (SRF)**. This frame is custom make and fabricated with 4mm thick column to provide more strength for the existing tower. Thus the proposed fix will add to the existing system & will also allow the bent frames to be repaired. The SRF are added to each of the 3 towers with be **2 "ADD-ON FRAME"** for each 2m section. The frames will have cross tubes & couplers to allow them to coupled to the existing tower and it perform 3 roles, 1st to provide additional stiffness to the tower, 2nd to share the weight loading on the tower and 3rd increase the side strength by 3 times as the 4mm thick side frames will add enormously to the tower strength. Also the tower base will increase as the side frames will increase the width and the total stability. However, this "ADD-ON FRAMES" installation system is connecting with couplers that positioned at a level which will not interfere with existing parts on the towers. Thus there will be a lot of build in flexibility to ensure that the Reinforcing structure can be easily installed. The propose system should be capable of being installed less then 14 days or equivalent but all depending on the weather or site condition, accessibility to site and problem encountered.

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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Towers Condition

Due to the fallen tree hit two of guy wire at 50m and 40m on Tower A and caused the Tower A & B tilt position. The tower B badly leaned toward to tower A. In order to install the Reinforcement frame we have to make the said leaned towers return to upright position. This rare situation involve an intensive engineering man-hours and expertise to solve the engineering challenges at Pasoh.

Work Planning

The repair work require 2 stages work to be execute.

1st task has been performed:- Repaired and make UpRight the damaged Towers

Intensive labours, tools & equipments and engineering work require to restore the tower A & B to UpRight position. All the towers require to reinforced first ,in order to make the towers to Upright position. All the existing anchors guy and additional guys require to pull the said towers & adjust accordingly.



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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Work Planning

Towers restored to UpRight position.



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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Work Planning

2nd task has been performed :- Installation of Special Reinforcement Frame

Tower A



Tower B



Tower C



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Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**

Additional Bracing

Additional bracing has been performed :- Installation of Additional Bracing

Tower A



Tower B



Tower C



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Prepared by Chris Chin

Title : **REPAIR OF PASOH RESEARCH CANOPY TOWER**
UpRight Warranty Letter

INSTANT UPRIGHT

27th December 2010

To Whom So Ever It May Concern

This is to certify that

Instant UpRight Limited

Confirms that the reinforcement work carried out on the Triple Pasoh Tower assembly, by Mega Access Sdn Bhd, will reinforce the area of the Tower where the Side Reinforcing frames are fitted by approx 2 times the original strength.

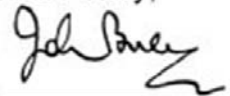
Thus Instant UpRight will warrant the reinforced area of the Tower against failure due to existing defects caused by previously fallen braches etc.

Instant UpRight recommends that the current reinforcing work is reviewed & checked every 3 months for the 1st year after the final installation date to ensure that all items are properly adjusted & tightened to guarantee effectiveness.

Any issues relating to the tower during this period should be immediately reported to Mega Access, for correction.

This Warranty letter is Valid Up to 31.12.2012

Yours Truly,



John Breen (Business Development Manager)

Tel: +35316209341 - Mob: +353877978719 - Fax: +35316209301

Web: www.instantupright.com

Email: jbreen@instantupright.com

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End of Report