Carbon Sequestration Projects Through Forest Management Activities: Avoided Logging Damaged and Forest Rehabilitation

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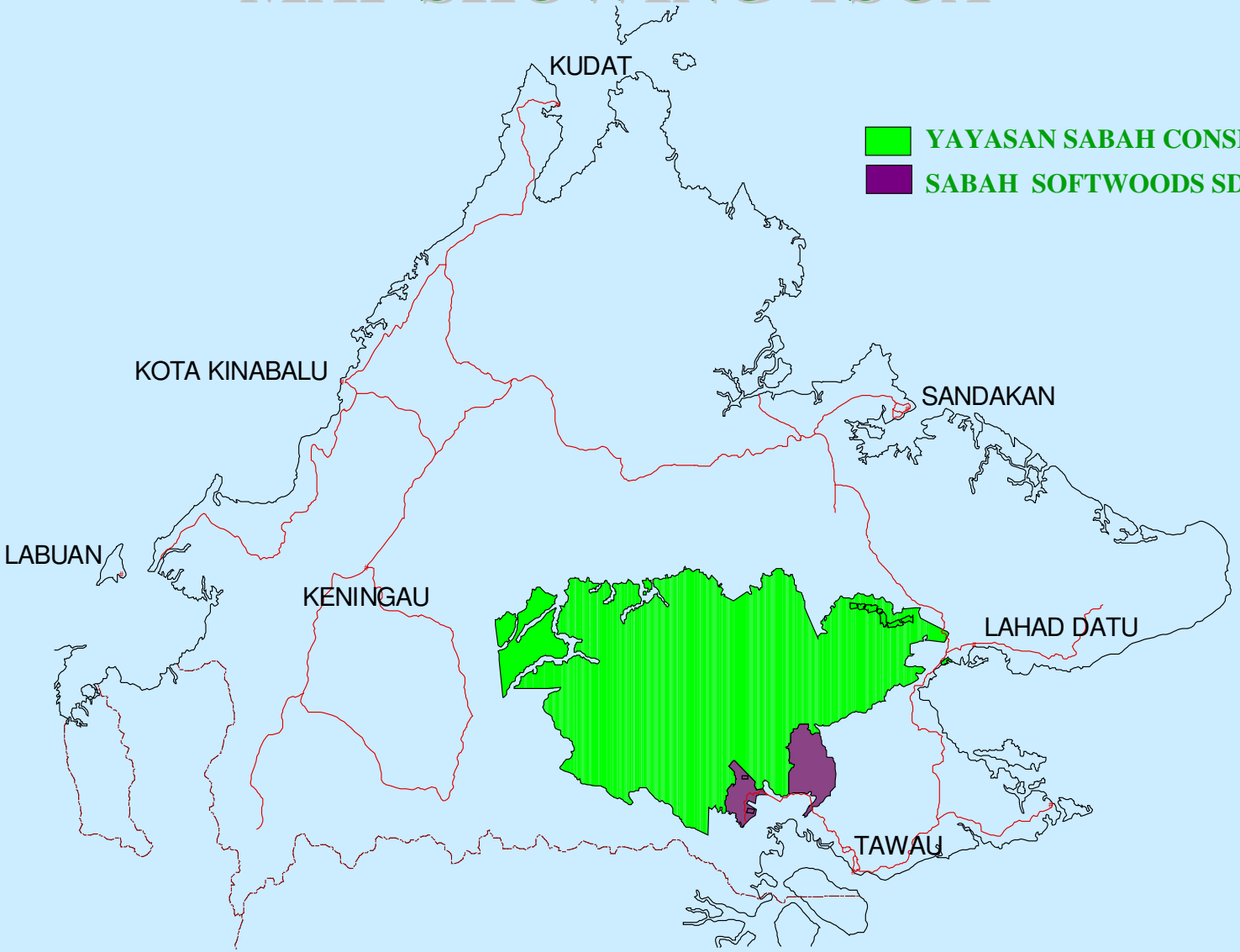
Yayasan Sabah Group

YAYASAN SABAH

- Established in 1966 by an enactment of the Sabah Legislative Assembly
- To enhance the quality of life of Malaysians in Sabah by supplementing and complementing government efforts – particularly in education and welfare.

- To finance the activities related to its responsibility, the government of Sabah provided Yayasan Sabah (YS) with forests lands or Timber Concession of approximately 1 million Ha
- The forest lands are rich in timber, yet very sensitive environmentally. Therefore, it is inherent in Yayasan Sabah to manage the area on a sustainable manner, both economically and environmentally. Forest Management Plan adopted in 1984.
- Area rich in wildlife (elephant, rhinoceros, orang utan etc. have been documented to be thriving within the area), thus, while the timber resources contain within the area is important to finance the implementation of its socio-economic responsibilities, at the same time Yayasan Sabah has to manage the area as environmentally friendly as possible.
- Towards these efforts, YS has carried out several environmental programmes such as the establishment of Protected Areas (PAs), as well as creating a programme specifically to carry out environmental education activities.

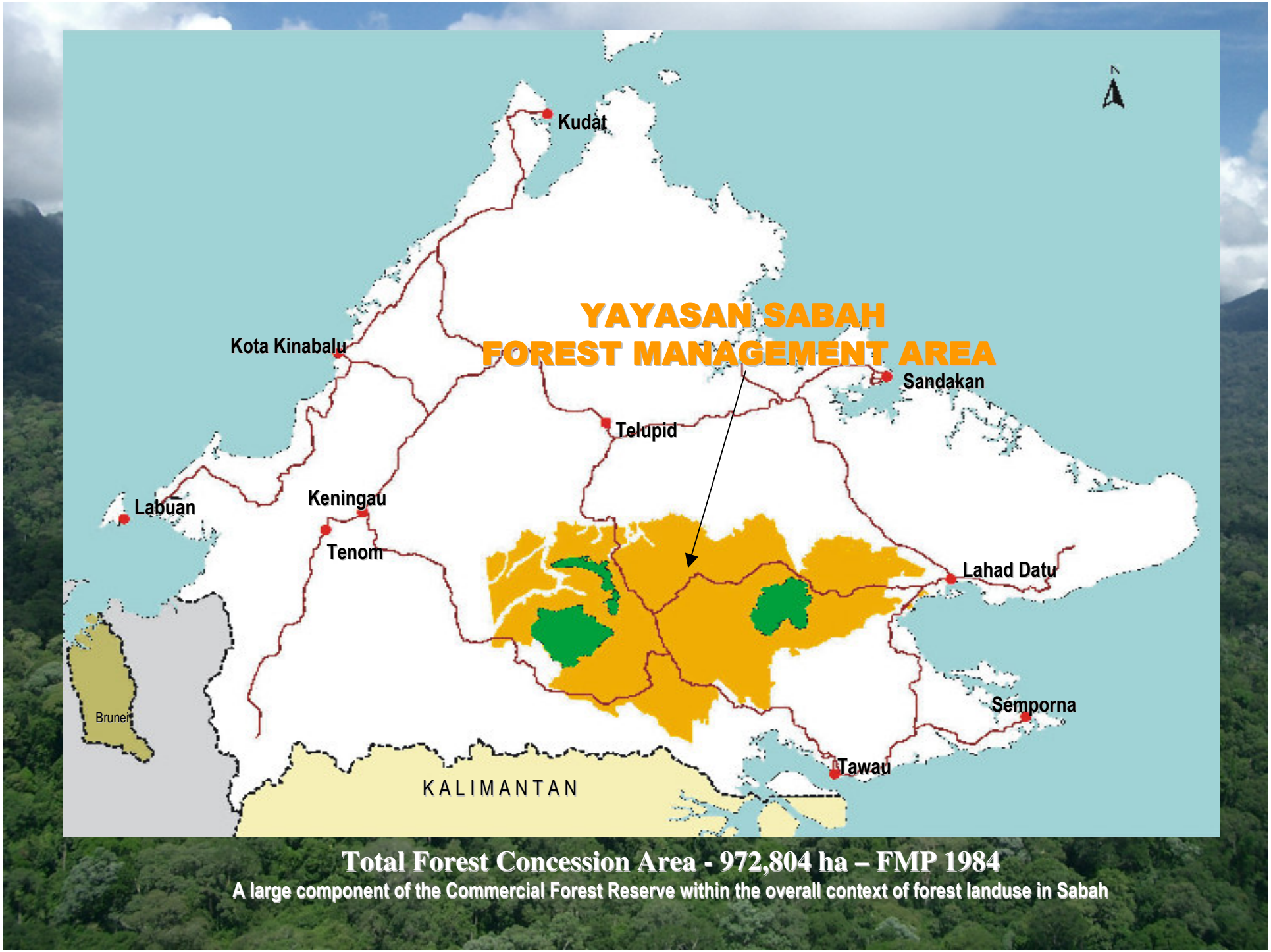
MAP SHOWING YSCA



FOREST LANDUSE CLASSIFICATION WITHIN THE YAYASAN SABAH FOREST CONCESSION

Classification	Area	
	Hectare (Ha)	Percent (%)
1. Production Forest	828,409	85
2. Protected/Conservation Forests	132,640	14
a) Danum Valley (43,800 ha)		
b) Maliau Basin (58,840 ha)		
c) Imbak Canyon (30,000 ha)		
3. Virgin Jungle Reserves	1,705	<1
4. Road-side Reserves	500	<1
5. Riparian Reserves	4,000	<1
6. Water Catchments	5,550	<1
Total Forest Concession Area (Ha)	972,804*	100

- *29% of total FR, 13% of total land area of Sabah



Total Forest Concession Area - 972,804 ha – FMP 1984

A large component of the Commercial Forest Reserve within the overall context of forest landuse in Sabah

CARBON OFFSET PROJECTS

Two forestry approaches in offsetting Greenhouse Gases (GHG'S) e.g. CO_2, CH_4, CFC etc.

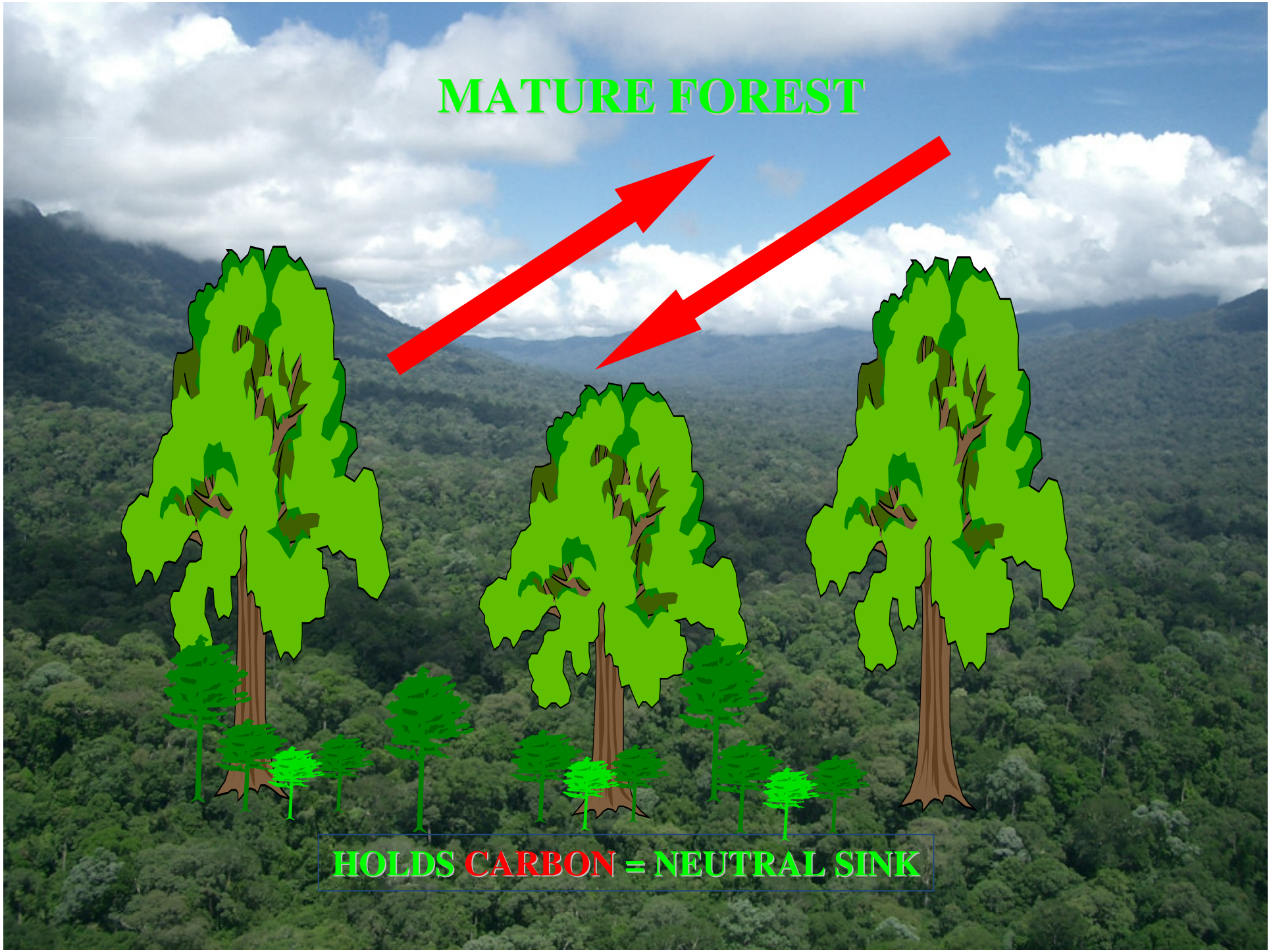
1.Reducing logging damages

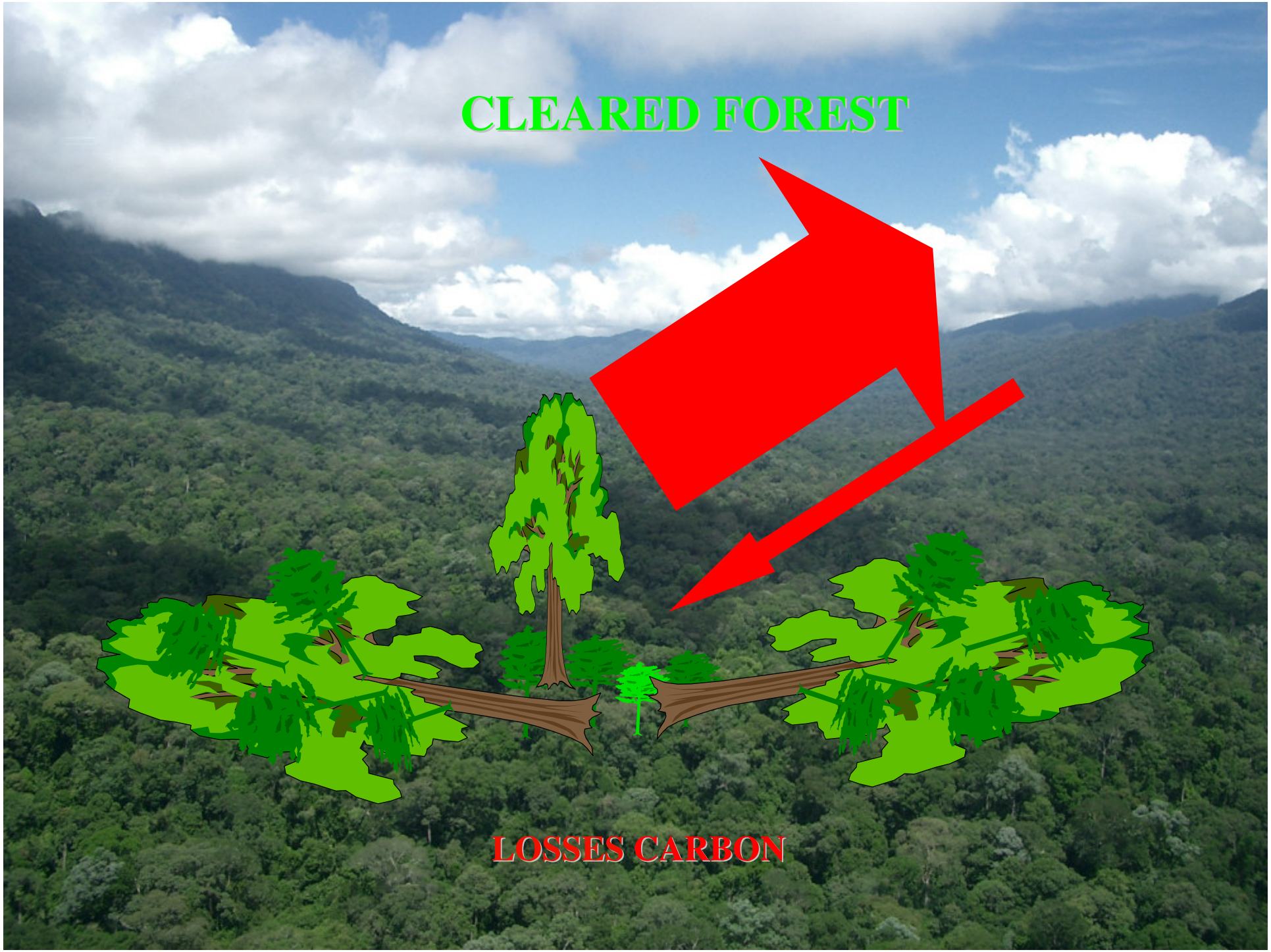
- Since dead trees and bare ground result in a net release of CO_2, the idea is to reduce these net releases and promote quicker tree growth after logging.

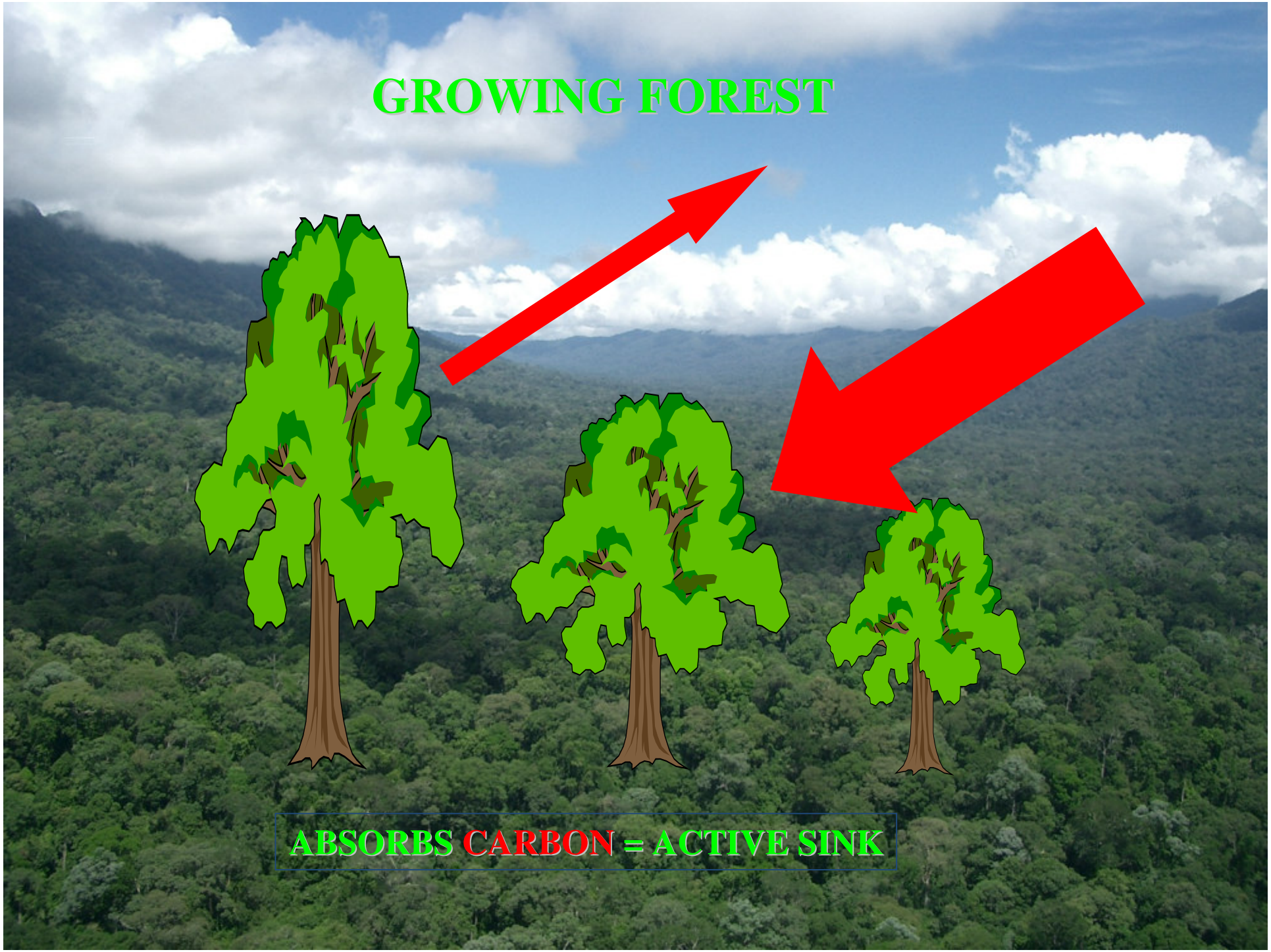
2. Forest rehabilitation (enrichment planting)

- As trees grow carbon is fixed or sequestered through the photosynthetic process. Tree grows faster in the tropical areas, therefore absorbs more CO_2.

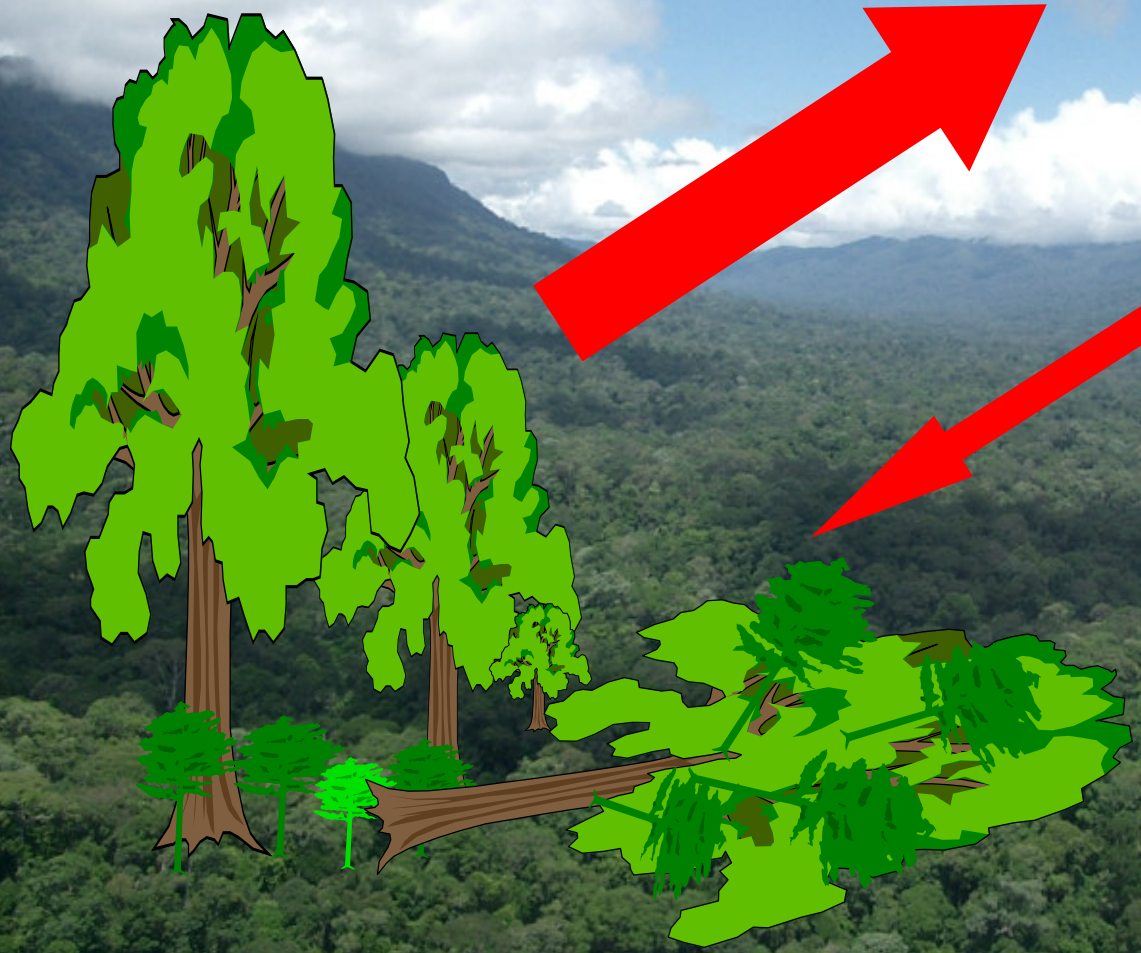

The
CONCEPT


MATURE FOREST
HOLDS CARBON = NEUTRAL SINK


CLEARED FOREST
LOSSES CARBON

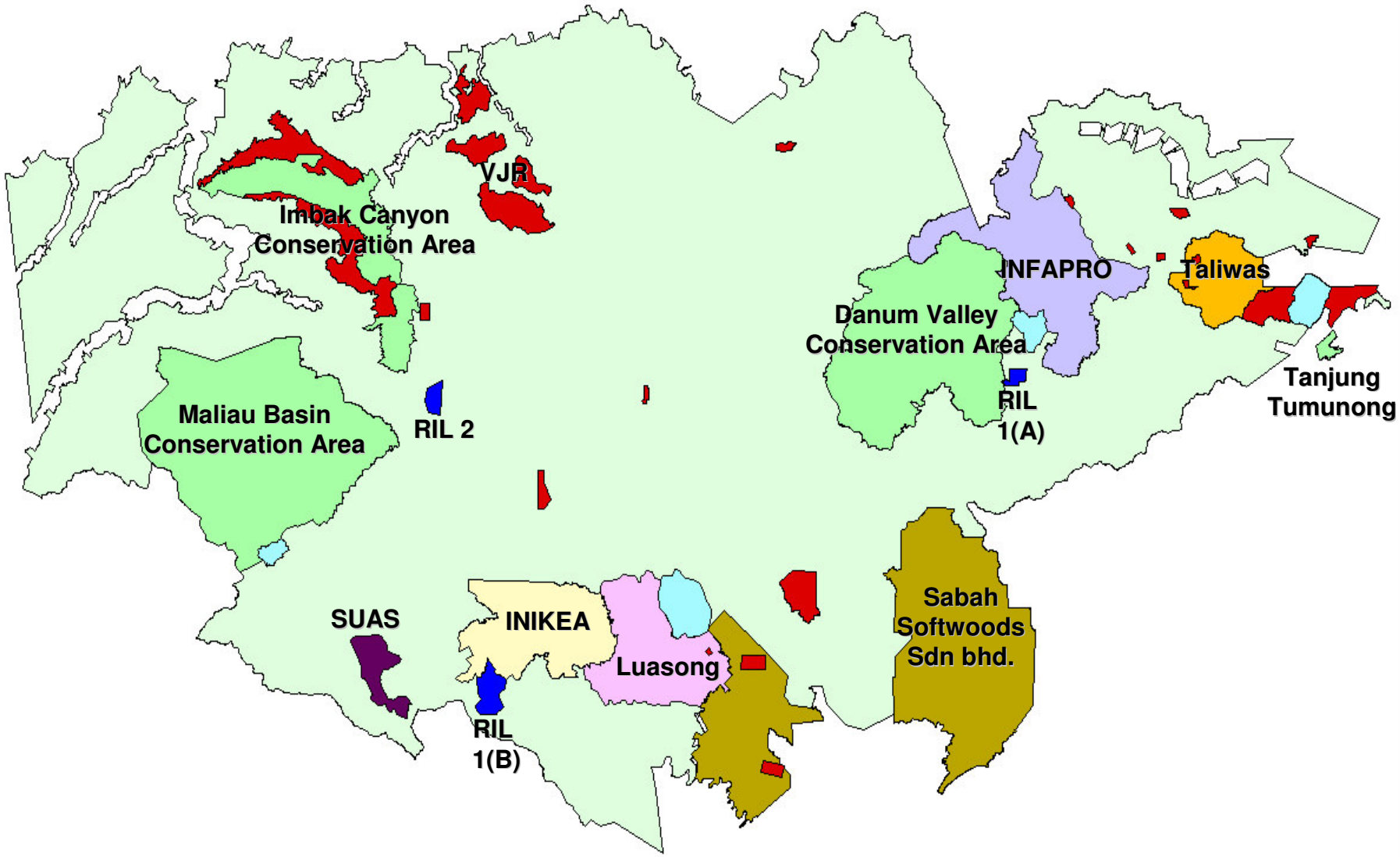

GROWING FOREST
ABSORBS CARBON = ACTIVE SINK

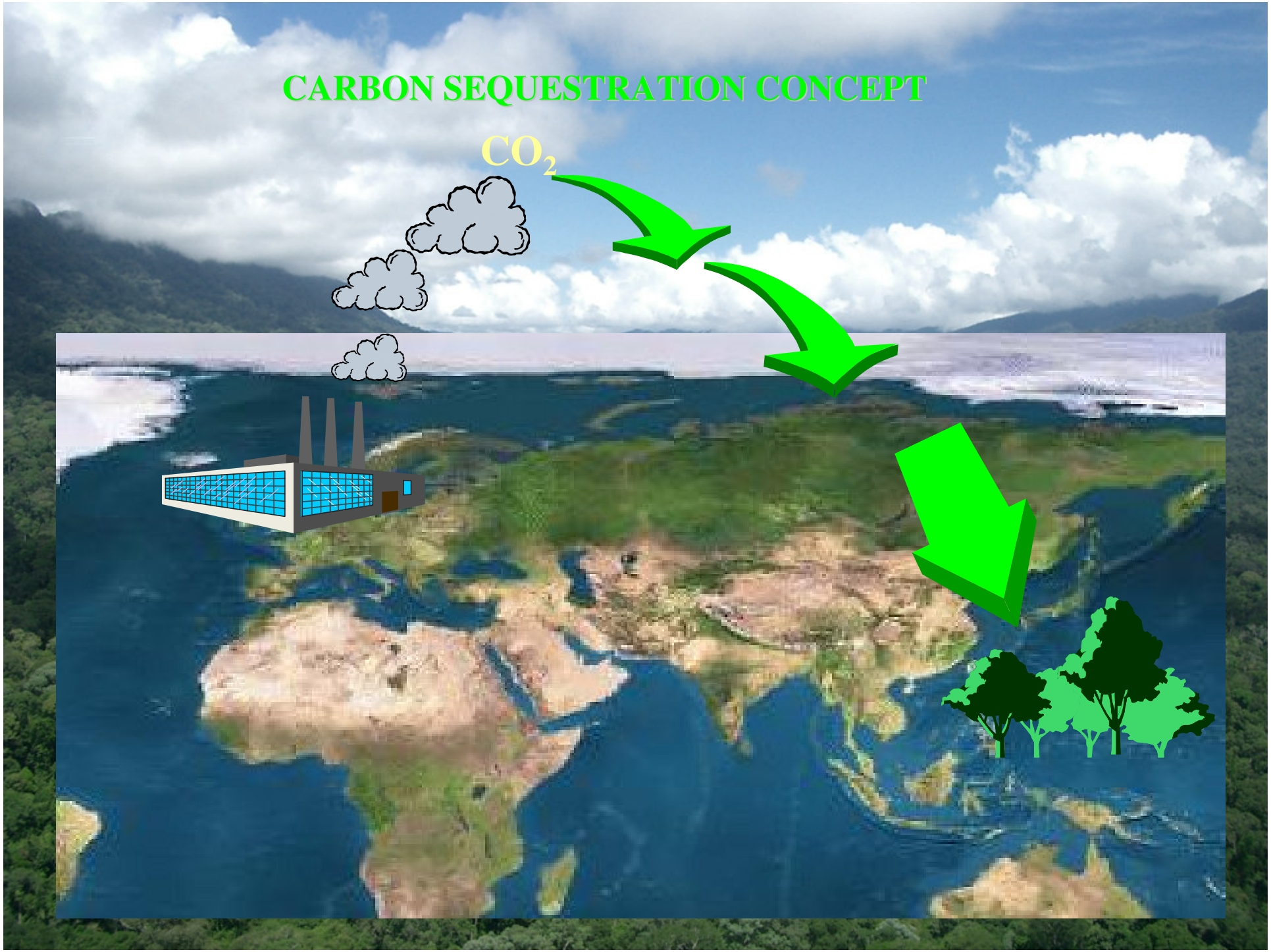
DISTURBED FOREST



PARTIAL LOSS OF CARBON = DEPENDING ON THE LOGGING METHOD

YAYASAN SABAH FOREST MANAGEMENT AREA




CARBON SEQUESTRATION CONCEPT
CO_2

YS/NEP CARBON OFFSET PROJECT

Avoided Logging Damaged

REDUCED IMPACT LOGGING (RIL)

The Project started in 1992 when New England Power (NEP) provided funds to ICSB, to implement a set of reduced-impact logging guidelines in a 1,400 ha of its forest concession

'RIL' was born

Further agreement in July 1995 for 1,000 ha which has been completed (RIL 2)

RIL SELECTION CRITERIA

- **Effective - Real changes in atmospheric CO_2 - "but for"**
- **Credible - Science**
- **Durable - Sequestration must be long lasting - decades**
- **Verifiable - Actions taken must be monitored / audited**
- **Measurable - CO_2 alterations can be quantified**
- **Expansible - Pilot phase can be expanded to large scale**
- **Acceptable - Public and regulatory acceptance**
- **Inexpensive - Less than US$2 per ton CO_2**
- **Ecological / Social - Responsible ecologically and socially**

RIL PROJECT

- **Participants :**

  New England Power (NEP), subsidiary of NEES
  Rakyat Berjaya Sdn Bhd (RBJ)
  Queensland Forest Services (consultants)
  COPEC (Broker).

- **Pilot Phase :**

  - Implement RIL techniques on 1400 Hectares
  - CO_2 offset estimate is 400,000 to 500,000 tons
  - Project has worked as measured against all selection criteria.

- **Cost:**

  Contract Price US$452,000

What is RIL Project?

- **Preventive rather than remedial**
- **Definition**

  Process and techniques of harvesting timber which are capable of reducing incidental damage.
- **Objective**

  50% reduction in incidental logging damage compared to conventional logging techniques

  - residual stand
  - soil disturbance

How Does RIL Reduce Damage?

1. Climber cutting 10 months before logging
2. Comprehensive timber harvest planning
3. Directional felling - direct tree fall
4. Skidding - restricted blading and increased winching distance
5. Increased number of supervisors - strict supervision
6. Removal of stream crossing structures -prevent water ponding
7. Landing reshaping - to encourage fast revegetation to reduce erosion

CLIMBER CUTTING

- Large woody lianas are cut 9-12 months prior to harvesting. With the canopy liana network destroyed or weakened, felled trees need no longer drag other trees down with them

STOCK MAPPING

- All harvest trees are identified, clearly numbered and marked systematically.
- Decision is made weather trees are fellable based on condition such as safety of the feller, damage to the tree, damage to PCT etc.

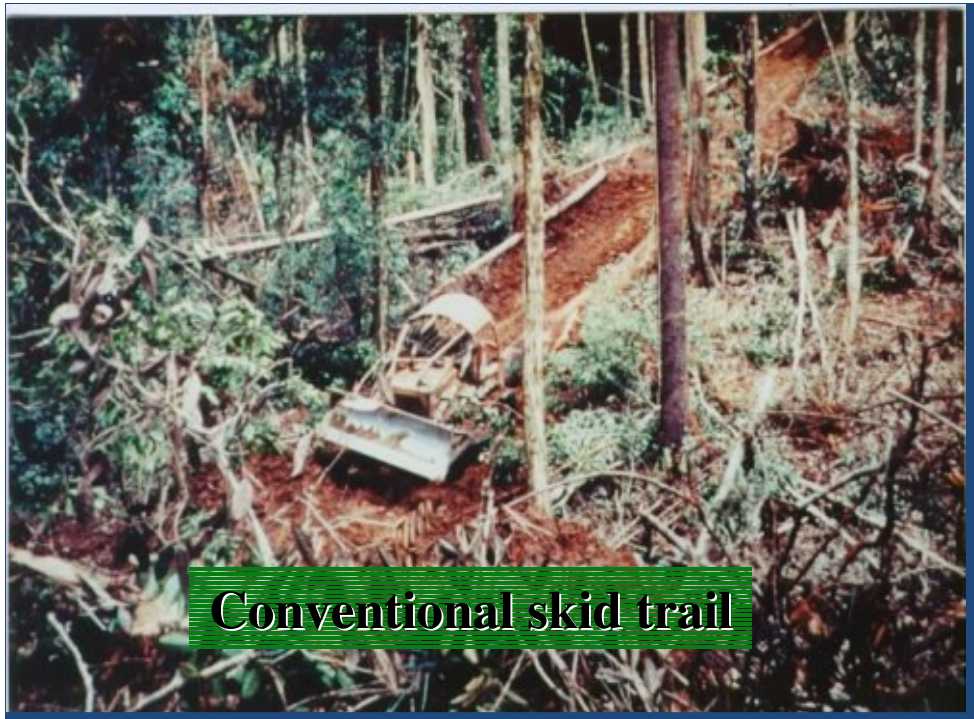
HARVESTING PLAN

-- harvest tree marking and mapping: tree distribution and location known

-- road planning: reduced density

-- skid trail planning: reduced density

-- log landing planning: strategic location, reduced size and frequency



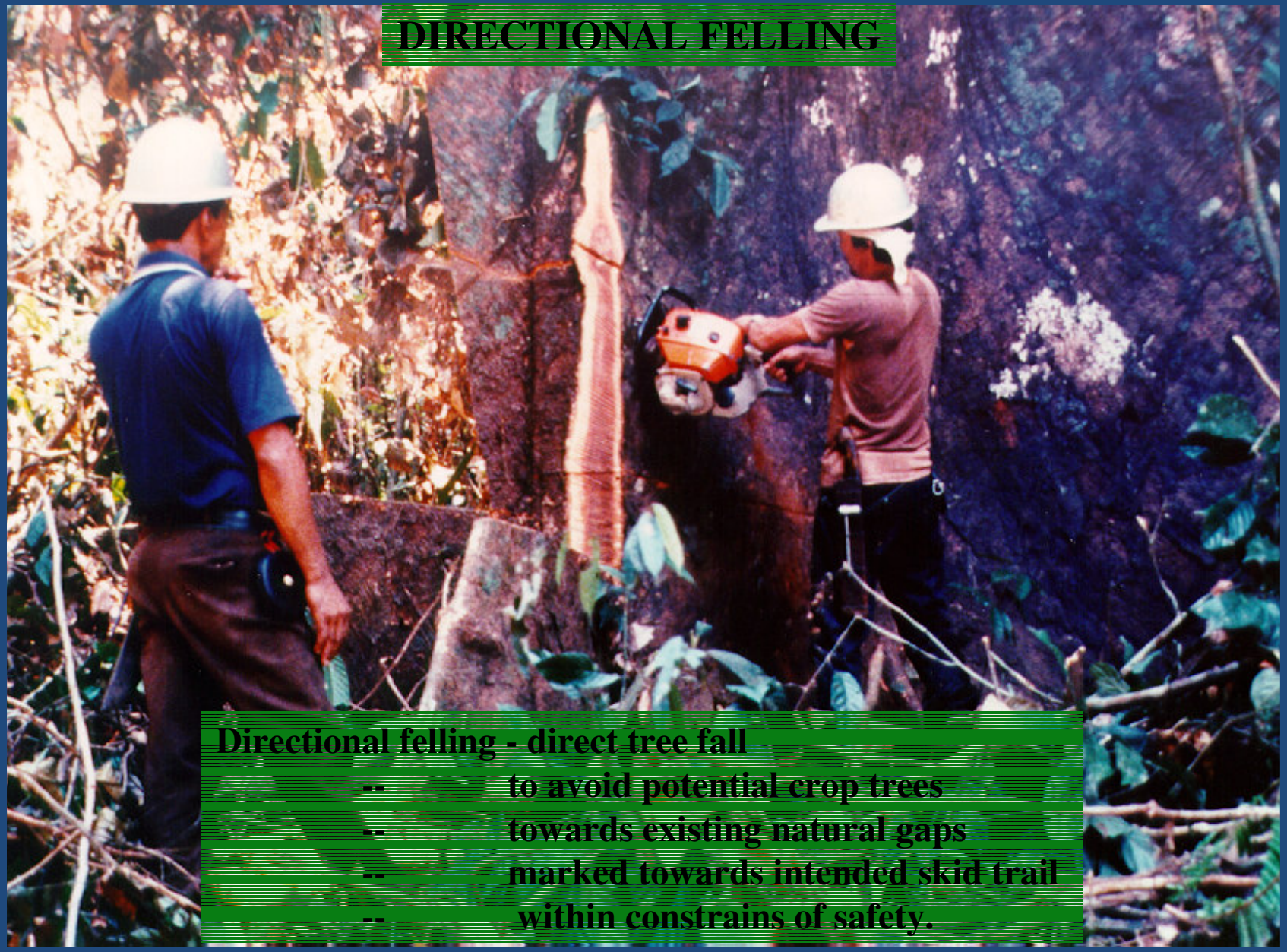
Conventional skid trail

Skid trail in RIL

SKID TRAIL

- Skid trails are marked out on the ground
- location of harvest trees and local obstacles are main considerations
- Small trees within the skid route are felled to show route and help protect the soil when tractors later pass over.
- Skid trail density must not exceed 50 m per ha
- restricted blading

DIRECTIONAL FELLING



Directional felling - direct tree fall

-- to avoid potential crop trees

-- towards existing natural gaps

-- marked towards intended skid trail

-- within constrains of safety.

Water bump and Cross drain in RIL Logged Area

Gully Erosion in Conventionally Logged Area

POST HARVEST

- On departure from sub-block, all stream obstructions are removed ,
- skid trails are drained at interval according to their slope,
- Cross drains are constructed and where applicable water "bump",
- Landings are reshaped to secure adequate surface drainage and ripped up to reduce soil compaction,
- Available logging debris redistributed on the landings.


THE
DIFFERENCE

DIFFERENCES IN HARVEST PROCESSES BETWEEN RIL AND CONVENTIONAL LOGGING

HARVEST PROCESS	RIL	CONVENTIONAL
a. Climber cutting	Yes	None
b. Comprehensive harvest planning		
- harvest tree marking and mapping	Yes	None
- road planning	Yes	Minimal
- skid trail planning	Yes	None
- log landing planning	Yes	None
c. Directional felling		
- to avoid potential crop trees	Yes	None
- towards existing natural gaps	Yes	None
d. Skidding and winching		
- restricted blading	Yes	None
- winching distance/cable pulling	Yes	None/drive direct to stump

DIFFERENCES IN HARVEST PROCESSES BETWEEN RIL AND CONVENTIONAL LOGGING (cont.)

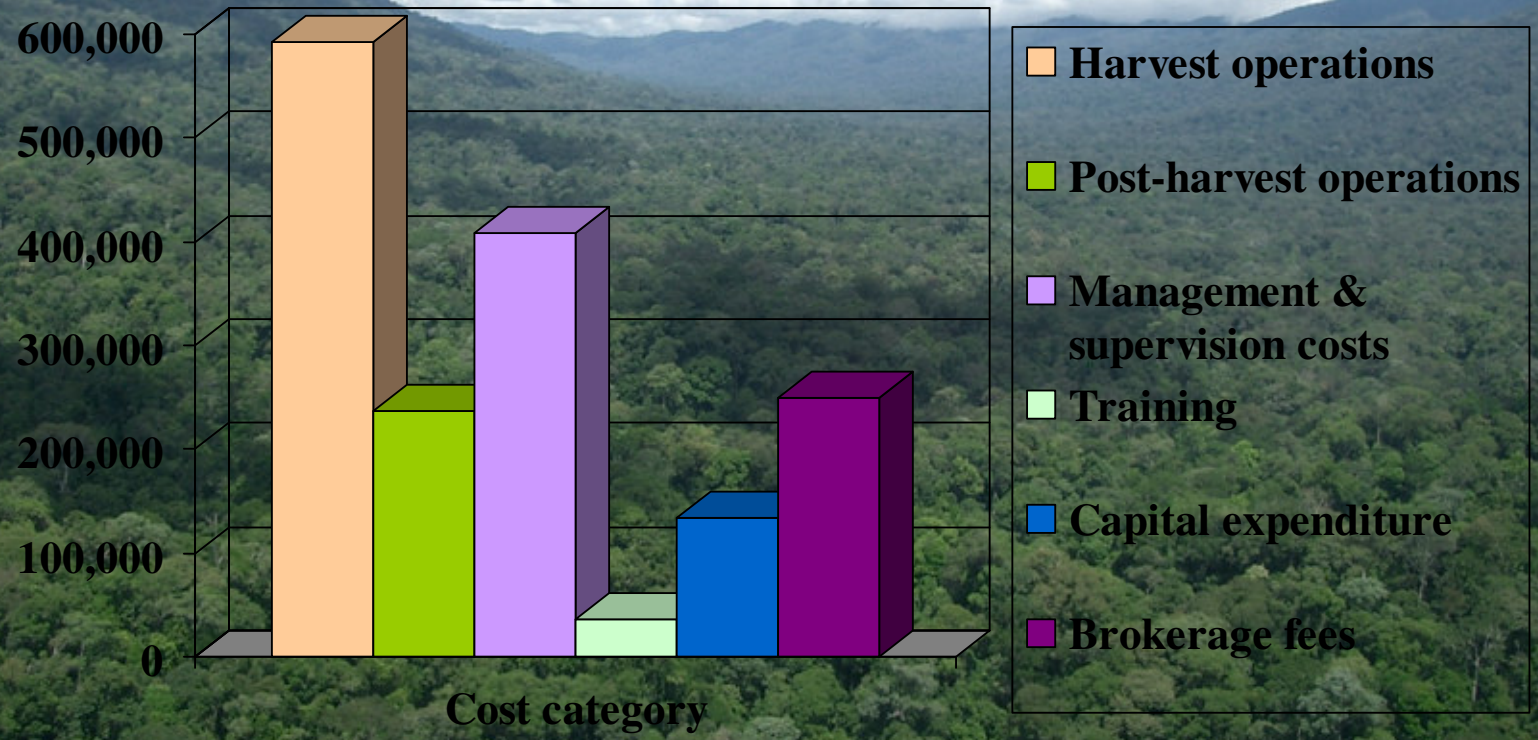
HARVEST PROCESS	RIL	CONVENTIONAL
e. Strict supervision of harvest operation		
- adherence to RIL guidelines	Yes	No guidelines
- continuous damage assessment & evaluation	Yes	None
- controlled damage	Yes	No
f. Cross-drain installation		
- soil erosion control	Yes	No
- diversion of surface run-off	Yes	No
- water quality maintained	Mostly	No
g. Removal of stream crossing structures		
- prevent water ponding	Yes	High occurrence of water ponding
h. Landing re-shaping	Yes	No


Cost?

Incremental Cost of RIL (funded by NEP) PHASE 1 (1,415ha)

Cost category	RM	RM/ha
Harvest operations	591,808	418
Post-harvest operations	236,855	167
Management & supervision costs	407,810	288
Training	37,393	26
Capital expenditure	134,192	95
Brokerage fees	248,770	176
TOTAL	1,656,828	1,171

Incremental Cost of RIL (funded by NEP) PHASE 1 (1,415ha)



COMPLIANCE and VERIFICATION

- Compliance is checked by a 3-person Environmental Audit Committee
- thorough site inspection is conducted 4-5 times during the contract.
- The Audit Committee comprises named representative from FRIM (YS nominee), the US-based Rainforest Alliance (the NEP nominee) and a joint auditor agreed by both parties (Joint Auditor).

Environmental Audit Committee (EAC)

- **Role :** Team of 3 auditors monitor implementation of RIL harvesting guidelines:
- **NEP Auditor :** Rainforest Alliance
  Richard Donovan
  Robert Zimmerman (alternate)
- **RBJ Auditor :** Forest Research Institute of Malaysia (FRIM)
  Dr Wan Razali
  Dr Zulkifli Yusof (alternate)
- **Joint Auditor:** Dr Francis E. Putz (University of Florida)
  Dr Dennis Dykstra (alternate-CIFOR)


RESULT


Conventionally Logged
RIL Logged

QUANTIFICATION OF CO_2

- A research program was conducted to quantify the carbon saving of RIL.
- Field measurements to quantify carbon difference between conventional logging and RIL was carried out by a team led by University of Florida PhD. Student then, Michelle Pinard. Team includes RBJ foresters, Malaysian technicians, and Malaysian and US graduate students.
- This effort was funded jointly by NEP and other granting institutions including National Geographic Society and CIFOR.

QUANTIFICATION OF CO_2 (cont.)

- Goal is to produce independent, publishable, peer reviewed, carbon quantification.
- Six paired plots of 40 ha were randomly sited within RIL and conventional blocks.
- Systematic biomass measurement were made of all the organic components of the forest vegetation, including roots, leaf litter and soil carbon.
- Estimated potential saving of at least 90-94 Mg of C per ha over 40 years.
- This equates to approximately 328-343 ton of CO_2 per ha.

Carbon stored in forest before logging

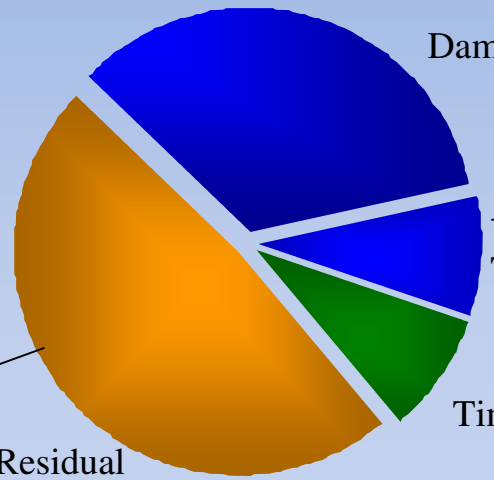
330 t C ha^{-1}

Trees *(75%)*

Soil *(20%)*

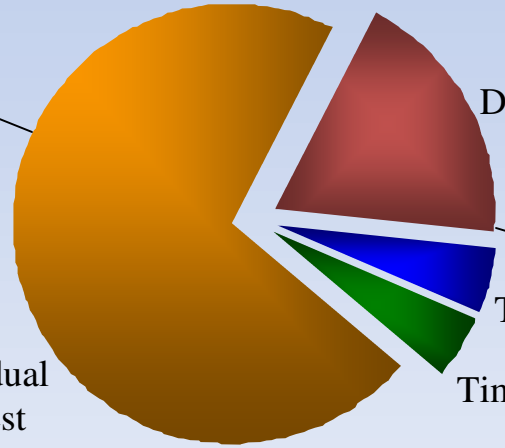
Debris *(5%)*

Carbon stored in forest 10 yrs after logging



Conventional Logging

120 t C ha $^{-1}$



Reduced Impact Logging

185 t C ha $^{-1}$

Carbon Retention difference between RIL and Conventionally Logged Forest

What is the cost of RIL Carbon ?

- Total Investment US$452,000
- Area (ha) 1415
- Time (years) 60
- C-gained 127,350 t
- CO_2-gained 464,828 t
- Cost ha^{-1} US$320
- Cost t^{-1} of C US$4.53
- Cost t^{-1} of CO_2 US$1.24

INFAPRO

Innoprise - FACE Foundation Rainforest Rehabilitation Project

REHABILITATION OF LOGGED FORESTS (ENRICHMENT PLANTING)

Tagging natural regeneration for tending

Climber cutting

INNOPRISE-FACE FOUNDATION RAINFOREST REHABILITATION PROJECT (INFAPRO)

- A CO_2 offset project situated near DVCA
- Made possible through financial assistance from FACE Foundation, The Netherlands.
- FACE was initially established by the Dutch Electricity Generating Board since 1991 to promote planting of forests to absorb CO_2 from the atmosphere but now operates forestry-based carbon offset projects world-wide to contribute to the targets set by the Kyoto Protocol (1997), and to provide CO_2 offset services to voluntary markets.
- Planted to date about 11,225 ha since mid-1992 (5 Contracts/Phases signed to date)
- Target planted area is 25,000 ha over 25 years.

Large scale nurseries in INFAPRO

In-house training

How is the Planting Carried out ?

- Planting consists solely of indigenous species, principally of the dipterocarps and other commercial species.
- To enhance biodiversity, 5% of the planting consists of indigenous fruit trees.
- Tending of existing natural regenerations.

Seed Preparation

Wildings

Innoprise - FACE Project Nursery
Capacity: 1 million seedlings

Line Planting of Dipterocarps

Line Planting of Kapur Paji

•3 year old Kapur paji


15 years old – kapur Paji

YAB The Prime Minister's Visit to INFAPRO, 1996

Visit by DYMM THE YANG DIPERTUAN AGONG, 1996


Cost?

COST OF INFAPRO (as of September, 2007)

Contract	1 (2,011 ha)			2 (3,012 ha)			3 (4,785 ha)		
Category	Face	ICSB	Total	Face	ICSB	Total	Face	ICSB	Total
Management	237,198	195,448	432,646	1,830,494	1,672,904	3,503,398		2,389,427	2,389,427
Development	2,399,404	266,636	2,666,040	3,980,350	-	3,980,350	4,856,279		4,856,279
Capital exp.	36,375	166,375	202,750	301,400	546,790	848,190		801,750	801,750
R&D	271,840	6,921	278,761	591,878	-	591,878	378,000		378,000
TOTAL	2,944,817	635,380	3,580,197	6,704,122	2,219,694	8,923,816	5,234,279	3,191,177	8,425,456

Note: Contracts 4 (1,117 ha) and 5 (600 ha) are currently in progress and maintenance activities are still progressing in all Contracts.

Mean Cost per ha = RM 2,150 or US$562.00

(total investment ~ RM21mil from Face & ICSB for Contract 1 to Contract 3)

Quantification of CO_2

- commissioned Institute for Forestry and Nature Research, Wageningen, Netherlands to develop model - CO_2FIX
- 16 forest types including heavily logged evergreen rainforest
- model approved internationally, including Institute of Terrestrial Ecology in Edinburg, Scotland

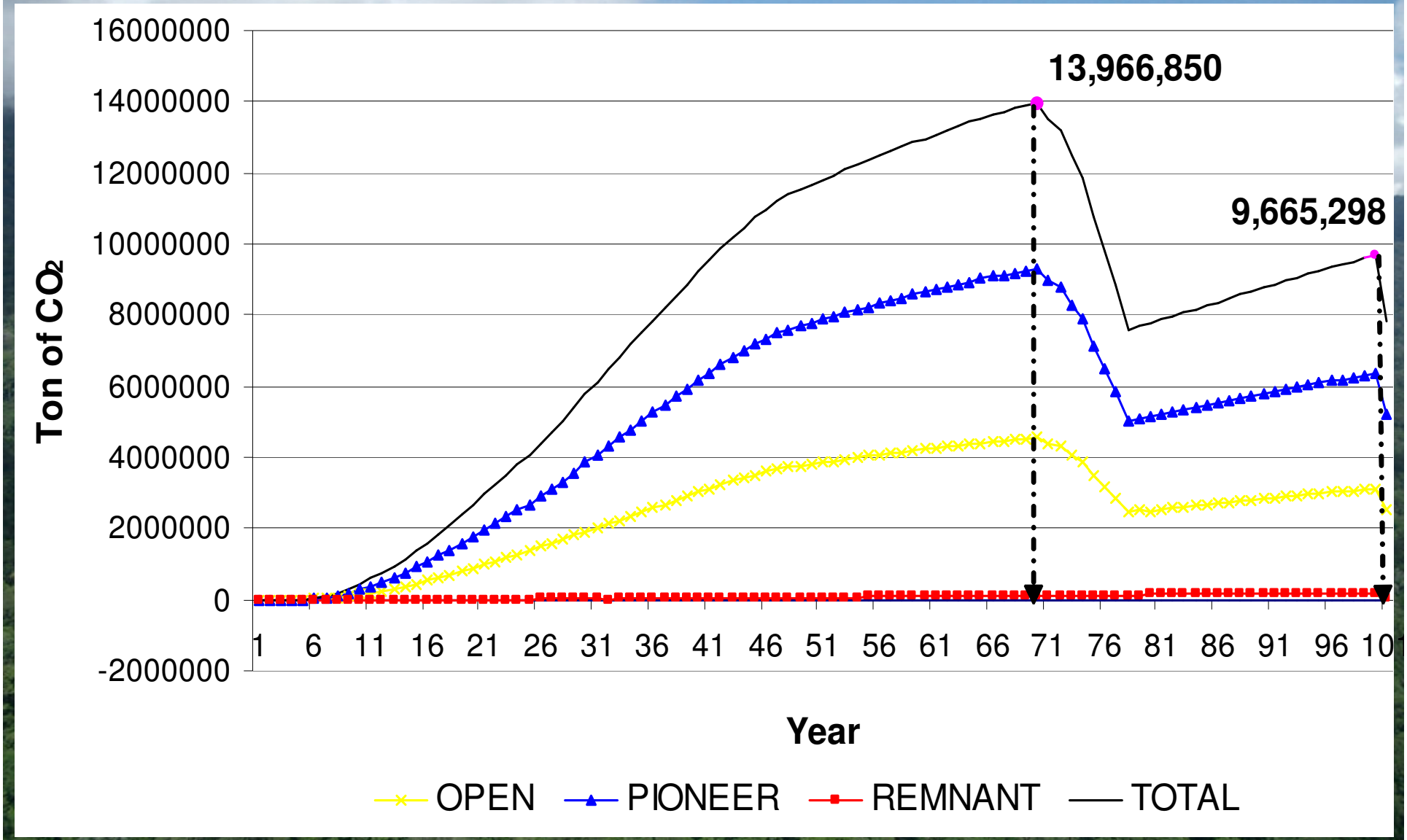
Quantification of CO_2
(Since Contract 4)

- Commissioned Institute of Forest Ecosystem Research (IFER), Czech Republic in carbon monitoring programme and MONIS using FIELDMAP – a tool designed for computer aided field data collection.
- Infapro currently establish 300 Permanent Sample Plots for the carbon monitoring programme covering the baseline and with project scenarios.
- Results shall be verified by an independent body soon

Project Monitoring INFAPRO

- **MONIS - a computerized GIS-based Monitoring and Information System for Database and Accounting System**
- **Incorporating FIELDMAP for carbon monitoring programme**
- **linked to digital maps and inputs of ground data (for example, census information on tended/planted seedlings)**
- **field and financial inspection and auditing by external party is undertaken from time to time in every contracts.**

CO_2 OFFSET PER VEGETATION TYPE



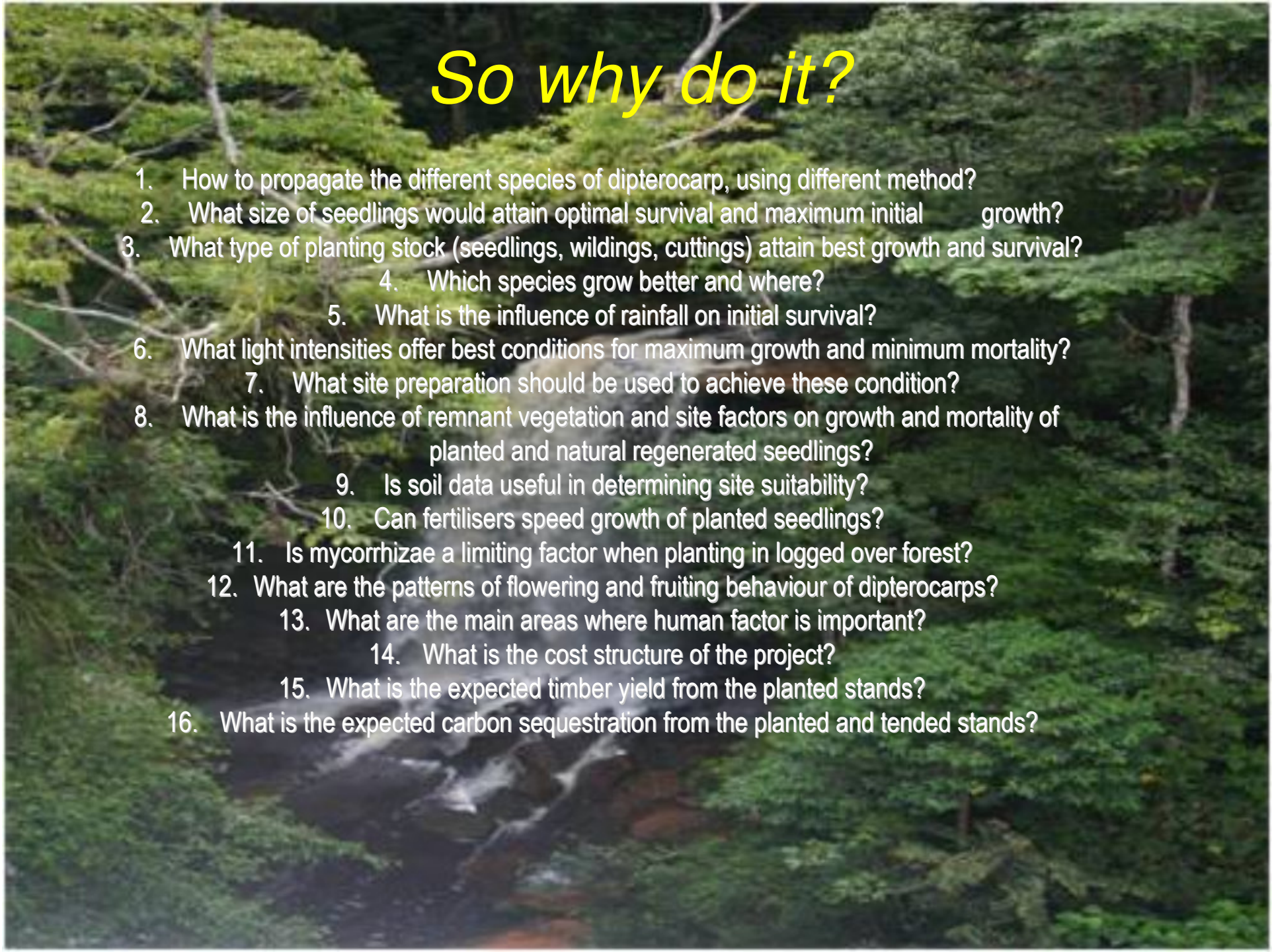
Source: FACE Foundation Report, 2002

What is the cost of Carbon ? (for Contracts 1 – 3)

• Total Investment	US$5.51 mil
• Area (ha)	9,808
• Time (years)	70
• C-gained	3,826,534 t (390 tha^{-1})
• CO_2-gained	13,966,850 t (1424tha^{-1})
• Cost ha^{-1}	US$562.00
• Cost t^{-1} of C	US$1.44
• Cost t^{-1} of CO_2	US$0.39

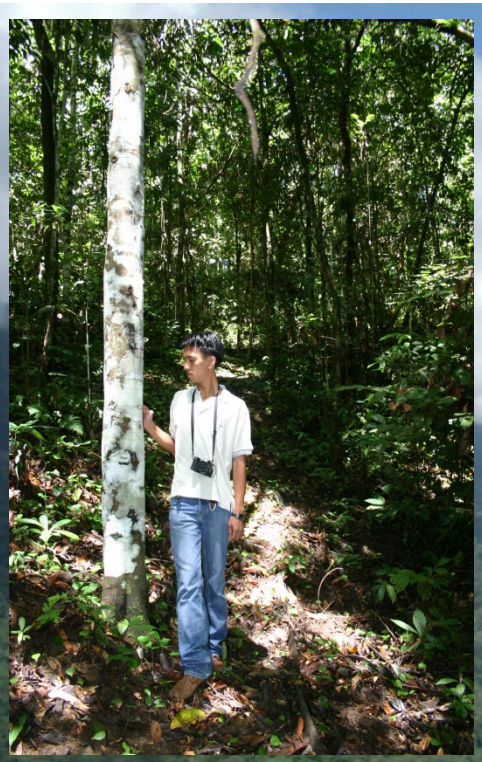
What is the cost of FACE Carbon ? (for Contracts 1 – 3)

• Total Investment	US$3.92 mil
• Area (ha)	9,808
• Time (years)	70
• C-gained	3,826,534t (390 tha^{-1})
• CO_2-gained	13,966,850t (1424 tha^{-1})
• Cost ha^{-1}	US$400.00
• Cost t^{-1} of C	US$1.02
• Cost t^{-1} of CO_2	US$0.28



So why do it?

1. How to propagate the different species of dipterocarp, using different method?
2. What size of seedlings would attain optimal survival and maximum initial growth?
3. What type of planting stock (seedlings, wildings, cuttings) attain best growth and survival?
4. Which species grow better and where?
5. What is the influence of rainfall on initial survival?
6. What light intensities offer best conditions for maximum growth and minimum mortality?
7. What site preparation should be used to achieve these condition?
8. What is the influence of remnant vegetation and site factors on growth and mortality of planted and natural regenerated seedlings?
9. Is soil data useful in determining site suitability?
10. Can fertilisers speed growth of planted seedlings?
11. Is mycorrhizae a limiting factor when planting in logged over forest?
12. What are the patterns of flowering and fruiting behaviour of dipterocarps?
13. What are the main areas where human factor is important?
14. What is the cost structure of the project?
15. What is the expected timber yield from the planted stands?
16. What is the expected carbon sequestration from the planted and tended stands?



Healthy Forest


TERIMA KASIH
THANK YOU
FOR YOUR ATTENTION