3. 海外研修（ミャンマー研修） 資料

平成 24 年度ミャンマー海外研修の記録（プロシーディング）
～住民が参加するカーボン・プロジェクトへ向けて～

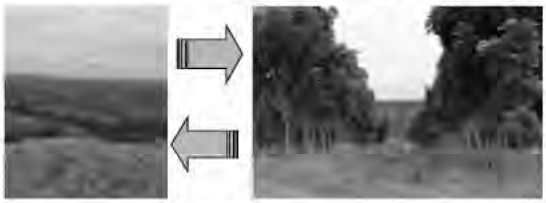
1 ミャンマーの森林・林業分野における基本政策
- 国際緑化推進センター 仲摩主任研究員
2 CDM 植林および REDD プラスの基本ルール／コンセプト
- IGES 山ノ下麻木乃研究員
3 ミャンマーにおける CDM 植林プロジェクト事例
- ミャンマー森林局 流域管理部長 Mr. Bo Ni 講師
4 ミャンマーの気候変動に関する森林・林業分野の政策
- ミャンマー森林研究所 副部長 Mr. Win Myint 講師
5 地上調査による炭素蓄積量の測定方法、モニタリング方法
- 国際緑化推進センター 森技術顧問
6講義: 持続的森林管理、REDD+活動推進のためのキャパシティ・ビルディング
- ミャンマー森林研究所 研究員 Dr.Rosy Ne Win 講師

Basic concept / rule of A/R CDM and REDD+

United Nations Framework Convention on Climate Change

Afforestation / Reforestation
Clean Development Mechanism

Reducing Emissions from Deforestation
and Forest Degradation in developing countries - plus -



Eiichiro Nakama

JAPAN INTERNATIONAL FORESTRY PROMOTION & COOPERATION CENTER

OUTLINE of This Presentation

1. United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (KP)
2. Kyoto Mechanism
3. Clean Development Mechanism (CDM)
4. Basic rule of A/R CDM
   (On going mechanism)
5. Basic concept of REDD-plus (+)
   (Future mechanism)

Worldwide carbon markets

Regulated (compliance) markets	Voluntary markets
● EU-Emissions Trading System (ETS)	● Chicago Climate Exchange (CCX), legally binding cap-and-trade system
● **UNFCCC** □ **AAUs under Kyoto Protocol (KP)** □ **JI and CDM under KP**	● broader, non-binding "Over-the-Counter" (OTC) offset market
● Regional Greenhouse Gas Initiatives (RGGI)	● Verified Carbon Standard (VCS) etc.

1. United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol(KP)

UNFCCC

The Convention on Climate Change sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change.

4

UNFCCC

Entry into force: 21 March 1994
Registration: 21 March 1994, No. 30822.
Status: Signatories: 165. Parties: 195.

Bali Road Map

AWG-KP | AWG-LCA

Cancun Agreements

COP17/CMP7

Adopt a universal legal agreement on climate change as soon as possible, and no later than 2015

5

UNFCCC

United Nations Framework Convention on Climate Change

Kyoto Protocol (KP)

Adopted in Kyoto, Japan, on 11 December 1997
Entered into force on 16 February 2005

Registration: 16 February 2005, No. 30822.
Status: Signatories: 84. Parties: 192

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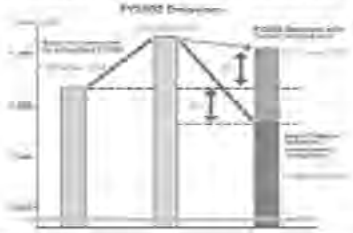
Kyoto Protocol (KP): Commitments

- Parties with commitments under the KP (Annex B Parties) have accepted targets for limiting or reducing emissions for the 5-year period of 2008 – 2012 (1st commitment period).
- E.g. : Japan (-6%), EU (-8%), Australia (+7%),
- Assigned amounts (cap) for each Party are calculated from the base-year emissions and emission reduction targets.



Emission Reduction Target Commitment of Japan

Source: Kyoto Protocol Target Achievement Plan, April 28, 2005

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How to meet the Kyoto target?

Emission reduction efforts only by domestic efforts in each developed county is low cost-benefit performance

meeting the Kyoto target is difficult

Flexibility mechanisms (Kyoto-mechanisms)
- International high cost-benefit performance
- Promoting emission reduction in non-Annex I countries (developing countries)

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Types of Kyoto credits

Domestic efforts
- AAUs (Assigned Amount Unit): Target emissions
- RMUs (Removal Unit): GHG removals by sinks

International flexible efforts, Kyoto mechanisms
- ERUs (Emission Reduction Unit): by JI
- CERs (Certified Emission Reduction): by CDM
- tCERs (temporary CER): by A/R CDM
- lCERs (long-term CER): by A/R CDM

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How to meet the Kyoto target (total emissions allowed) in an Annex B Party

Total amounts of emissions in an Annex B Party during the 1st Commitment Period (2008 -2012) =

- AAUs by ET
- ERUs, CERs, tCERs, lCERs by JI/CDM
- RMUs
- Original AAUs of Annex B Party (Kyoto target)

= Original AAUs + RMUs + JI/CDM credits (ERUs、CERs、tCERs、lCERs) + AAUs by ET

2. Kyoto Mechanism

Annex B Parties can achieve their emission reduction targets in a cost-effective manner, using three Mechanisms.

- International Emission Trading (IET), article 17 of the KP
- Joint Implementation (JI), article 6 of the KP
- Clean Development Mechanism (CDM), article 12 of the KP

Besides Parties, private and/or public entity can participate in the Kyoto Mechanisms, provided that authorized by a Party.

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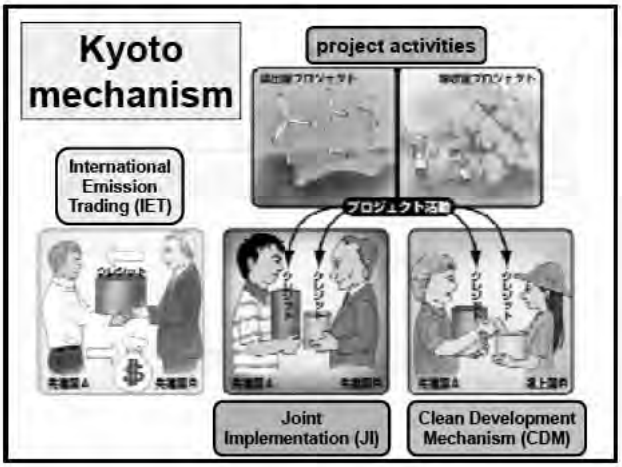
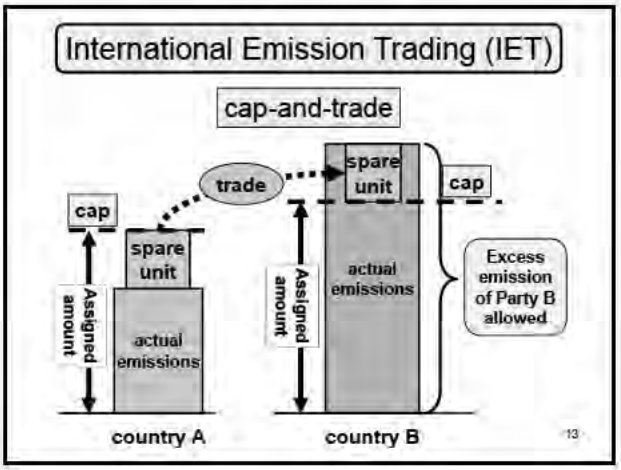
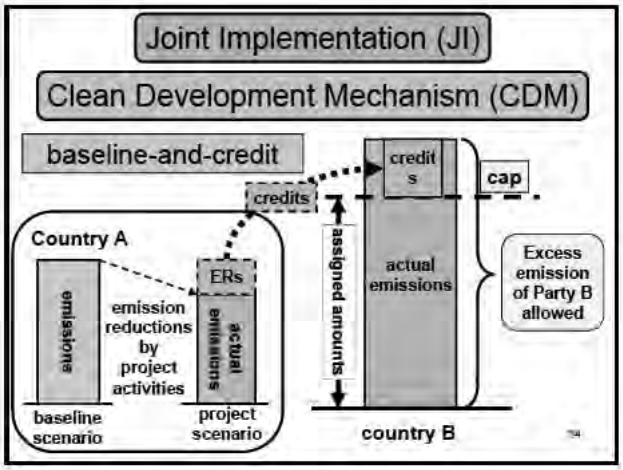
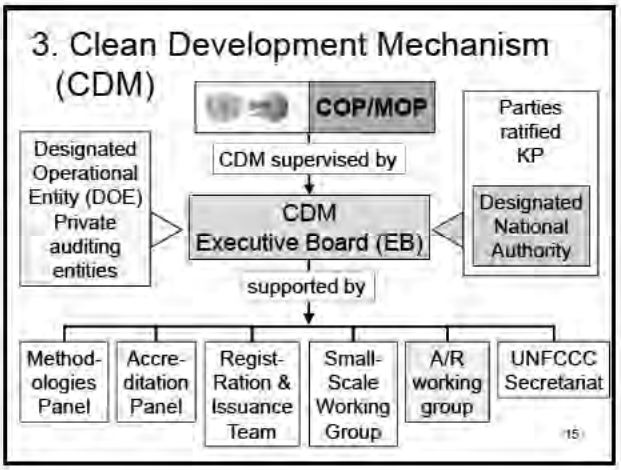
Kyoto mechanism





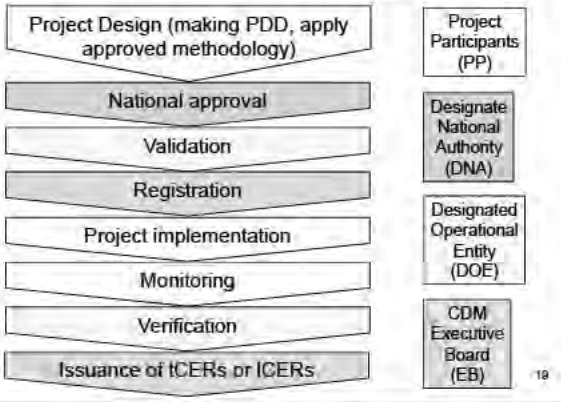




List of DOEs

Ref. Number	Entity	Sectoral scopes for validation	Sectoral scopes for verification and certification
E-0001	Japan Quality Assurance Organisation (JQA)	1-15	1-15
E-0002	JACO CDM., LTD (JACO)	1-15	1-15
E-0003	DNV Climate Change Services AS (DNV)	1-15	1-15
E-0005	TÜV SÜD Industrie Service GmbH (TÜV SÜD)	1-15	1-15
E-0006	Deloitte Tohmatsu Evaluation and Certification Organization (Deloitte-TECO)	1-10, 12, 13, 15	1-10, 12, 13, 15
...	...	...	...
E-0052	Carbon Check (Pty) Ltd (Carbon Check)	1-5, 8-10, 13	1-5, 8-10, 13

Procedures for A/R CDM project activities



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Sectoral scopes and registered projects of CDM

	Sectoral Scope	Registered Projects
reductions in anthropogenic emissions by sources	(01) Energy industries (renewable - / non-renewable sources)	4,568
	(02) Energy distribution	0
	(03) Energy demand	66
	(04) Manufacturing industries	336
	(05) Chemical industries	90
	(06) Construction	0
	(07) Transport	23
	(08) Mining/mineral production	63
	(09) Metal production	10
	(10) Fugitive emissions from fuels (solid, oil and gas)	191

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Sectoral scopes and registered projects of CDM

	Sectoral Scope	Registered Projects
reductions in anthropogenic emissions by sources	(11) Fugitive emissions from production and consumption of halocarbons and sulphur hexafluoride	30
	(12) Solvent use	0
	(13) Waste handling and disposal	757
	(15) Agriculture	167
net anthropogenic GHG removals by Sinks	(14) Afforestation and reforestation	40
Total		5,519

As of November 6th, 2012

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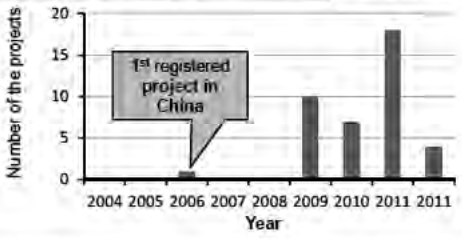
Number of the registered A/R CDM projects by year

Registered A/R CDM projects: total 40 — As of 07 NOV 2012



Number of the registered A/R CDM projects is increased because of the simplification of rules and improvement of accounting methodologies of GHG removals by sink.

Regional distribution of registered A/R CDM projects

Registered A/R CDM projects: total 40 — As of 07 NOV 2012

Africa	
D. R. of the Congo	1
Ethiopia	1
Kenya	3
Senegal	1
Uganda	6
Subtotal	12
	30%

Europe	
Albania	1
R. of Moldova	1
Subtotal	2
	5%

Asia	
China	3
Viet Nam	1
India	7
Subtotal	11
	28%

Latin America	
Argentina	1
Bolivia	1
Brazil	2
Chile	2
Colombia	5
Nicaragua	1
Paraguay	1
Peru	1
Uruguay	1
Subtotal	15
	38%

Please see the accompanying sheet for details

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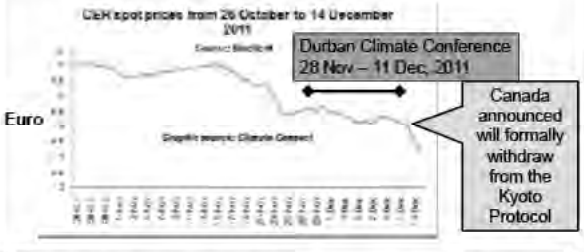
Price of the Kyoto credit



Price of the Kyoto credit (CER) has high uncertainty because of the market mechanism (based on supply and demand) ! Price of the t- or l-CER of A/R CDM is much lower than the permanent CER of emission reduction CDM !!

4. Basic rule of A/R CDM

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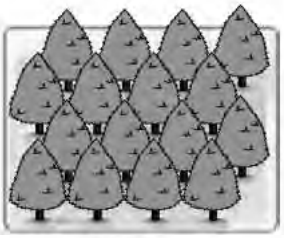
What is Afforestation/reforestation CDM ?

on non-forest land

through human-induced planting



to forest land
by afforestation or
reforestation activities

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"Forest" definition under the CDM

3 indicators

1. minimum area of land of 0.05-1.0 ha
2. with tree crown cover (or equivalent stocking level) of more than 10 - 30 %
3. with trees with the potential to reach a minimum height of 2 - 5 m at maturity in situ

Forest Definition

	China	Vietnam	Japan
1. (ha)	0.067	0.5	0.3
2. (%)	20	30	30
3. (m)	2	3	5

A Party not included in Annex I may host an A/R CDM project activity if it has selected values and reported to the EB through its DNA for the CDM

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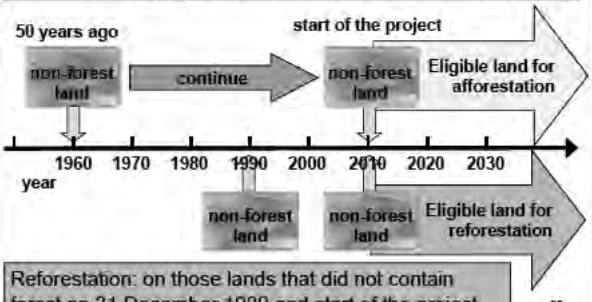
Land eligibility for A/R CDM project activities

Afforestation: conversion of land that has not been forested for a period of at least 50 years to forested land



Reforestation: on those lands that did not contain forest on 31 December 1989 and start of the project

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Eligible land,
mosaic of grassland & forest

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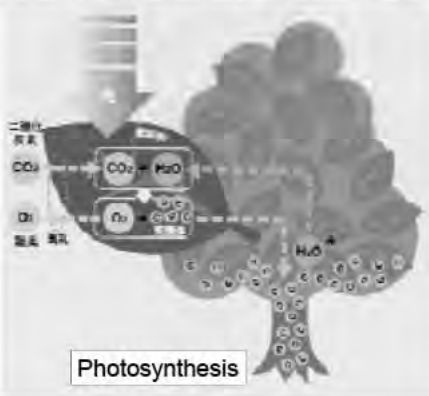
Net anthropogenic GHG removals by sinks



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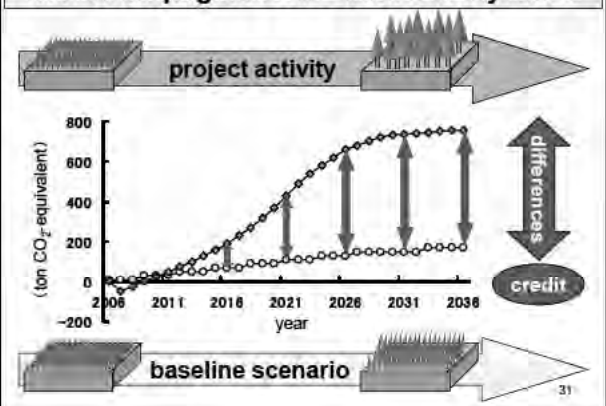
Net anthropogenic GHG removals by sinks



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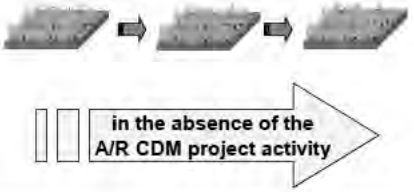
Baseline scenario

The baseline scenario for an A/R CDM project activity is the scenario that reasonably represents the sum of the changes in carbon stocks in the carbon pools within the project boundary that would occur in the absence of the A/R CDM project activity.



in the absence of the A/R CDM project activity

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Project activity (project scenario)

An A/R CDM project activity is an afforestation or reforestation measure, operation or action that aims at achieving net anthropogenic GHG removals by sinks.

The Kyoto Protocol and the CDM modalities and procedures use the term "project activity" as opposed to "project".

project activity

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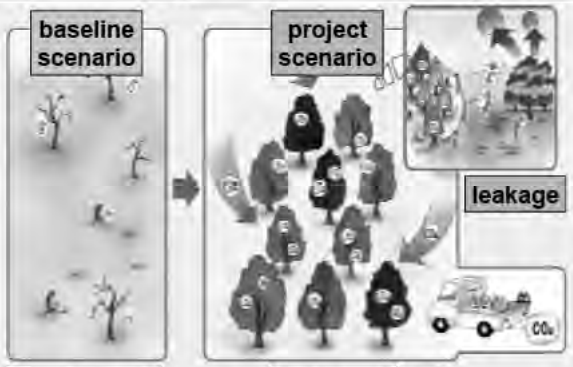
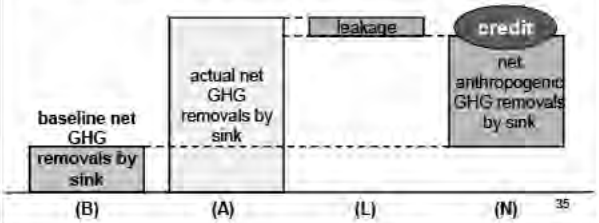
Net anthropogenic GHG removals by sinks



How to calculate net anthropogenic GHG removals by sink

Net anthropogenic GHG removals by sink (N) is the amount of CO2 removed by the project activity and is equal to the amount of credit issued by the project.
It is calculated as; (N) = (A) - (B) - (L)



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Baseline net GHG removals by sinks

is the sum of the changes in carbon stocks in the carbon pools within the project boundary that would have occurred in the absence of the A/R CDM project activity.

Actual net GHG removals by sinks

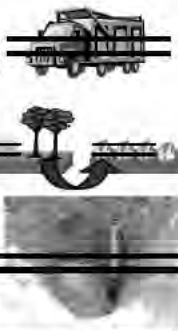
is the sum of the verifiable changes in carbon stocks in the carbon pools within the project boundary, minus the increase in emissions of the GHGs by the sources that are increased as a result of the implementation of the A/R project activity within the project boundary, attributable to the A/R CDM project activity.

Leakage

is the increase in GHG emissions by sources which occurs outside the boundary of an A/R CDM project activity which is measurable and attributable to the A/R CDM project activity.[36]

Project emissions (within the project boundary)

- ✓Fossil fuels burning: CO_2
- ✓Biomass loss (wood / herb): CO_2
- ✓Biomass burning (wood / herb): (CO_2), CH_4, N_2O
- ✓Fertilization: N_2O
- ✓N-fixing species: N_2O (denitrification)
- ✓Forage-fed live stock: CH_4, N_2O



Underline: currently negligible by simplification

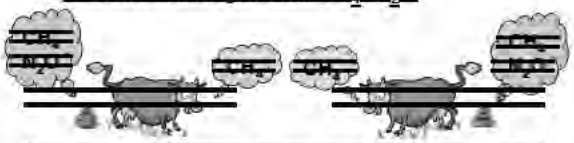
Leakage emissions (1) (outside of the project boundary)

- ✓Decrease in carbon stocks
  - Displacement of pre-project activities
    - Agriculture,
    - Grazing
    - Fuel-wood collection
    - Deforestation & land use change
  - Increase use of biomass
    - Wood posts for fencing

Underline: currently negligible by simplification

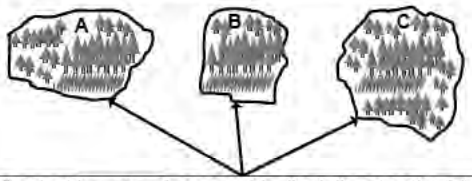
Leakage emissions (2) (outside of the project boundary)

- ✓increase in GHGs emissions
  - Fossil fuels burning: CO_2
  - Forage-fed live stock
    - Enteric fermentation: CH_4
    - Manure management: CH_4, N_2O



Underline: currently negligible by simplification

Project boundarys for A/R CDM

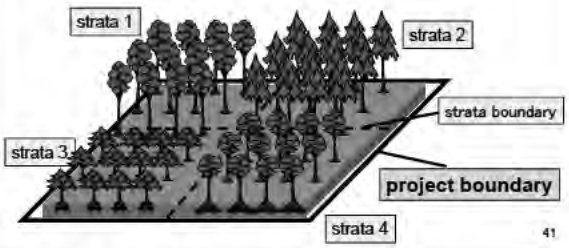


The "project boundary" geographically delineates the A/R CDM project activity under the control of the project participants.

An A/R CDM project activity may contain more than one discrete areas of land. If an A/R CDM project activity contains more than one discrete area of land

Stratification for A/R CDM

"Stratification" is for facilitating field operations and increasing the accuracy of calculation and estimation of Carbon stock



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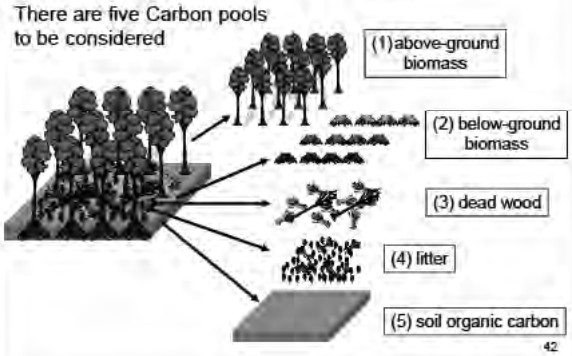
Carbon pools for A/R CDM

There are five Carbon pools to be considered



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Five Carbon Pools for Carbon Stock Estimation

No.	Carbon Pool	Grouping
1	Above Ground Biomass (AGB)	Living Biomass (LB)
2	Below Ground Biomass (BGB)	
3	Dead Wood	Dead organic matter (DOM)
4	Litter	
5	Soil organic carbon (SOC)	SOC

A/R CDM Methodologies

Baseline scenario

Baseline net GHG removals by sinks (1)

= Carbon stock change

Project scenario

Actual net GHG removals by sinks (2)

= + Carbon stock change

– Project emission (inside)

Leakage (3)

(emission increase outside of the project boundary)

Net anthropogenic GHG removals by sinks

= (2) – (1) – (3) = CERs

Methodologies for A/R CDM project activities

Project participants willing to validate / register an A/R CDM project activity shall:

⇨ use a A/R methodology previously approved by the Executive Board

or

⇨ propose a new A/R methodology to the Executive Board for consideration and approval

Methodology Progress Table

Large Scale Methodologies	CDM	A/R CDM
Approved methodologies	87	10
Approved consolidated methodologies	21	2
Source of A.M.	133	14
Implicitly A.M. through consolidation	22	0
In progress	15	0
Rejected methodologies	181	22
Withdrawn methodologies	17	3

As of 20th OCT 2012

→ Getting a methodology approved is not easy.

- Avoid submitting new methodologies - modify the existing ones.

Methodological Tools for A/R CDM

As of 20th OCT 2012

1	Tool for the demonstration and assessment of additionality
2	Combined tool to identify the baseline scenario and demonstrate additionality
3	Calculation of the number of sample plots for measurements
4	Tool for testing significance of GHG emissions
5	Estimation of GHG emissions related to fossil fuel combustion
6	Accounting of the soil organic carbon pool may be conservatively neglected
7	Estimation of direct nitrous oxide emission from nitrogen fertilization
8	Estimation of non-CO2 GHG emissions resulting from burning of biomass
9	GHG emissions from increased use of non-renewable woody biomass
10	Estimation of carbon stocks and change in dead wood and litter
11	Tool for the identification of degraded or degrading lands
12	Estimation of carbon stocks and change of trees and shrubs
13	Estimation of the increase in GHG emissions attributable to displacement of pre-project agricultural activities
14	Tool for estimation of change in soil organic carbon stocks
15	Appropriateness of allometric equations for estimation of A.G. tree biomass
16	Appropriateness of volume equations for estimation of A.G. tree biomass

3. Success points of A/R CDM (2)

In order to pass validation of A/R CDM, project proponents shall analyze / assess and clearly state the result in Project Design Document (PDD).

3-2. Environmental impacts

3-3. Socio economic impacts

3-4. Stakeholders' comments

CDM Project Design Document for AR (CDM-AR-PDD)

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Environmental impacts

Analysis of Environmental Impacts on;

- ✓Biodiversity and natural ecosystems
- ✓Impacts outside the project boundary
- ✓Hydrology
- ✓Soils
- ✓Risk of fires,
- ✓Pests and diseases
- ...etc

→ If any negative impact is considered,

Environmental Impact Assessment (in accordance with the procedures required by the host party)

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Socio economic impacts

Analysis of Socio-economic Impacts on;

- ✓Local community
- ✓Indigenous peoples
- ✓Land tenure
- ✓Local employment
- ✓Food production
- ✓Cultural and religious site
- ✓Access to fuelwood and other forest
- ✓...etc

→ If any negative impact is considered,

Environmental Impact Assessment (in accordance with the procedures required by the host party)

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Stakeholders' comments

For implementation of an A/R CDM project activities, various stakeholders will be involved.

e.g. Public or private entities, local community etc.

Project participants shall collect comments from local stakeholders in an open and transparent manner.

And explain how due account has been taken of comments received from stakeholders.

e.g. Whether stakeholders agree to the AR-CDM project activity or not., the impact on each stakeholder, output to be desired by the project ...etc.

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Analysis / assessment on

3-1. Environmental impacts
3-2. Socio economic impacts
3-3. Stakeholders' comments

→ **Counter measures**

It is very useful to avoid
- negative effect on environment,
- negative effect on social economy
- conflict with stakeholders including local people surrounding the project site.

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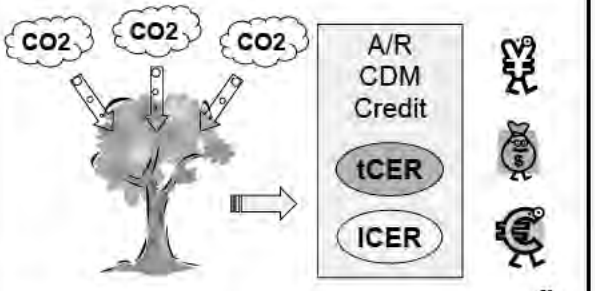
Incentive to project proponents to maintain the plantation forest



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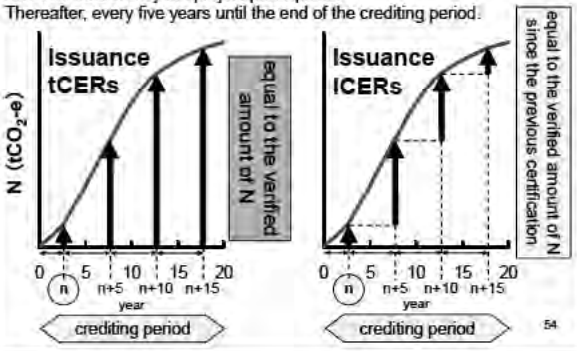
Issuance of tCERs or lCERs for A/R CDM

The initial verification and certification of an A/R CDM may be undertaken at a time selected by the project participants.
Thereafter, every five years until the end of the crediting period.



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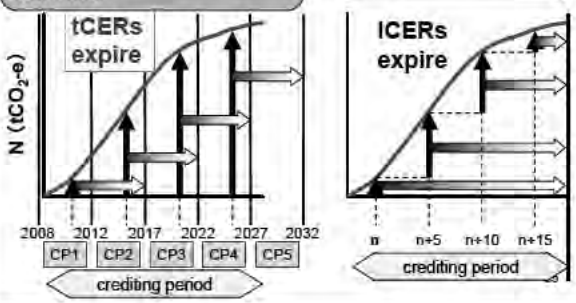
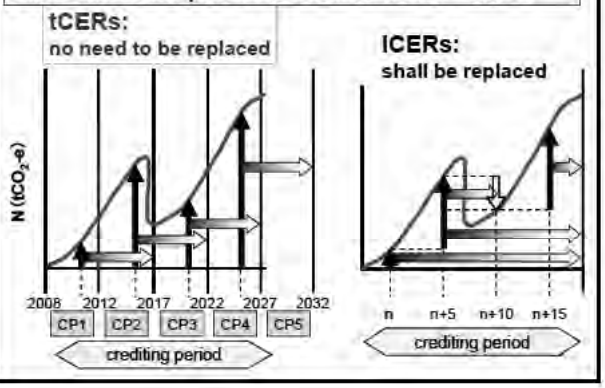
Expiration of tCERs or lCERs for A/R CDM

tCERs: shall expire at the end of the Commitment Period (CP) subsequent to the CP for which it was issued

lCERs: shall expire at the end of the crediting period



If reversal of net anthropogenic GHG removals by sinks since the previous certification occured



Replacement of tCERs or lCERs for A/R CDM

tCERs:

To replace an exipre tCER, the concerned Party shall transfer AAU, CER, ERU, RMU or tCER.

Temporary credits will be expired !
Replacement must be done !!
It is too difficult for marketing !!!

lCERs:

To replace an expire lCER, the concerned Party shall transfer AAU, CER, ERU or RMU.

To replace an reversal lCER a Party shall transfer one AAU, CER, ERU, RMU or lCER from the same project activity

BIG PROBLEM

57

4. Basic concept of REDD-plus

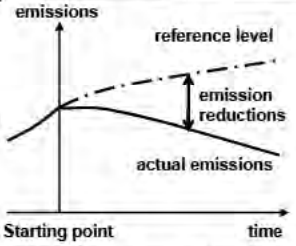
Reducing emissions from deforestation in developing countries ; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries

58

What is REDD+?

Papua New Guinea and Costa Rica jointly proposed REDD mechanism in COP11, UNFCCC (2005)

- Future projection of GHG emissions from deforestation as reference level based on historical evidence
- Avoided deforestation activities
- Monitoring of actual emissions
- Incentives based on the actual emission reduction



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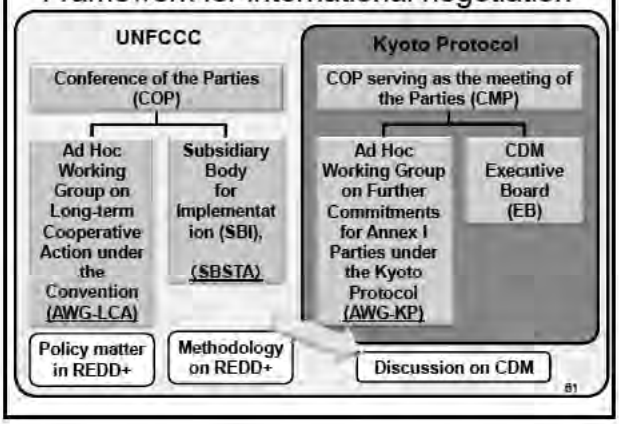
Progress of discussion on REDD+

COP11 Montreal, Canada (2005)	PNG and Costa Rica proposed mechanism on REDD (Reducing Emissions from Deforestation in Developing countries)	
COP13 Bali, Indonesia (2007)	Bali Action Plan (Decision1/CP.13 para1(b)(iii)): Agreement to include REDD+ activities in mitigation against climate change	
AWG-LCA / SBSTA	Forest Carbon Partnership Fund (FCPF) by World Bank (2008)	UN-REDD (2008)
COP15 Copenhagen, Denmark (2009)	Copenhagen Agreement: Importance in establishment of REDD+ mechanism, Guideline of methodology on REDD+	
AWG-LCA / SBSTA	Forest Investment Program (FIP) by World Bank (2009)	
	Process in France & Norway (MAR, MAY 2010): REDD+ Partnership	
	High Level Official Meeting in Japan (OCT 2010 in Nagoya)	
COP16 Cancun, Mexico (2010)	Cancun Agreement: Phased approach to implement REDD+ and principal agreement on REDD+	
AWG-LCA / SBSTA		
COP17 Durban, South Africa (2011)		

Framework for international negotiation



Decision on REDD+ in COP16
REDD+ activities

Support to developing countries, Parties should collectively aim to slow, halt and reverse forest cover and carbon loss

Encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities

(a) Reducing emissions from deforestation;
(b) Reducing emissions from forest degradation;
(c) Conservation of forest carbon stocks;
(d) Sustainable management of forests;
(e) Enhancement of forest carbon stocks;

Decision on REDD+ in COP16
Safeguards (1)

(a) That actions complement or are consistent with the objectives of national forest programmes and relevant international conventions and agreements;

(b) Transparent and effective national forest governance structures;

(c) Respect for the knowledge and rights of indigenous peoples and members of local communities;

(d) The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities;

63

Decision on REDD+ in COP16
Safeguards (2)

(e) That actions are consistent with the conservation of natural forests and biological diversity and to enhance other social and environmental benefits;

(f) Actions to address the risks of reversals;

(g) Actions to reduce displacement of emissions.

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REDD+: Phased Approach

Efforts with the support of multilateral or bilateral initiatives, to build capacity to be ready for a REDD+ mechanism.

Phase1: Readiness	Phase2: Implementation	Pahse3: Full Implementation
Developing a REDD+ strategy supported by grants	Implementing a REDD+ strategy, supported by (a) grants or other financial support for capability building, and enabling policies and measures (b) payments for emission reductions measured by proxies	Continued implementation of REDD+ strategy, payments for verified emission reductions and removals

Demonstration activities

65

REDD+: Demonstration Activities

Demonstration activities are essential in order to establish a basic stock of practical experiences related to REDD

» Forest Carbon Partnership Facility (FCPF)
Thirty-seven forest developing countries (14 in Africa, 15 in Latin America and the Caribbean, and 8 in Asia-Pacific)

» Kalimantan Forests and Climate Partnership
Australia and Indonesia are currently working on a demonstration activity in the carbon rich peatland forests of Central Kalimantan

» UN-REDD Programme
The Programme currently supports 44 partner countries spanning Africa, Asia-Pacific and Latin America, of which 16 are receiving support to National Programme activities

UN-REDD Programme

Myanmar Joins the UN-REDD Programme December 2011

Thank you for your kind attention

Oh kun = **Arigatou**

1

A/R CDM PROJECTS IN VIETNAM: EXPERIENCES, LESSONS LEARNED AND RECOMMENDATIONS

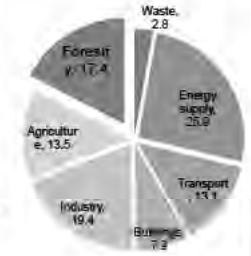
—To Realize Sustainable Forest Management in Forest Carbon Project—

Makino YAMANOSHITA
Policy Researcher,
Forest Conservation Group
Institute for Global Environmental Strategies (IGES)
yamanoshita@iges.or.jp

2

Important role of forest sector in climate mitigation

- Emission from deforestation in tropical regions: 3 billion tCO_2/yr
  - Total emission from Japan = 1.3 billion tCO_2/yr
- Reducing emission from deforestation in tropics is essential for the climate mitigation



Sources of global GHG emission by sector (IPCC 2007)

3

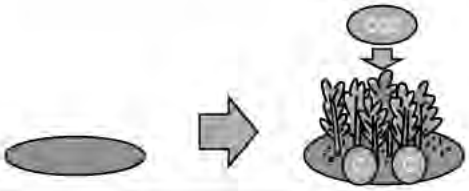
Role of the forest in Climate Change

- Forest provides a variety of services
  - biodiversity
  - providing timber, food, medicine
  - regulating water cycle, purification of water
  - Carbon sequestration
- Afforestation, reforestation (A/R) & forest conservation projects in D-ing countiries have long been implemented in the context of development & environment protection and supported by the ODA
- Recently, the function of Carbon sequestration is focused
- Those activities are implemented in the context of climate change mitigation as forest carbon projects

4

Afforestation and Reforestation

- Expansion of the forest area by planting trees = expansion of Carbon sink
- Contributing to reduce CO_2 in the atmosphere and store Carbon as long as the plantation exists



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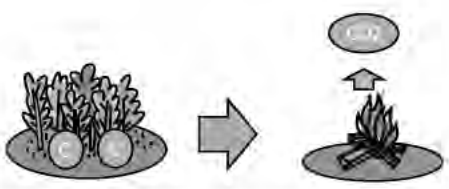
Deforestation and forest degradation

- Clearing the existing natural forests = loss of Carbon sink and emitting Carbon in the forest to the atmosphere
- Reducing deforestation and forest degradation contributes to the climate mitigation



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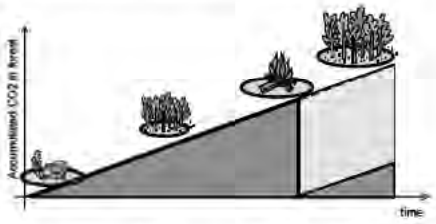
The longer the forest sustains, the larger it contributes to the climate mitigation



- We need forests which is managed & accumulates Carbon for long time for the climate mitigation

7

Risks to be avoided for climate mitigation

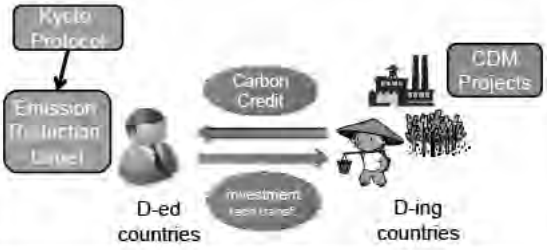
In the forest carbon project mechanism, the issue was identified as RISK.

- Non permanence risk
  - The CO_2 accumulated in forest would be released later
  - by fires, by land use conversion
- Leakage risk
  - Another new emission would be caused by the project implementation
  - by displacement of activities (grazing, slash and burn)

8

CDM based on market mechanism

- The Kyoto Protocol of the UNFCCC allows to include A/R activities in the Clean Development Mechanism (CDM)



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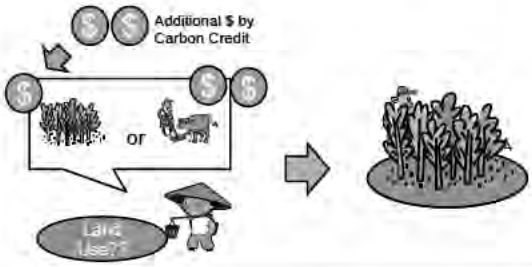
Economic incentive for A/R activities

- Economic incentives may change the behavior of the people
- The benefit from Carbon attracts people to plant trees
  - Changing the decision on land use



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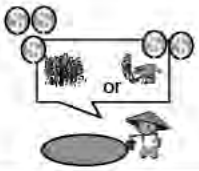
Assumption in the A/R CDM

- We believe that the local people plants trees and manage the forest when enough economic incentive from the carbon credit is provided

But... Is it true??



11

Case study in a small scale A/R CDM project in Vietnam

A registered small scale A/R CDM project in Cao Phong, Hoa Binh, Vietnam

- JICA supported the project from development to registration
- An NPO manages the project
- A private company supported the project financially for their social responsibility

12

Cao Phong A/R CDM Project

Project participants	Forest Development Fund (NPO) (established by Cao Phong DPC and Vietnam Forest University in April 2008)
Registration	26 April 2009
Methodology	AR-AMS0001 / Version 04.1
Credit and credit period	tCER, 16 years
Planting area	308.5 ha
Land use before project	Degraded production forest land allocated to local farmers
Households participated	310 households
Brief history	• Formulated under JICA Development Study "Capacity Building for AR-CDM Promotion in Vietnam" (Oct. 2006 – March 2009) • JICA also provided fund for project validation by DOE • Honda Vietnam donates fund for project implementation (VND 3.5 bil. = US$200,000)
Present status	• Planting activities started in 2009 and achieved 135ha • Remaining area (173.5 ha) will be planted in 2010

Brief History of Cao Phong Project

2007	• JICA Project started
2008	• Project design completed
2009	• Project registered to UN & JICA PJT ended • Honda Vietnam's support & tree planting start
2010	• Tree planting
2011	• Tending
2012	• Tending

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Project Area before planting (2008)

15

Current situation (2012)

17

18

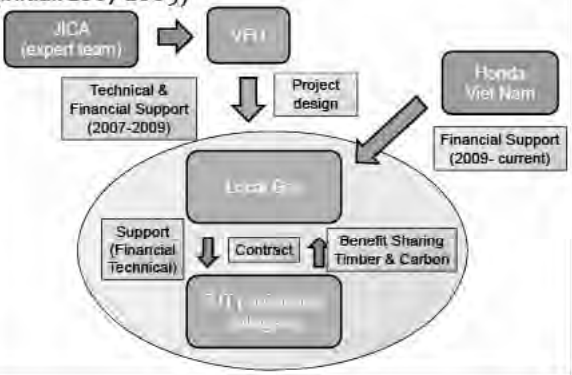
Current project status
- Planted area -

	Area (ha)
Planed planted area	309.0
Actual planted area	217.0 (70 %)
Unplanted area	92.0
Topographical difficulty	27.7 (30%)
Unsuitable species to the site condition	28.1 (31%)
Villagers did not agree	36.2 (39%)

19

20

Institutional arrangement of the project (initial: 2007-2009)



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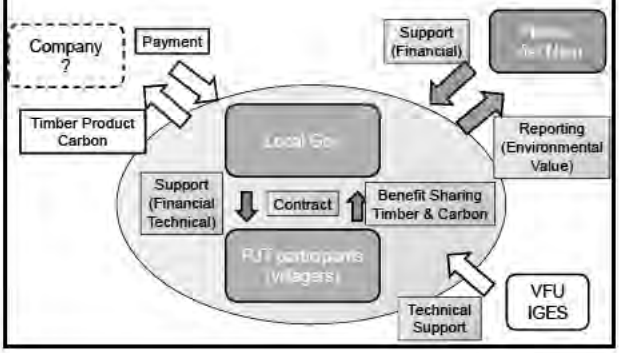
Institutional arrangement of the project (current: 2012)



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Purpose & method of the survey

Is the risk of non permanence and leakage reduced in this A/R CDM project?

What is the root cause of the risk and how can we reduce?

- The project was developed following the current A/R CDM rule which excludes the local community

Method

- Workshops and group discussion using PRA tools
- Household interviews

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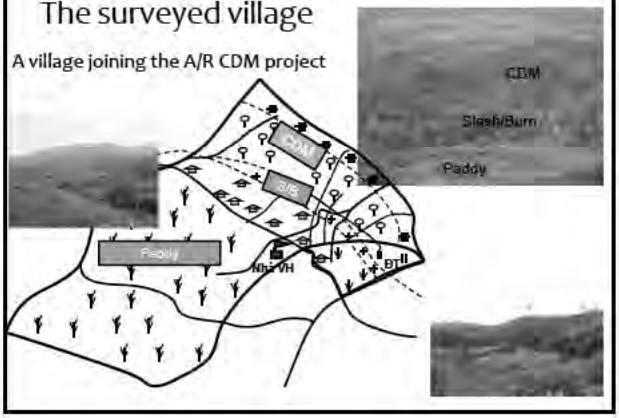
The surveyed village

A village joining the A/R CDM project



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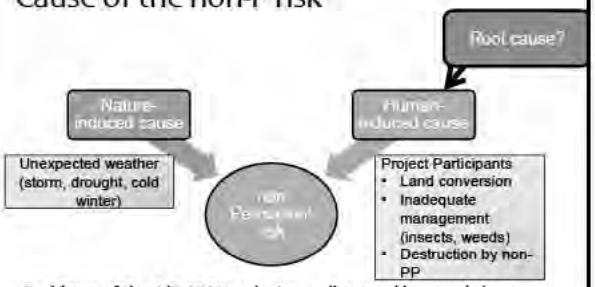
Activities in the Project Area before the A/R CDM starting

- The land use right was allocated to households
- All villagers could use the land
- Only land use right holders became A/R CDM project participants following the official land title

25

Cause of the non-P risk

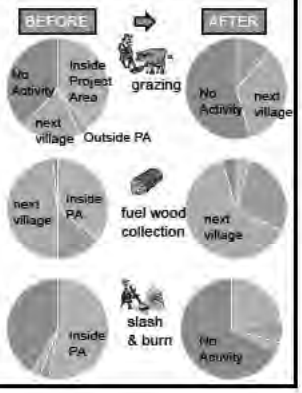


- Problems of the A/R CDM project was discussed in a workshop
- Project participants identified the risk of non permanence
- Human-induced causes can be prevented
  - root cause should be identified

26

Project caused land use change in the village

- The displacement of the activities was caused by the project implementation
  - = risk of leakage
- Livelihood of the villager was influenced by the land restriction
- Villager owed the cost of project implementation
  - Going further for grazing and fuel wood collection
  - Income reduction by giving up grazing, S&B



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Cassava slash and burn cultivation

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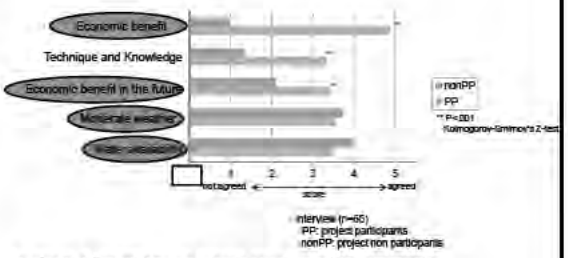
Benefit from the project



interview (n=65)
PP: project participants
nonPP: project non participants

- Ecological benefit from forest are shared in community
- Only PP receives economic benefit
- No incentive for NonPP's for Forest Management = no ownership

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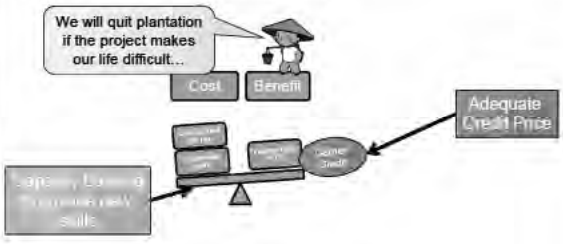
Needs of capacity building



- To ensure the sustainability, capacity building is important
- Not only the capacity building for forest management skills
- Also agriculture skills are necessary to compensate the cost they owed.

30

Capacity building for decision making

- The project development was lead by the project developer and community just followed the developer (=no ownership)
- In Vietnam, it is common that the community follows the higher authority's decision.
  - Land-use plan was developed by gov.
  - No experience in decision making among community members
- The basic ability for decision making and consensus building was lacking in the community

Capacity building for decision making is also important and necessary

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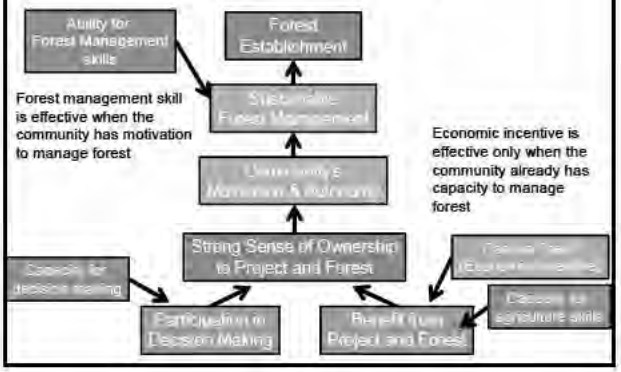
Economic Incentive + Capacity!!



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LESSONS LEARNED & RECOMMENDATIONS

33

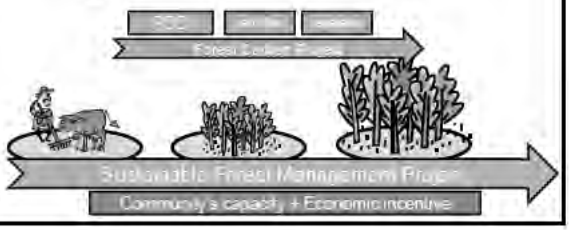
Problems in A/R CDM project development

- The complex methodology pulls the intention of the project developer to solve the methodological issues to get carbon credit rather than the issues in sustainable forest management.
  - How to write a good Project Design Document
  - How to reduce the project cost
  - How to generate credits in the economically effective way

34

But the most important part of the A/R CDM project is…

- A/R CDM is only a part (or an "add-on") of the Sustainable Forest Management Project
- Capacity building of the community is essential for the sustainable forest management
  - But A/R CDM doesn't consider about the capacity building of the community



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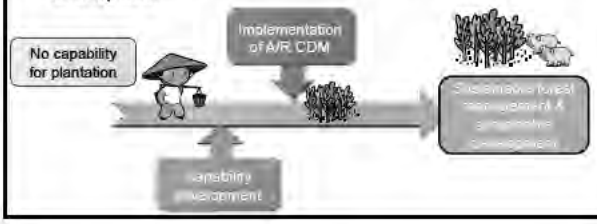
Not only forest management skills, but also capabilities to be improved in a forest carbon project

For the sustainable forest management in A/R CDM project;

- Capacity development phase should be introduced before the forest carbon project implementation phase
- Then, implementing A/R CDM with stronger economic incentive
- The capacity developed in the project will be applied to solve other problems in the future = contribution to the sustainable development



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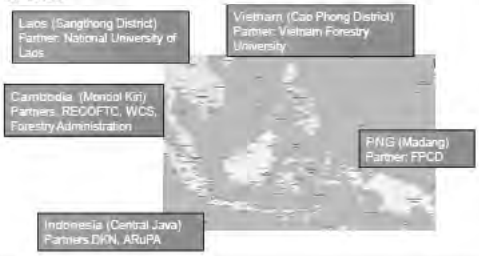
IGES
Community Carbon Accounting (CCA) project

- To develop and test approaches to engage local communities in monitoring their forest carbon stocks



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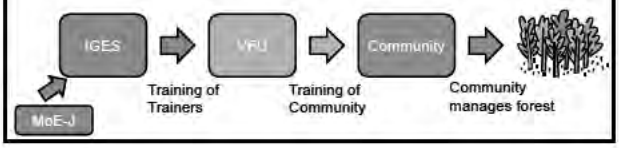
Purpose of CCA project

- The community should manage the planted forest sustainably by themselves independently
- To build capacity of local community to manage their forest
- As the first step, forest (carbon) monitoring is conducting
  - Carbon monitoring is required in the A/R CDM
  - Information on the monitoring is important for the forest management for tending, harvesting etc.



38

Training of trainers at VFU

39

Training of community

40

Measuring diameter of trees

41

Measuring tree height

42

Learning how to use the tool

43

Data recording

44

THANK YOU

45

Institute for Global Environmental Strategies (IGES)

- Forest Conservation Team, Natural Resources Management Group
- Main focus; REDD+, community forest management, illegal logging issues
  - REDD+ database
  - Community Carbon Accounting
  - Training manual for FPIC trainer

Visit our web site
http://www.iges.or.jp/en/fc/index.html

Forestry in Myanmar

Forest Department
Ministry of Environmental Conservation and Forestry

12th November, 2012

1

Outline of the presentation

- Introduction
- Myanmar Forest Policy
- Organizational structure of MOECAF
- Forest resource base and forest management system
- Forest conservation in upland areas
- Mangroves in the coastal areas
- Issues
- Conclusion

2

Country Profile

- **Location**
  - Latitudes = 9° 58′ to 28° 29′ North
  - Longitudes = 92° 10′ to 101° 10′ East
- **Area**
  - Total land area = 676,577 km²
  - Length (north to south) = 2,090 km
    Maximum width (west to east) = 805 km
- **Rainfall**

  Minimum rainfall = 500 mm
  Maximum rainfall = 5, 000 mm
- **Population**
  - 58.6 million (2010)

- **Climate**
- Temperature

  25° C to 33° C (Rainy Season)
  10° C to 25° C (Cold Season)
  32° C to 38° C (Hot Season)
  43° C (Maximum Temperature)

3

Country Profile Cont.

- The topography of Myanmar can roughly be divided into three parts–
  - the Western Hills Region,
  - the Central Valley Region and
  - the Eastern Hills Region.
- About 42% of the total land area is covered with mountain and 7 out of 14 States and Regions are mountainous regions.
- 70% of total population are residing in rural areas.
- More than 12 million people, or 24% of the total population, are living in the mountainous areas.

4

Forest Policy and legislations

POLICY IMPERATIVES

New Forest Policy was formulated in 1995. It is a major breakthrough in Forestry Sector of Myanmar.

PROTECTION of soil, water, wildlife, biodiversity and environment;
SUSTAINABILITY of forest resources to ensure perpetual supply of both tangible and intangible benefits

BASIC NEEDS of the people for fuel, shelter, food and recreation;

EFFICIENCY to harness, in the socio-environmentally friendly manner, the full economic potential of the forest resources;

PARTICIPATION of the people in the conservation and utilization of the forests;

PUBLIC AWARENESS about the vital role of the forests in the well being and socio-economic development of the nation.

5

Forest policy and legislations

- The important instruments currently used for managing the forest in Myanmar are as follows:
  - Forest law (1992);
  - Protection of wildlife and wild plants and conservation of natural areas law (1994);
  - Myanmar Forest Policy (1995);
  - Community forestry instructions (1995);
  - National forestry action plan (1995);
  - Myanmar Agenda 21 (1997);
  - Criteria and indicators for sustainable forest management (1999);
  - National code of forest harvesting practices in Myanmar (2000)
  - National Sustainable Development Strategy (2009)

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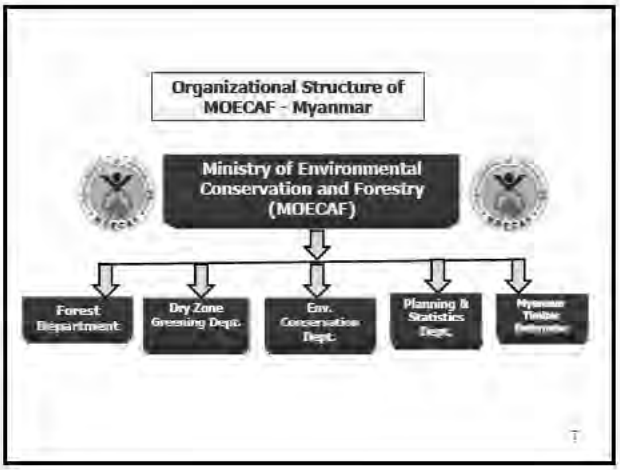


Major responsibilities

Planning and Statistics Department (PSD) is responsible for coordinating and facilitating the tasks of FD, MTE, DEC and DZGD in line with the directives laid down by the Ministry of Forestry, and acts as a forum on policy issues in forestry.

Forest Department (FD) is responsible for protection, and conservation of the wildlife and sustainable management of the forest resources of the whole country.

Myanmar Timber Enterprise (MTE) is responsible for timber harvesting, milling and downstream processing and marketing of forest products.

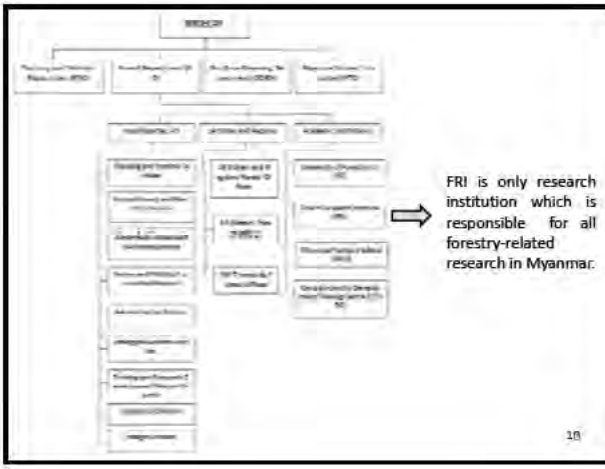
8

Major responsibilities

Dry Zone Greening Department (DZGD) is responsible for reforestation of degraded forest lands and restoration of the environment in the dry zone of Central Myanmar.

Environmental Conservation Department is responsible for environmental conservation and Rehabilitation

9



FRI is only research institution which is responsible for all forestry-related research in Myanmar.

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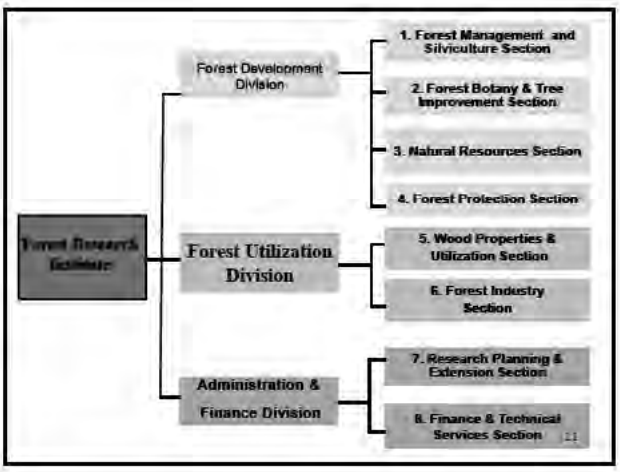


Forest resource base – conservation of natural forests

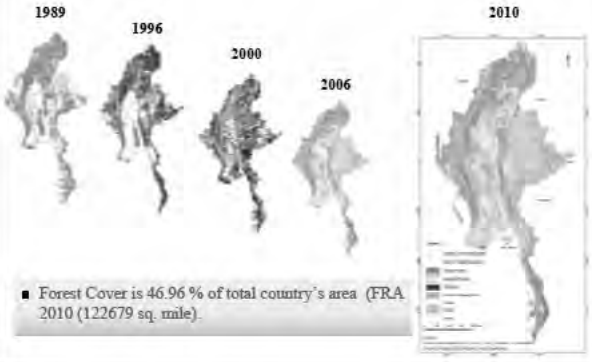
Permanent forest estate (PFE)

Legal classification	Area (km^2)	% of land area
Reserved forest	121,842.91	18.00
Protected public forest	40,949.60	6.05
Protected area system	35,106.85	6.67
Area of PFE	197,899.36	30.73

Source: Forestry in Myanmar, 2011

12

Forest Cover Change in Myanmar



- Forest Cover is 46.96 % of total country's area (FRA 2010 (122679 sq. mile).

Protected Area System (PAS) in Myanmar

1. Khakarborzi NP
2. Tamanthi WS
3. Pidaung WS
4. Chatthin WS
5. Minwun-Taung WS
6. Shwe-U-Daung WS
7. Alaungdaw-kathapa NP
8. Pyin-Oo-Lwin WS
9. Mingon Taung WS
10. Lawkanandar WS
11. Natmataung NP
12. Wethikan WS
13. Shwesettaw WS
14. Popa NP
15. Padalingu WS
16. Taunggyi WS
17. Inle Lake WS
18. Loimowe WS

Protected Area System (PAS)

19. Parsar WS
20. Rakhine-Yoma elephant range
21. Thamihla Kyun WS
22. Mainmahla Kyun WS
23. Hlawga WP
24. Moyingyi WS
25. Kelatha WS
26. Kyaikhtiyo WS
27. Kahilu WS
28. Mulayit WS
29. Mosoos Island WS
30. Lampi Marine Park
31. Indawgyi WS
32. Kyauk Pan Taung WS
33. Hponkan Rzai WS
34. Hukaung Valley WS

Major forest types

No.	Types of Forests	Area (,000 ha)	% of Total Forest Area
1.	Mangrove forest	467.33	1.47
2.	Tropical evergreen forest	5,470.60	17.22
3.	Mixed deciduous forest	12,157.30	38.26
4.	Dry forest	3,114.71	9.80
5.	Deciduous Dipterocarp (Indaing)) forest	1,321.87	4.16
6.	Hill and temperate evergreen forest	8,541.19	26.88
7.	Scrub land	700.00	2.21
	Total	31,773.00	100

Forest Management

- MOECAF has a long history in forest management dating back to 19 century.
- **Myanmar Selection System** (MSS) has been practiced for the sustainable management of forest resources of Myanmar.
- C & I for SFM – 7 Criteria and 51 Indicators at the National Level
- In 2001, Myanmar formulated a **30-Year Forestry Sector Master Plan** and FD has been implementing according to the guiding principles of Master Plan.

Plantation forestry

1856 Small scale plantation initiated using Taungya method
1941 The extent of plantations reach 47,167 ha
1980 Large scale plantations began
1984 Annual plantation target reached 32,000 ha
1998 Special teak plantation programme was launched to increase timber production

Private teak plantations and non-teak commercial plantation programme started 25-12-20 06. Up till March, 2010, 13,127 ha and 16,220 ha of teak and non-teak private plantations have been established, respectively.

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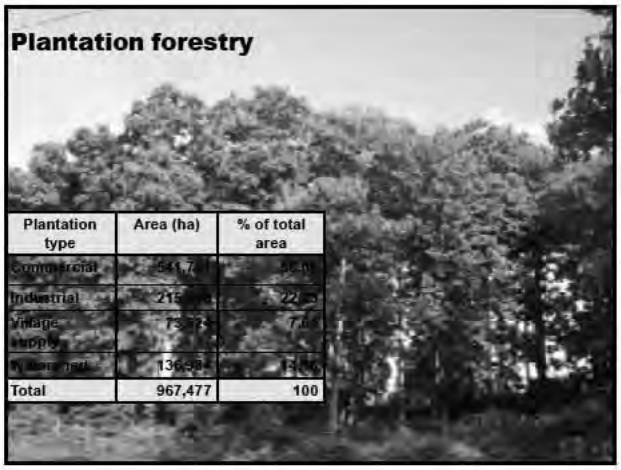
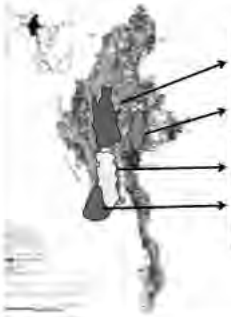
Plantation forestry



Plantation type	Area (ha)	% of total area
Commercial	541,7	[illegible]
Industrial	215	22
Village woodlot	15,3	7,0
Fuelwood	136,9	13,0
Total	967,477	100

National-Level Large-scale Reforestation Zones



Central Dry Zone: Rainfall 700 mm/yr	Desert-like formation and land degradation
Upland Watershed Zone: Rainfall 1473/yr	Serious soil erosion
Bago Yoma Zone: Rainfall 1993 mm/yr	Rapid deforestation
Mangrove-Delta Zone: Rainfall > 3500 mm/yr	Natural disaster and livelihood

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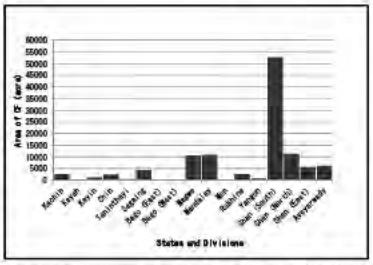
- Community Forestry Instructions (CFI) were issued in 1995 allowing the local people to participate in forest management activities.



Total area of community forests = 102,402 acre (41,458 ha)
Total members of forest user groups = 39,298

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Watershed management and potential groundwater resources in Myanmar

Sr.	River basin name	Catchment area (km^2)	Water amount (km^3)
1.	Chindwin	115300	57,58
2.	Ayeyarwady (Upper)	193300	92,60
3.	Ayeyarwady (Lower)	95600	153,25
4.	Sittoung	48100	28,40
5.	Rivers in Rakhaing State	58300	41,77
6.	Rivers in Tanintharyi division	40600	39,28
7.	Thanlwin (in Myanmar)	158000	74,78
8.	Mekong (in Myanmar)	28600	7,05
	Total	737800	494,71

Source: State of water Myanmar, Water Environment partnership in Asia, www.waterpartnership.com

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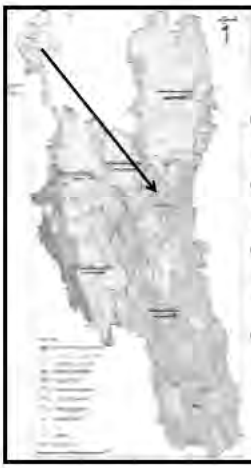

Watershed Conservation and Forest Management in Upland Regions

- About 42% of the total land area is covered with mountain and 7 out of 14 States and Regions are mountainous regions.
- For conserving soil and water, establishment of watershed plantation is one of the strategies adopted in NFMP.
- From 2001-2002 to 2009-2010, a total of 64,443 ha of watershed plantation has been developed with an annual average of 7,160 ha. by Forest Department.
- Watershed areas of Inle Lake in Southern Shan State is one the most important upland areas of Myanmar.

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The project focused on:
- ❖implementation of sustainable land-use practices,
- ❖development of agro-forestry systems,
- ❖Inle Lake Watershed conservation and income generation activities for the local people.

Recently, a five-year plan, namely, **"Environmental Conservation and Sustainability of the Inle Lake"** has been formulated for 2010-11 to 2014-15 and implementing by the MOECAF in cooperation with concerned Ministries, UN organizations, NGOs and all relevant stakeholders.

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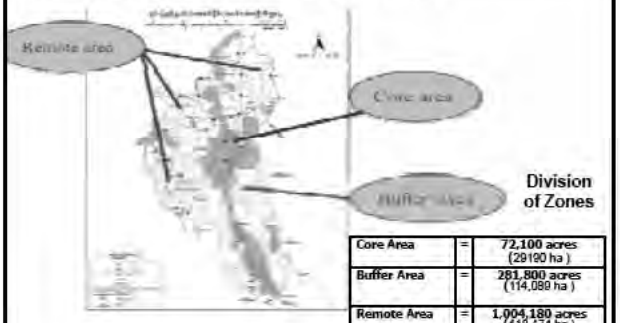
Upland Reforestation and Rural Development Activities Southern Shan State (Inle Watershed Area)

Contour Planting in sloping areas

Soil conservation plantation established in 1978.

Zoning of Inlay Lake Watershed Upland Areas



Division of Zones

Core Area	=	72,100 acres (29190 ha)
Buffer Area	=	281,800 acres (114,089 ha)
Remote Area	=	1,004,180 acres (418,174 ha)
Inlay Lake Watershed Area	=	1,358,080 acres (550,000 ha)

Inlay lake and its conservation

Major activities being carried out in the upland areas of Inle Lake watershed areas:

- ❖Conservation of watershed area, drainage system management and maintenance of water surface area
- ❖Gully erosion and sedimentation control
- ❖Awareness raising, capacity building and technical cooperation
- ❖Conservation of biodiversity and ecosystem
- ❖Development activities of socio-economic condition of local communities
- ❖ Combating shifting cultivation through sustainable land-use practices, and participatory approach

Mangrove in Myanmar

- Mangrove forests are of the fundamental natural resources found in coastlines throughout tropical and subtropical regions of the world.
- In Myanmar, mangroves occur extensively in three geographical regions namely, Taninthayi Division, Yakhine State and Ayeyarwaddy Delta.
- Along the coastline of the country, these mangrove forests serve as the link between inland and marine ecosystems.

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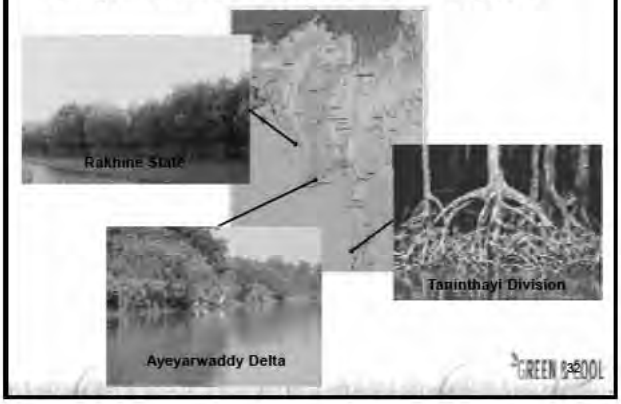
Mangroves in three geographical regions



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Mangrove in Myanmar Cont.

- **The Ayeyawady Delta** covers an area of 33,670 km² and is composed of a large network of creeks, streams and rivers.
- Due to its low altitude (maximum 3 meter above sea level), this region is frequently flooded by tides and rains during the rainy seasons.
- The tidal action in the Delta region together with various other conditions constitutes an ideal ecological environment for mangrove vegetation.
- In Myanmar, Ayeyawady Delta alone, therefore, encompassed about 2,500 km² of mangrove forest in the past.

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Mangrove in Mainmahla wildlife s anctuary before Cyclone Nargis

Mangrove in Mainmahla wildlife sa nctuary after Cyclone Nargis

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Vicious Circle

Mangrove destruction in Ayeyawady Delta

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Multiple use nursery office

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Issues and challenges

Even though Myanmar has a long experience in forest management since the start of 19 century, to fulfill the objectives of the SFM in the country is a long way.

Long-term actions are needed in addressing the threats to forest ecosystems.

Threats included are:

- Unsustainable development processes at local levels causing conversion, degradation and depletion of the natural forest environment.
- Weakness in coordination, overlapping jurisdictions and often conflicting interests in forest management, resulting in development processes which impact negatively on forest ecosystems.
- Weak governance at every level, resulting in a failure to implement and enforce forest policies and laws effectively.

Issues and challenges

- Unequal sharing of benefits accrued from forest ecosystems among relevant stakeholders causing increasing inequity among local populations.
- Insufficient and belated performance for reforestation and restoration, rendering further depletion and degradation of the forest ecosystems.
- Gaps in capacity, knowledge and empowerment among forest ecosystem managers and users, resulting in conservation and development efforts fail to maximize positive social, economic and ecological impacts.

Conclusion

With the long tradition in forest Management,

- Myanmar is striving to sustain its valuable forest resources.
- National forest policy focusing on the SFM has been in place since its promulgation in 1995.
- To achieve national goal of SFM, forest legislations were reviewed and revised. NFMP has been reviewed and reformulated in accordance with changing situations.
- Also management plans at FMU level were reviewed and revised in line with SFM concepts.
- In order to monitor, assess and reporting on SFM, Myanmar has developed its own C&Is and is actively participating regional initiatives such as MAR-SFM and Timber Certification.

National Forest Policy Adaptive to CC: A/RCDM & REDD+ in Myanmar

Win Myint
Assistant Director
Forest Research Institute

Training Seminar on A/R CDM and REDD+ in Myanmar,
Central Forestry Development Training Centre, Hmawbi
12 – 15 November, 2012

1

Contents

- Introduction
- Brief on CDM & REDD+
- Adaptive measures of Myanmar: (Policy, Legal, Institutional Framework)
- Forest Resources (Natural Forests, Plantations)
- Discussions
- Conclusion

2

Introduction

- Regardless of monetary incentive mechanism and technical matters for carbon measures - forest conservation in sustainable manner has been an age-old conventional practice for Myanmar.
- Thanks to well known Myanmar Selection System (MSS), Myanmar has stood with a pride of about 50 percent forested country for centuries in the region

3

Brief on Global Climate Change Issue

- 1992 Rio Earth Summit
- 1994 UNFCCC (to stabilize GHG emissions at a level not to be harmful global climate system)
- COP: conferences (1995 Berlin COP1 to..2010 Cancun COP16)
- 1997 Kyoto Protocol (COP3)
  - Annex 1-countries(38 industrialized)- (contribute 61.6% of global GHG emission) first committed..
  - To reduce emission down to the level of 5.2% below their 1990 (base yr) emission...between 2008 – 2012
  - by means: (i)Intl Emission Trade (IET), (ii) Joint Implementation (JI) and (iii) CDM

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CDM: Clean Development Mechanism

- Various sectors in CDM: Industry, Energy, Transport, Construction, Agriculture, Forestry ... so on.
- Forestry sector: A/R CDM (Afforestation/Reforestation)

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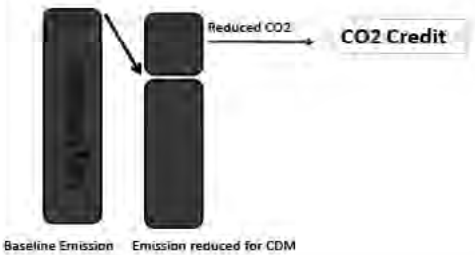
Concept of CDM



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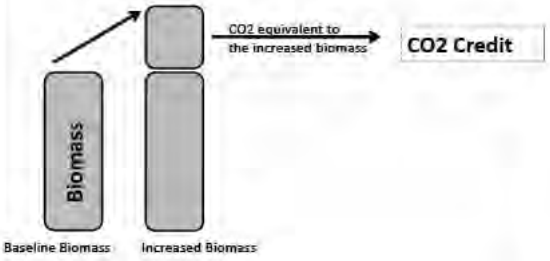
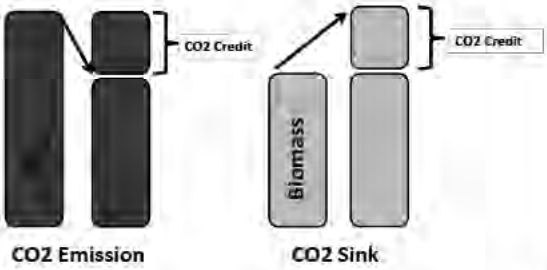
Brief on REDD+

- R • Reducing
- E • Emission
- D • Deforestation
- D • Forest Degradation
- + • Forest Conservation: SFM, A/R

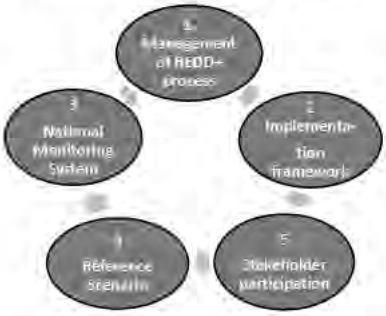
Concept of REDD+



Concept of CDM vs REDD+



Components of REDD program



Adaptive measures of Myanmar

- As for the national structure for REDD+, already existing national structure, which are attributable to success story of forest conservation should be taken into account.
  (a) legal framework
  (b) management system
  (c) institutional arrangement
  (d) forest resource,

Regulatory Framework

1. Forest Policy - (1995)
2. Forest Law (1902)- (1992)
3. Myanmar Agenda 21 (1997)
4. Protection of wildlife and wild plants and conservation of natural areas law (1936) - (1994)
5. National Forest Master Plan for 30 years; 2000-01 to 2030-31
6. National code of Practice for forest Harvesting
7. Community Forestry Instructions (1995)
8. Criteria and Indicators (C&I) for SFM
9. Forest Management Plan for FMU (district) level.

Regulatory Framework: Myanmar Agenda 21

- Myanmar Agenda 21 was formulated reflecting to the call of the Earth Summit.
- It gives special emphasis on sustainable forest resources management in Chap 14 and biodiversity conservation Chap 15.
- The following programme areas to solve forestry related issues could be well adapted to REDD+ components no. 1 and 2.

Regulatory Framework: Myanmar Agenda 21

- Accelerate sustainable development of forest resources (para 14-1)
- Develop the forestry sector to meet basic needs (para 14-2)
- Promote efficiency in the production of forestry goods and services (par 14-3)
- Strengthen forestry policies legislation and institutions (para 14-4)
- Enhance people's participation in forestry development and management (para 14-5)
- Strengthen protected area planning and management (para 15-1)
- Conserve biodiversity (para 15-2)

Regulatory Framework: Myanmar Forest Policy

- Myanmar Forest Policy (1995) has originated from the Indian Forest Policy (1894) and has developed in a way that to solve situational issues case be case.
- In fact, principle of Myanmar forest policy has been more on conservation of forests and biodiversity than merely production.

Regulatory Framework : Myanmar Forest Policy

- **Six imperatives in turn support basic requirements for REDD components.**
- **Protection –natural resources; forest, soil and water, ecosystems, biodiversity**
- **Sustainability – maintenance and rational use of natural resources**
- **Basic Needs – providing forest products and services to the people**
- **Efficiency – harnessing the full economic potential of the forest while controlling socio-environmentally side effects**
- **Participation – enlisting active participation of people in national and local efforts**
- **Public awareness – decision makers and stakeholders**

Regulatory Framework: reference to ASEAN common position

- With respect to the views of ASEAN common position (Submitted to COP 16) on the fact-
- to take account the social and environmental safeguards, to ensure the rights of forest dependents, etc.,
- Forest Law (1992) has already encompassed in its basic principles as follows;

Indigenous and Local Community Safeguards

- Since long time before, Myanmar Forest Act (1902) acknowledged the rights and privileges of local people when ever forest reservation was made. Thus, existing Myanmar Forest Law (1992) has also clearly mentioned in the section 6 (b) as follows:

"The Minister shall in respect of constituting a reserved forest appoint a forest Settlement Officer to inquire into and determine in the manner prescribed the affected rights of the public on the relevant land and to carry out demarcation of the reserved forest."

Regulatory Framework: rights and privilege of local people

- to safeguard livelihoods of local people, their rights and privilege are identified and notified since beginning of the process to constitute a reserved forest (para 6 – b, c, d).

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Forest Management System

- Myanmar Selection System
- Forest Management Plan
- Elephant Logging
- Rafting

20

Forest Management System: Myanmar Selection System

- The principle forest management applied in managing the natural forests in Myanmar since 1856.
  1. Prescribed girth limit
  2. Annual allowable cut
  3. 30-year felling cycle

  are control measures **to ensure harvesting timber in sustainable basis.**

The essence - **harvesting only increment** and **leaving the capital** without being compromised, is very in line with REDD+ incentive.

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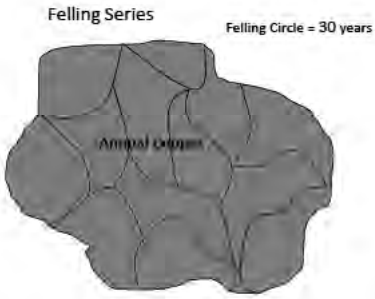
Felling Series



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Myanmar Forest Management

- Forest districts (Forest Management Unit)
- Management Plan or Working Plan
- Revised in every 10 year.
- Altogether 62 forest districts are managed under respective management plans.
- Forests in a district, in order for effective management, are formed into working circles (WC);
  - production WC
  - plantation WC
  - local supply WC
  - watershed WC
  - non-wood forest WC.

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Myanmar Selection System: Least Impact Logging

- Myanmar is a single country being practicing elephant logging : skidding and
- Rafting in transportation of logs are the common practices.
- About 3000 elephants are working for timber harvesting through out the country.
- Elephant logging has been recognized as the least impact logging system and thus would be a potential attributable to successful REDD+ program.

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Institutional Arrangement

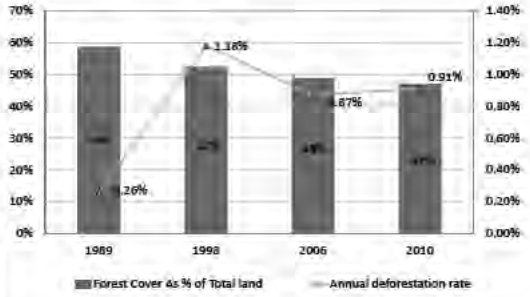
- Under the Ministry of Forestry, the following institutions are responsible for implementing the Myanmar forest policy.
- Planning and Statistic Department (PSD)
- Forest Department (FD)
- Myanmar Timber Enterprise (MTE)
- Dry Zone Greening Department (DZGD)

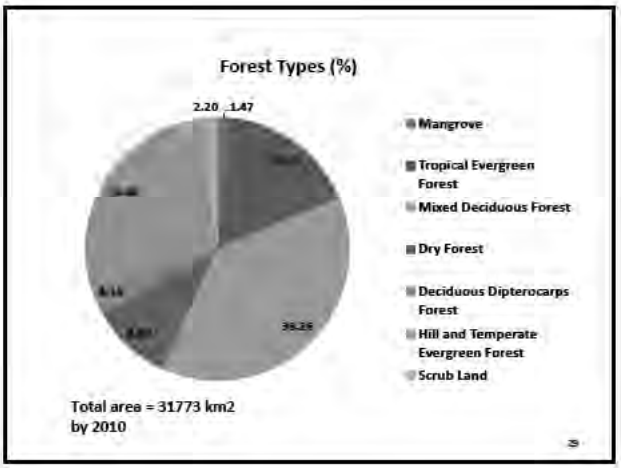
Dry Zone Greening Department (1997)

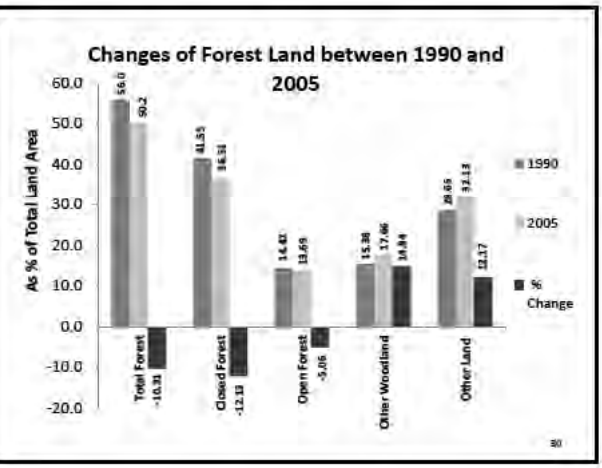
- four major tasks assigned to the DZGD are as follows:
- (i) Establishment of forest plantations for local supply and greening;
- (ii) Protection and conservation of remnant natural forests;
- (iii) Promotion of woodfuel substitution; and
- (iv) Development of water resources.

Forest resources: Natural Forests

- **Permanent forest estates** (PFE) 176,254 km2
  - Reserved forests (RF) 121,911 km2
  - Protected public forests (PPF) 35,248 km2
  - Protected areas sytem (PAS) 19,095 km2
  - ➢The policy objective: RF 30 % and PAS 10% is being striving by the FD. These categories are strictly controlled and thus have high potential to carbon storage .
  - ➢PPF are also important role as an buffer zones to the RF and as an source of basic needs, offering much more rights and privilege, to the rural people. For the sake of the interests of the rural people, PPF are also should be taken into account in REDD process.







Forest Resource: Plantations

- It is asserted in the 1995 Myanmar Forest Policy that existing natural forests will not be substituted with forest plantations.
- Due to the rapid deforestation, large scale plantation forestry began in 1980s on the degraded forests.
- Four types of forest plantations under the annual plantation programme of about 30,000 ha. This extensive annual forest plantation programme would be a potential to be integrated into REDD+ programme.

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Types of Forest Plantations

Total area 967,477 ha by 2010

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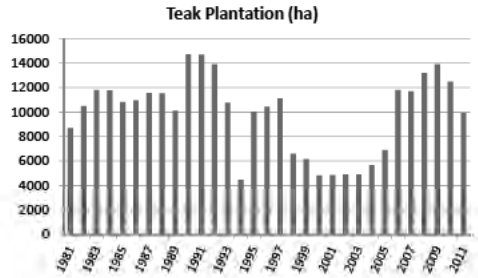

Total area (305,720 ha) with annual planting rate (9862 ha)
MAI : Planted teak at 23 yrs old = 7.38 m3/ha*
Natural Teak = 0.29 m3/ha **
* Win Myint (2011)
** Dr. Kyaw Tint

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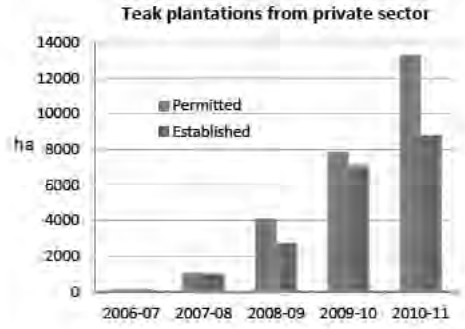

19,705 ha has been established

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Discussion: Issues in Forest Conservation

- Excessive logging
- Fuel wood collection
- Land use changes in forest reserve area:
  - Shifting cultivation
  - Encroachment for agriculture land
  - Establishment for shrimp, fish ponds
  - Expansion of Salt pans
  - Human Settlement
- Land use conflicts
- Poor awareness of communities forest conservation

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Discussion: Drivers to Deforestation and Degradation

- Lack of comprehensive land use plan
- Limited capacity for planning and implementation of participatory management plan (coordination relevant organizations and authority and local community)
- Poverty of local people
- Weak law enforcement
- Inaccessibility
- Insufficient finance

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Discussion: Status in particular preparation for REDD+

- Some modifications in exiting structure and programme are needed to be suited for REDD-plus. Major areas in needs of modification in existing national programme are;
- Human resource development, capacity building
- Credible policy
- Secure finance
- Comprehensive master plan

Status in particular preparation for REDD+: other Recommendations

- Livelihood substitutions for local people
- Enhance pubic awareness
- Strengthening the coordination and cooperation inter-sectoral organizations
- Formulating the integrated management plan with participation by all stakeholders
- Strengthening law enforcement
- Strengthening institutional arrangement and capacity building
- Promoting collaboration with NGOs and INGOs

Conclusion

- In the context of REDD-plus mechanism, Myanmar, although in its early stage
- With her historical successful forest and nature conservation experiences
- Ready to make concerted efforts in collaboration with regional and international programme to achieve a common goal of to combat climate change.

Thank You for Your Kind Attention

12th Nov. 14:00~15:30

Capacity Building Seminar on
A/R CDM and REDD+ in Myanmar

Methods for Monitoring and Estimating of Forest Carbon Stocks

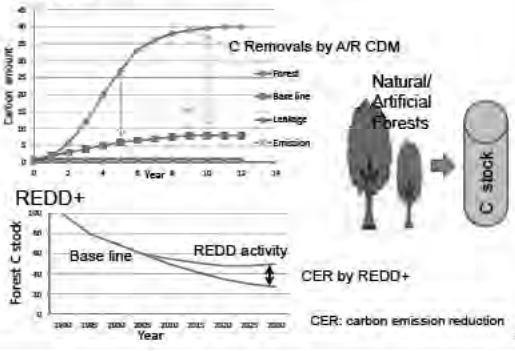
By Tokunori MORI

JIFPRO

Contents

Ⅰ. Introduction
Evaluation of forest as Carbon pools

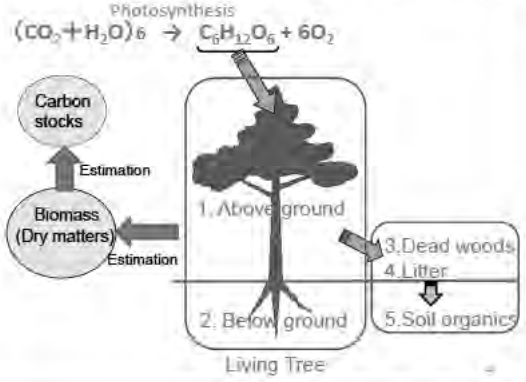
AR CDM



REDD+

CER: carbon emission reduction

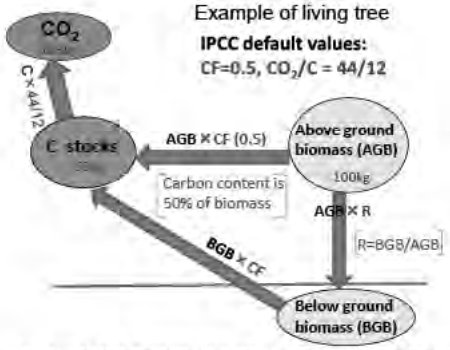
Carbon Pools of Forest 5 carbon pools



Ⅱ. Carbon stock estimation from biomass

Example of living tree

IPCC default values:
CF=0.5, CO_2/C = 44/12



R ratios vary with tree species, tree ages, and climatic conditions

Estimation of Living Tree Biomass

1. Above ground biomass (AGB)

A. Direct Method: Allometry equation
Example: $AGB = a \times (DBH)^b$ (kg/tree)

B. Indirect (BEF) Method:
① Estimation of stem volume (SV)
② SV (m^3) × Wood density (WD) (ton/m^3) × BEF = AGB (ton/tree)

(BEF is ratio of AGB/stem biomass)

2. Below ground biomass (BGB)

BGB = AGB × R (R is ratio of BGB/AGB)

WD, BEF & R are default values specific to species, climatic conditions etc.
Reference: IPCC Good Practice Guidance for LULUCF, Chapter 3, 2003.

Estimation of Carbon and CO2 stocks from tree biomass

1. Carbon stocks of above and below ground biomass
   AGC= AGB ×0.5 (CF: carbon factor) (kg C/tree) *
   BGC= BGB ×0.5 (CF: carbon factor) (kg C/tree)

2. Total Carbon stocks = AGC + BGC (kg C/tree)
   When it is no need to separate AGC and BGC,
   Total C Stock= AGB × (1+R) × CF

3. CO_2 stocks of trees (kg CO_2/tree)
   CO_2 stocks = Total C stocks × 44/12 (Ratio of CO_2/C)

* When indirect method is used, unit is ton C/tree

A. Calculation example of direct (allometry equation) method

Table: Monitoring data of sample plot

No. of trees	DBH (cm)	Height (m)	AGB (kg/tree)
1	10	11	29.36
2	12	13	44.92
3	14	15	64.46
4	16	15	79.82
↓	↓	↓	↓
Total			1,000.00

$AGB = 0.1083 \times (DBH^2 \times H)^{0.800}$

AGB (kg/plot)

If plot area is 500m²,
1,000(kg/plot) × 10,000(m²)/500(m²) = 1,000 × 20 = 20,000 (kg/ha) = 20 (ton/ha)
AGB 1ha Plot area

AGC stocks = 20 × 0.5 (CF)= 10 (ton/ha), then Total C stocks = 10 × (1+R)

Example of Allometry equations

Use relationships between tree biomass and tree size
Tree sizes are generally DBH (cm), Tree Height (m), and,
in some cases, Wood density, Basal area and combination of them
Equation is species specific but can expand to similar life or forest types

Example:

$AGB = 0.0930 \times (DBH^2)^{1.255}$	(*Tectona grandis* in Thailand)
$AGB = 0.1123 \times DBH^{2.416}$	(4 BL forests in central Japan)
$AGB = 0.1266 \times (DBH^2)^{1.201}$	(8 tropical planting tree species)
$AGB = 0.1083 \times (DBH^2 \times H)^{0.80}$	(Secondary forest, humid tropics)
$ln(AGB) = -1.265+2.009 \times ln(DBH)+1.7 \times ln(WD)$	(Mangrove)
$AGB = exp\{-1.996+2.32 \times ln(DBH)\}$	(BL tree, dry tropics)
$AGB^* = 6.8711 \times BA+0.7672$	(100 forests of 19 tropical and 3 subtropical countries)

Dimension of AGB is kg/tree in general. Only AGB* is ton/ha, BA is m²/ha.

B. Indirect Method

First step: Estimation of stem volume from field data

Example of pine forests

10 year old				15 year old			
No.	D	H	SV (m³)	No	D	H	SV (m³)
1	16.4	12.3	0.124	1	19.2	17.1	0.221
2	17.5	13.3	0.149	2	20.5	18.3	0.265
n	-	-	-	n	-	-	-
Total			5.50				10.00

D:DBH(cm)
H:Height(m)

Plot area: 500m²

$SV(m^3/tree) = 0.000085 \times (D^2 \times H)^{0.899}$ Equation for *P. kesiya* in Philippine

SV (m³/ha) at 10 yr: 5.5(m³/plot) × 10,000/500 = 110 (m³/ha)
SV (m³/ha) at 15 yr: 10.0(m³/plot) × 10,000/500 = 200 (m³/ha)
Volume increment for 5 yr. : 200-110 = 90 (m³/ha)
PAI :90/5=18 m³/ha.yr

Step 2: Biomass and Carbon stock estimation after stem volume estimation

Example of SV increment for 10 to 15 years in *P. kesiya* forest.
Stem volume: 90m³/ha. If WD:0.45, BEF:1.24, R:0.26;

1) Above ground biomass by BEF method
   90m³/ha × 0.45(WD) × 1.23(BEF) ≒ 50.2 ton/ha
2) Total C stock of tree
   (50.2 × (1+0.26(R)) × 0.5(CF) ≒ 31.6 ton C/ha
3) CO_2 of trees
   31.6 × 44/12 ≒ 116 ton CO_2/ha

★ Annual CO_2 : 116 ton/5 years ≒ 23.0 ton CO_2/ha·yr.

General range of Annual CO_2 stocks: 10~30 ton CO_2/ha·yr of planted forests in tropics

Example of BEF, R, WD in inventory report of Japan

	Species	BEF ≦ 20D	BEF > 20D	R	WD
Conifers	*C. japonica*	1.57	1.23	0.25	0.31
	P. densiflora	1.63	1.23	0.26	0.45
	L. kaempferi	1.50	1.15	0.29	0.42
	Foreign Sp.	1.41	1.41	0.17	0.32
Broad-leaved	*F. crenata*	1.58	1.32	0.26	0.57
	Populus sp.	1.33	1.18	0.26	0.29
	Mixed Sp.(Central)	1.37	1.37	0.26	0.47
	Foreign sp.	1.41	1.41	0.16	0.66

20D: 20cm DBH

Some examples of BEF, R, & WD listed in GPG for LULUCF (IPCC 2003)
Tropical pine: BEF1=1.2, BEF2=1.3 Tropical broadleaf: BEF1=1.5, BEF2=3.4
Tropical primary forest: R=0.24, Tropical dry forest: R=0.27, *A. mangium*: R=0.17
P. caribae: WD=0.48, *A. mangium*: WD=0.45, *E. deglupta*: WD=0.34

Appropriateness of allometry and stem volume equations or stem volume table in case of AR-CDM

Ex-ante estimation (Before project start)

1: species-, genus-, family-specific in the host country or neighboring countries (e.g. similar edapho-climatic zone)
2: forest type-specific in the country or from neighboring countries
3: pan tropical forest type-specific such as those provided in Table 4.A.1 to 4.A.3 of LULUCF (IPCC 2003)

Ex-post estimation (Monitoring after project start)

1: Species or group-of species specific equation in similar edapho-climatic conditions and if one of following conditions is satisfied
(a) Use in national forest inventory of the host party
(b) Use in commercial forestry for 10 or more years
(c) equation derived from data based >30 trees and R^2 >0.85
2: If it dose not meet the above conditions, make equation using the data from planted trees in the project. Use the standard method indicated in methodological tool s (EB65-Annex28 and EB67-Annex24)

This order is similar to the case of choice of WD, R, BEF_2 etc.

Monitoring for REDD+ may be required the same grade of Ex-post estimation

Estimation of Change in Carbon stocks in living tree in A/R CDM

1. Stock change method
Changes of tree biomass (B) between two sample plots (temporary or permanent) data at different times.
e.g. Sample plot B_{t1} & B_{t2} at time (t_1) and (t_2).
(B_{t1}) and (B_{t2}) * CF= carbon stock C_{t1} and C_{t2}
$(C_{t2} - C_{t1})/(t_2 - t_1) = \Delta C$ <ton C/yr>

2. Increment method
Changes of tree biomass in the permanent plots between 2 verification times. Biomass change= $\Delta B = (B_{v2} - B_{v1})/(v2-v1)$
e.g. Sample plot $\Delta B * CF = \Delta C$ <ton C/yr>

3. Default method
Use default B for only trees in baseline or shrubs.
Data of B from National forest inventory, Regional/Global data like FAO data or GPG-LULUCF (IPCC)

Methodological tool for estimation of C in trees and shrubs (EB60-Annex13)

Example of default value for PDD of A/R CDM

Stem volume yield prediction table (*Acacia mangium* site II)

Age	Number	Mean Height	Mean DBH	Stem volume	MAI	CAI
year	tree/ha	m	cm	m3/ha	m3/ha·y	m3/ha·y
1	2702	3.82	3.78	11.69	11.69	11.69
2	1838	7.34	8.93	34.55	17.28	22.86
3	1284	10.24	9.50	80.31	20.10	25.76
4	1428	12.64	11.75	88.65	21.71	26.54
5	932	14.62	13.75	112.88	22.58	28.03
6	843	16.27	15.53	137.80	22.93	24.72
7	779	17.63	17.11	160.53	22.93	22.93
8	730	18.76	18.50	181.40	22.68	20.87
9	693	19.70	19.72	200.11	22.23	18.71
10	664	20.48	20.77	218.68	21.87	18.57

III. Carbon stocks of Dead wood, Litter, and Soil organics

Forest monitoring plot for dead wood, litter and soil organics in Japan

About 2,500 plots for 25 million ha forest area.
Plot diameter: 36m

Carbon stocks of dead wood, litter, and soil of forests in Japan

	Dead wood	Litter	Soil (D:30cm)
carbon (kg/m²)	0.30~0.51	0.36~0.61	5.0~8.0
carbon (ton/ha)	3.0~5.1	3.6~6.1	50~80

D: depth

Carbon stocks of dead woods by measurement

A. Standing dead wood in monitoring sample plot

A.1 Classifying of standing dead wood classes
(1) With branches and twigs, but no leaves (new standing dead tree):
→Biomass estimation method is the same as living trees

(2) Stem without branches and twigs (old dead tree stump):
a) Height (H) ≤ 4m: Diameter at middle height; D_{MID}
b) H > 4m: DBH measure, then $D_{MID} = 0.57*DBH*[H/(H-H_{DBH})]^{0.80}$
Biomass of standing dead trees in plot
Bsd = WD * (1+R) * π/4*Σ(D_{MID}^2) * H * β (t d.m./plot)
WD: basic wood density, R: Root-shoot ratio
β: wood density reduction factor
(sound=1.0, intermediate=0.5, rotten=0.25) (IPCC Reporting table)

A.2 Carbon stock of standing dead tree in a plot
$Csd_{i,plot}$ = CF * 44/12 * Bsd (tCO2/plot)

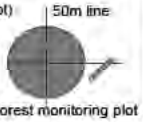
A.3 Carbon stock in a stratum
$Csd_{stratum} = A_{stratum}/A_{plot} * \Sigma_s(Csd_{plot})$ A: area
s: stratum

B. Lying dead wood(Ldw) by line transect method

Set orthogonally bisecting two lines (total ≥100m) in a sample plot
Cross at center of plot, if 50m is difficult, 2 lines apart 20m each other.
Count dead wood and measure of its diameter & decay class on the line.

$BLdw_i = WD \times \pi^2/8L \times \sum D_{L,i}^2 \times \beta_i$ — Biomass of Ldw_i (t/plot)
$D_{L,i}$: Diameter of lying dead wood on the line (cm),
L: Length of line, 100m, WD: Wood density
β_i: Reduction factor for decay class (1.0; 0.8; 0.45)

$CLdw = BLdw_i \times CF \times 44/12$ — CO2 of Ldw (t/plot)

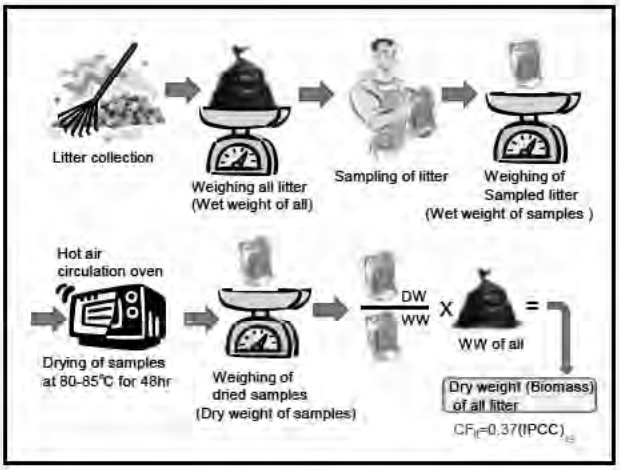


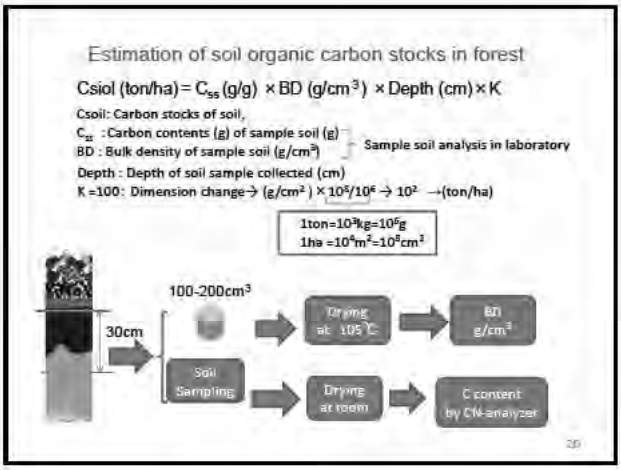
Forest monitoring plot

Carbon stock of litter

Collect litter (twigs<2cm Φ) in about 1m² sample frame which set 4 in a plot. Then combined all litter, weighing of wet litter (Blt,wet), then oven dry for dry/wet ratio(DWR), finally calculate dry weight of all litter (B_{lt})

$B_{lt} = B_{lt,wet} \times DWR$
$B_{lt,sp} = \Sigma B_{lti} \times A_{sp}/4 \cdot A_{fr}$ A_{sp}: Area of sample plot, A_{fr}: frame area
$C_{lt,sp} = B_{lt,sp} \times CF_{lt} \times 44/12$ (CO2 in a plot)
$C_{lt,st} = C_{lt,sp} \times A_{st}/A_{sp}$ (CO2 in stratum) A_{st}: Area of stratum
Notice: CF_c=0.37(IPCC) when litter biomass convert to Carbon





Estimation of C stock changes in dead wood, litter and soil organics by default method (in A/R CDM)

(A) Default values(DF) for dead wood and litter. DW: Dead wood, LT: litter

Biom	Elevation (m)	Precipitation (mm)	DF_{DW}* (%)	DF_{LT}* (%)
Tropical	<3,000	<1,000	2	4
Tropical	<2,000	1,000– 1,600	1	1
Tropical	<2,000	>1,600	6	1
Tropical	≥2,000	All	7	1
Temperate/Boreal	All	All	8	4

* % of Carbon stocks of living trees at a given year (tC yr^{-1})

(B) Default values for soil organic carbon

Not applicable land	Rate of accumulation	Applicable year
1) to 4) listed bellow	0.5 tC ha^{-1} yr^{-1}	20 year*

1) Wet land & Peat land (organics accumulated lands).
2) Land preparation (>10% of area) by slash and burn.
3) No removing of litter during project period.
4) Plowing/ripping/scarification for site preparation (>10%).

*After 20 years, no accumulation (equilibrium). No need monitoring for 0-20 yr.

Methodology and tools related to estimation of CO_2 removals by dead wood, litter and soil in A/R CDM

Approved AR CDM Methodology

☆ AR-AM0002 & AMC0001: Dead wood, Litter, Soil organics
☆ AR-AM0004, 5, 6: Soil organics
☆ AR-AMC0002: in case, Soil organics
(http://cdm.unfccc.int/methodologies/ARmethodologies/approved_ar.html)

Approved Tools

☆ Estimation of C stocks and its change in dead wood and litter (EB67, Annex23)
☆ Estimation of change in soil organic carbon stocks (EB60, Annex12)
(☆ Estimation of C stocks & their changes of trees and shrubs (EB60, Annex13))
Executive Board Meeting Record→ (http://cdm.unfccc.int/EB/index.html)

Abbreviation in carbon amount estimation of living trees

Word	Unit	
DBH	cm	Diameter at Breast Height of stem
H	m	Tree Height
BA	m^2/ha	Basal area of ha = m^2 Σba/ha
ba	m^2/tree	Basal area of a tree = π * (DBH/2)^2
Biomass	Kg or Mg	Weight of dry matter of plant body
AGB	*ibid*	Above-ground biomass
BGB	*ibid*	Below-ground biomass
AGC	*ibid*	Carbon amount of AGB = 0.5 × AGB
BGC	*ibid*	Carbon amount of BGB = 0.5 × BGB
d.m.		Dry matter
CF		Carbon factor = 0.5 (ratio of C in tree biomass)
R		Ratio of BGB to AGB
SV or V	m^3	Tree stem volume
WD	Mg/m^3	Basic Wood Density
BEF		Biomass Expansion Factor =Tree biomass/Stem biomass
44/12		Conversion factor from C amount to CO2 amount
Mg		Weight unit: 10^6g = 1,000kg = 1 ton

Abbreviation in carbon amount estimation of dead wood, litter and soil organics

Word	Unit	
Bsd	ton/tree	Biomass of standing dead wood
D_{MID}	cm	Stem diameter at middle height of standing dead wood
Csd	ton/tree	Carbon stock of standing dead wood
β		Wood density reduction factor
BLdw	ton/tree	Biomass of lying dead wood
DL	cm	Diameter of lying dead wood on transect line
L	m	Length of transect line (generally 100m)
CLdw	ton/plot	
Bl	kg/m2	Biomass of litter in sub-sample plot
DWR		Dry/wet ratio of litter
Asp & Afr	m2	Area of sub-sample plot and frame
Csoil	ton/ha	Carbon amount of soil in a fix depth layer (30cm)
Css	g/g	Carbon content of sampled soil
BD	g/cm3	Bulk density of sampled soil
DF		Default value

IV. Monitoring Procedures and Field Practice for Estimation of Carbon Stocks

1: Monitoring procedures
As base of ground survey for forest inventory

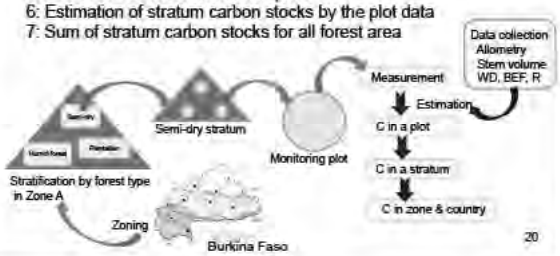
2: Field practice on 13th
+ Sample plot setting,
+ DBH, H measurement

3: Calculation of Carbon stocks by field data (afternoon, 13th)

1

Estimation of forest carbon stocks in a country

1: Zoning of similar edapho-climatic area in a country
2: Stratification by species/forest types in the zone
3: Determination of monitoring plot number by statistical method and the plot allocation
4: Measurement of the monitoring plots of each stratum
5: Estimation of carbon stocks in plots
6: Estimation of stratum carbon stocks by the plot data
7: Sum of stratum carbon stocks for all forest area



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Monitoring procedures for project scale

1) Determination of project and strata boundaries and their area
2) To monitor for each stratum (e.g. species, planted years, etc.)
3) Determination of size and number of sample plots
   - Plot size: 100m² to 1,000m² depending on standing tree densities
   - Number of sample plots is calculated by the equation of the AR CDM methodological tool (Slide 4) (EB 58 Annex15)
4) Allocation of sample plots: random and systematical setting in every stratum (Slide 6)
5) Measuring of sample trees (number of trees, species, DBH, H etc.)
6) Calculation of carbon stocks
7) QC and QA procedures;
   for example, re-measurement and data checking by third party, data maintenance and archiving , uncertainty assessment etc.

3

Strata and sample plot size of Cao Phong A/R CDM project in Vietnam

Stratum	Species	Planting year	Planting density (ft/ha)	Total area (ha)
1	*A. mangium*	2008	1,600	140.19
2	*A. mangium*	2009	1,600	140.19
3	*A. auriculiformis*	2009	2,000	28.12

Sample plot size 20m × 20m (400m²)
It is desirable to include at least 30 number of trees in one sample plot at the harvesting year.
In *A. mangium*, 50% thinning at 8 years, then
one sample plot includes 1,600 X 400/10,000 X 0.5= 32 trees

4

Number of sample plots within project area

$$n = \frac{N \times t_{VAL}^2 \times (\sum_i w_i \times s_i)^2}{N \times E2 + t_{VAL}^2 \times \sum_i w_i \times s_i^2}$$

$$n_i = n \times \frac{w_i \times s_i}{\sum w_i \times s_i}$$ (number of plot in stratum i)

n: Number of sample plots
N: Total number of possible sample plot = Project area/sample plot area
t_{VAL}: Two-sided Student's t-values
When confidence level: 90% & Degree of freedom : ∞, then t_{VAL} =1.645
W_i: Relative weight of the stratum area = Stratum i area/project area
S_i: Estimated standard deviation of biomass in stratum i
E: Standard error of biomass estimation
Default value is 10% of mean biomass in project area
i: 1,2,3..... Number of stratum

If n < 30, then chose t_{VAL} of degree of freedom is equal to (n-1),
New n by this second calculation is final value of n.

5

Example of Calculation of Plot Number

Stratum	Area(ha)	N	W_i	S_i	Biomass
S1	100		100/300	18.0	70 t/ha
S2	200		200/300	25.0	90 t/ha
Total	300	300/0.05		Mean	83.3 t/ha

Sample plot area = 0.05ha
E = 83.3 x 10%= 8.33, t_{VAL}= 1.645 at 90% confidence, Df =∞

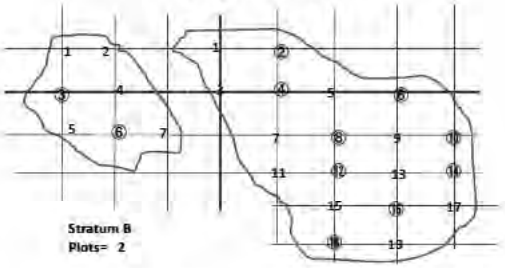
Numerator: (300/0.05) x 1.645^2 x ((100/300 x 18.0) + (200/300 x 25.0))²
= 6,000 x 2.706 x (5.99 + 16.67)² =16,236 x 513.48 = 8,336,661
Denominator: (300/0.05) x 8.33^2 + 1.645^2 x (100/300 x18.0^2 + 200/300x25.0^2)
= 6,000 x 69.39 + 2.706 x (107.89 + 416.88) = 416,340 + 1,420.0=417,760

n=8,336,661/417,760= 19.96 =20

If total plot number is n<30, then recalculate again using t_{VAL} = 1.729 at Df=n-1=19, Final number = 22.04 = 23

6

Systematic Distribution of Sample plots
(e.g. n=12)



Schematic figure

7

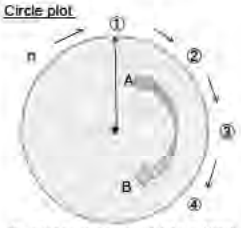
Field Practices on 13th Nov.
Measurement of DBH and tree height in a plot

1: Selection of plot sites
(Two sample plots, three groups measure one plot)
2: Decision of plot size,100m² to 1,000m²
(statistically desirable tree number is >50 to 60 trees)
3: Decision of center of circle plot (or corner of square plot)
4: Measure radius distance (horizontal)
using compass, measuring tapes, distance meter etc.
5: Numbering of all trees inside a plot by marker
6: DBH measurement and recording species, shapes of trees etc, if necessary
7: Select about >15 trees randomly from small to large DBH class. It is desirable to include the smallest and largest DBH trees.
8: Measure tree height of them

8

Setting of circle or square monitoring plot

Circle plot



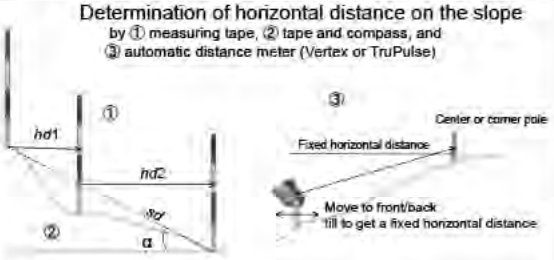
1. Measure one radius (e.g.13m)
2. Stretch a rope on one radius lines ①
3. While measuring radius ②, ③, stretch rope along the circuit
4. Numbering trees from A to B direction and measure DBH of all numbered trees
5. Measure height of selected trees

Square plot

1. Fix one corner point
2. Decide a side by compass and measure fixed distance
3. Continue for 4 sides and Stretch a rope on boundary
4. Numbering of trees inside
5. Measure DBH of all and height of selected trees

9

Determination of horizontal distance on the slope
by ① measuring tape, ② tape and compass, and
③ automatic distance meter (Vertex or TruPulse)

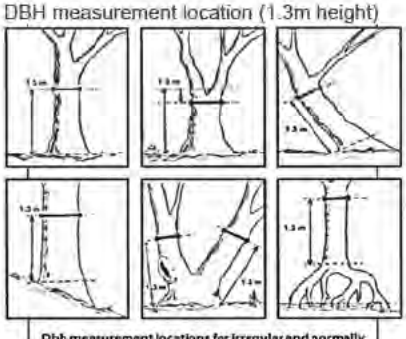


① Primitive and simple method
Measure horizontal distance (*hd*) with step by step
② Slope distance (*sd*) and angle measurement (α)
Horizontal distance = $sd \times \cos(\alpha)$
③ Automatic method
Focus on target, and move to reach a fix distance that will be appeared in the machine.

10

Measurement of DBH of various tree forms

DBH measurement location (1.3m height)



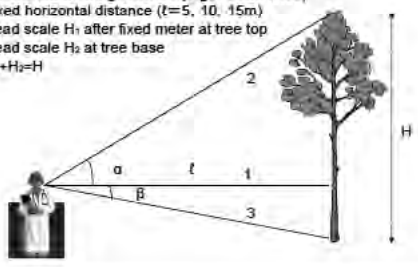
Dbh measurement locations for irregular and normally shaped trees

11

Measurement of tree height (Sample trees only)

Automatic height meter (e.g. by far-red light or ultra-sonic)
Step 1: Horizontal distance (*ℓ*)
Step 2: Angle from horizon to tree top (α) and/or base (β)
Step 3: Automatic calculation of tree height (H)
$H = \ell(\tan\alpha + \tan\beta)$

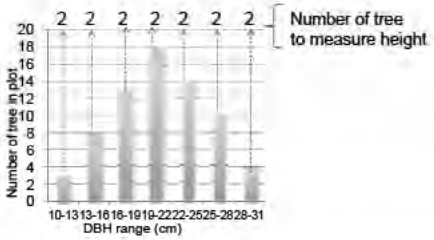
Semi-automatic height meter (e.g. Blume leiss)
1: Fixed horizontal distance (ℓ=5, 10, 15m)
2: Read scale H_1 after fixed meter at tree top
3: Read scale H_2 at tree base
4: $H_1+H_2=H$



12

Selection of trees for tree height measurement

Choose more than 15 trees from all range of DBH in a plot



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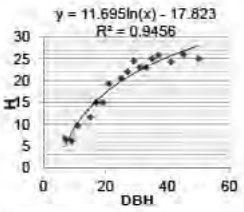
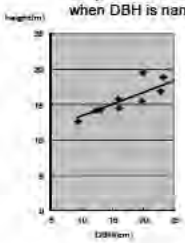
Estimation of Tree Height Using Excel



H=a+b x logDBH
or
H=a+[DBH/(b+c x DBH)]²
a,b,c=coefficient

Simplified method when DBH is narrow range



H =a x DBH +b

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V. Biomass measurement of tree, 14th Nov.

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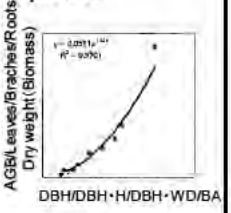
Biomass and Allometry equation

Tree organs grow with a balanced in size.
This relationship of the size is expressed as an equation such as $Y = a * X^b$
(*a*, *b* are coefficient)
When Biomass (Y axis) is estimated, variable (X axis) is generally DBH, H, WD etc.



This allometric relation is the best corelation within a species,
But also possible to use for a group of species with similar life form, forests under similar edapho-climatic conditions, or similar forest type.
Example:

$AGB=0.3009 * DBH^{2.196}$	Primary forest in tropics
$AGB=0.0829 * DBH^{2.43}$	Early succession secondary forest in tropics
$AGB=0.251 * WD * DBH^{2.46}$	Mangrove Forests

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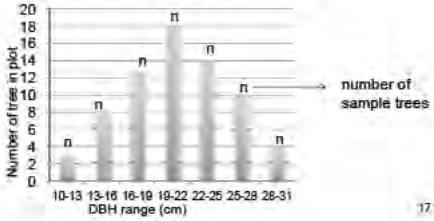
Plot measurement and selection of sample trees

1) Select typical area of a targeted forest area
   Plot is better to include all range of tree size
2) Measure necessary parameter needed the equation.
   e.g. DBH, H, etc.
2) Select sample(felling) trees for biomass measurement
   e.g. sample trees are selected uniformly from all range of tree size



17

Procedures for tree biomass measurement

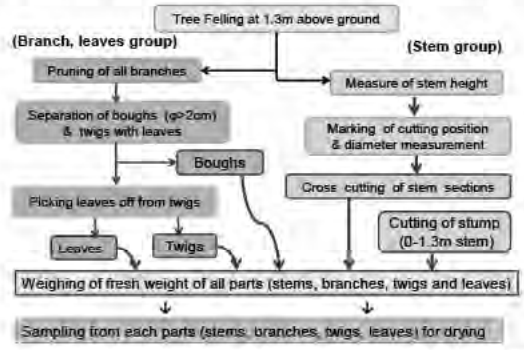
Felling and separation of organs of sampled tree

Separation of stem and branches
Stem cutting

Separation of twigs and leaves, and weighing of fresh weight

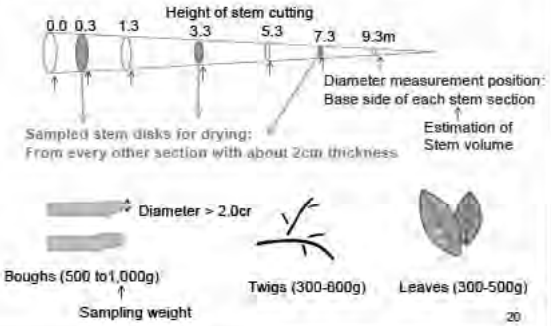
18

Work flow diagram for Biomass measurement



19

Sampling for drying



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Dry weight determination

Packing of drying samples into paper bag and weighing them (fresh weight: FW).
Then drying them at 80-85C for 2-3 days, and weighing of their dry weight (DW).
Calculation of dry weight/fresh weight ratio.

Dry weight calculation sheet

Stem	FW+Tare	Tare	FW	S. FW*	S. DW*	S.DW/S.FW	DW
0-0.3 m	5.3	0.1	5.2	0.6	0.36	0.36/0.6=0.6	5.2×0.6
0.3-1.3 m	15.5	0.1	15.4				15.4×0.6
1.3-3.3 m							
3.3-5.3 m							
5.3-7.3 m							
↓	↓	↓	↓	↓	↓	↓	↓
15.3-17.0							
Boughs							
Twigs							
Leaves							

* S.FW: Sample fresh weight, S.DW: Sample dry weight.

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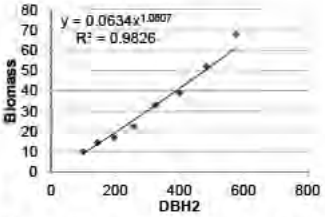
Determination of equation

Excel sheet

DBH^2	Biomass
100	10
144	14.5
196	17
256	22.5
324	33
400	39
484	52
576	68

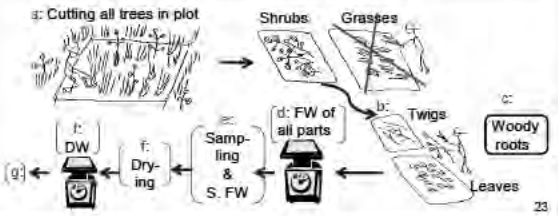


1: In put DBH^2 and dry weight of all sampled trees into Excel sheet (Operation in Excel software)
2: Make graph by scattered plot
3: Select approximate curve
4: Select power equation, & check display of formula and R^2

22

Estimation of C of woody plant in Base line (C_{BL})

a: Cut all woody plants in a sample plot
b: Separation of woody organ (stem, branches) and leaves
c: If necessary, digging out of roots.
d: Weighing of fresh weight(FW) of all parts above.
e: Sampling of all parts (ca.300g) and weighing them (S.FW).
f: Drying of all samples and weighing of their dry weight(S.DW).
g: Biomass of a part i, Bi=FW × (S.DW/S.FW)
h: $\Sigma Bi \times FC = C_{BL}$ CF = 0.37 for grass and shrub



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Baseline vegetation

Plot for measurement

Thank you for your kind attention

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Capacity building for developing REDD-plus activities in the context of sustainable forest management

Dr. Rosy Ne Win
Staff Officer
Forest Research Institute

Training seminar on A/R CDM and REDD+ in Myanmar
15 November, 2012

1

Outline for presentation

I. Introduction

II. Sustainable Forest Management in Myanmar

III. Concept of REDD plus

IV. Current activities of REDD plus in Myanmar

V. Conclusion

2

I. Introduction

- One of the world's most important renewable natural resources

- 47 % of the world's total forest area and have high economic and environmental value

- Contain the vast majority of the world's plants and animals

- Provide habitats for millions of species of plants and animals

- Home for 70% of the world's vascular plants

3

II. Sustainable Forest Management in Myanmar

Forest Policy (1995)

Protection	Natural resources: forest, soil and water, ecosystems, biodiversity
Sustainability	Maintenance and rational use of natural resources
Basic Needs	Providing forest products and services to the people
Efficiency	Efficiency to harness, in the socio environmentally friendly manner, the full economic potential of the forest resources;
Participation	Participation of the people in the conservation and utilization of forests
Public awareness	Public awareness about the vital role of forests in the well-being and socioeconomic development of the nation

4

The important instruments currently used for managing the forests and environment in Myanmar:

- Forest law (1992);
- Protection of wildlife and wild plants and conservation of natural areas law (1994);
- Myanmar Forest Policy (1995);
- Community Forestry Instructions (1995);
- National forestry action plan (1995);
- Myanmar Agenda 21 (1997);
- Criteria and indicators for sustainable forest management (1999);
- National code of forest harvesting practices in Myanmar (2000)

5

Types of forest cover


Mangrove Forest


Tropical Evergreen Forest


Mixed Deciduous Forest


Dry Forest


Indaing Forest


Hill and Temperate Forest


Swamp Forest

No.	Types of Forests	Area (,000 ha)	% of Total Forested Area
1.	Mangrove forest	1,375	4
2.	Tropical evergreen forest	5,5000	16
3.	Mixed deciduous forest	13,407	37
4.	Dry forest	3,483	10
5.	Deciduous indaing (Dipterocarp)forest	1,719	5
6.	Hill and temperate evergreen forest	8,939	25
7.	Scrub land	998	3
	Total	35,375	100

6

Organizational structure for forest management

Ministry of Environmental Conservation and Forestry

- Forest Department
- Dry Zone Greening Dept.
- Planning & Statistics Dept.
- Myanma Timber Enterprise

Forestry Institutions and governance in Myanmar

Ministry of Forestry (September 6, 2011) ⇒ Ministry of Environmental Conservation and Forestry (MOECAF)

(1) Forest Department ⇒ protection, conservation and sustainable management of forest

(2) Dry Zone Greening Department (DZGD) ⇒ reforestation of degraded lands and environmental restoration in the central Myanmar Dry Zone

(3) Planning and Statistics Department (PSD) ⇒ facilitates the work of the remaining organizations by the Minister's office

(4) Myanmar Timber Enterprise (MTE) ⇒ timber harvesting, milling, downstream processing and marketing of forest products

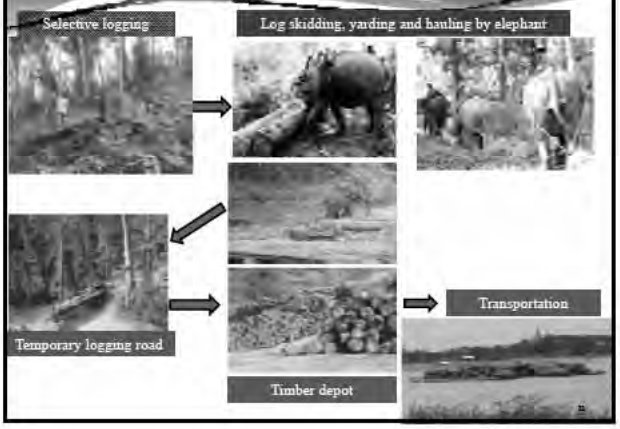
Building capacity in MOECAF

No.	Institution	Officer	Staff	Total
1	Minister's Office	16	19	35
2	Planning and Statistics Department	42	105	147
3	Forest Department	567	14,862	15,429
4	Dry Zone Greening Department	137	3,094	3,231
5	Myanmar Timber Enterprise	1,131	45,280	46,411
	Total	1,893	63,360	65,253

Management System (Myanmar Selection System, MSS)

- **It is an exploitation-cum-cultural System.**
- **Minimum impacts to the environment.**
- MSS is practiced within the bound of :
  - (1) Space/Area limit (Felling series)
  - (2) Size/Girth limit and (minimum girth limit)
  - (3) Time limit (a felling cycle of 30 years)
- **Enumeration of future yield trees down to fixed sizes**
- **Leaving high quality teak tree as seed tree (mother tree)**
- **Fixing of Annual Allowable Cut for teak and hardwood**

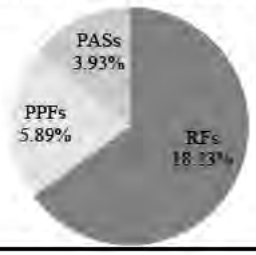
Selective Logging in Natural Forest



Permanent Forest Estate (2009)

- Reserved Forests (RFs)- **823 RFs** (123,373.23 km^2)
- Protected Public Forests (PPFs)- **263 PPFs** (39,880.48 km^2)
- Protected Area Systems (PASs)- **34 PASs** (26,613.47 km^2)

Permanent Forest Estate (2009)- % of total land area



Protected Area System (PAS)

1. Khakarborzi NP
2. Tamanthi WS
3. Pidaung WS
4. Chatthin WS
5. Minwun-Taung WS
6. Siwe-U-Daung WS
7. Alaungdaw-kathapa NP
8. Pyin-Oo-Lwin WS
9. Mingon Taung WS
10. Lawkanandar WS
11. Natmataung NP
12. Wethikan WS
13. Siwesettaw WS
14. Popa NP
15. Padalingu WS
16. Taunggyi WS
17. Inle Lake WS
18. Loimowe WS

19. Parsar WS
20. Rakhine-Yoma elephant range
21. Thamihla Kyun WS
22. Mainmahla Kyun WS
23. Hlawga WP
24. Moyingyi WS
25. Kelatha WS
26. Kyaikhtiyo WS
27. Kahilu WS
28. Mulayit WS
29. Moscos Island WS
30. Lampi Marine Park
31. Indawgyi WS
32. Kyank Pan Taung WS
33. Hponkan Kzai WS
34. Hukaung Valley WS

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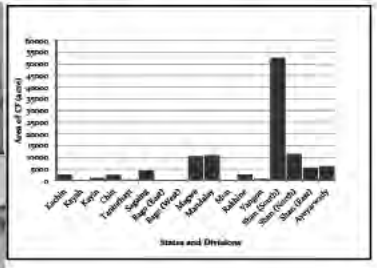
Area of forest plantations (1981-82 to 2009-2010)

Plantation type	Area (ha)	% of total area
Commercial	450,656	53.7
Industrial	72,519	8.6
Village supply	180,009	21.5
Watershed	135,459	16.2
Total	838,642	100

Source: Forest Department, 2010

Stakeholder engagement - People's participation

Total area of community forests = 102,402 acre (41,458 ha)
Total members of forest user groups = 39,298



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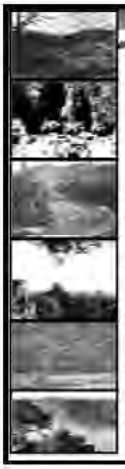

Major international agreement

Myanmar was signatory to:

- UN Framework Convention on Climate Change (UNFCCC) in November 1994;
- Kyoto Protocol in 2003 as non-Annex I country.
- UN Convention to Combat Desertification (UNCCD) in January 1994;
- UN Convention on Biological Diversity (CBD) in November 1994;
- International Tropical Timber Organization (ITTO) in November 1993;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in June 1997;
- Botanical Gardens Conservation International in November 1998.

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Major drivers of deforestation in Myanmar

- over-exploitation;
- illegal logging;
- shifting cultivation;
- expansion of agricultural land;
- fuelwood collection;
- urbanization;
- infrastructure development;
- mining and
- conversion of forest into other land uses (eg. oil palm, sugar cane, rubber plantations, industrial and special economic development zones etc.)

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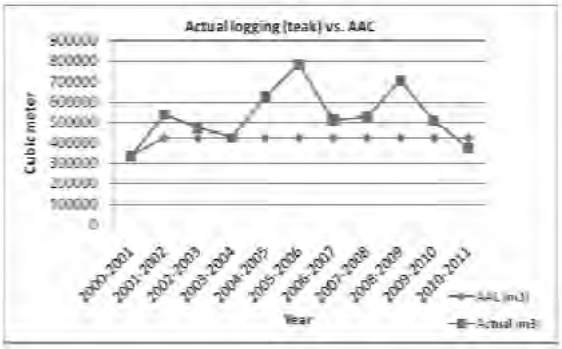

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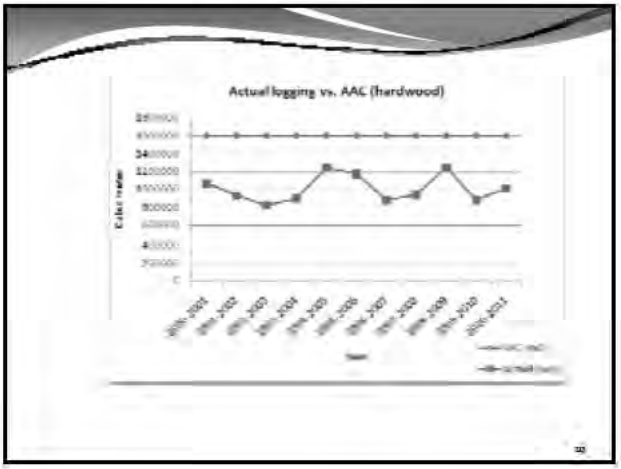

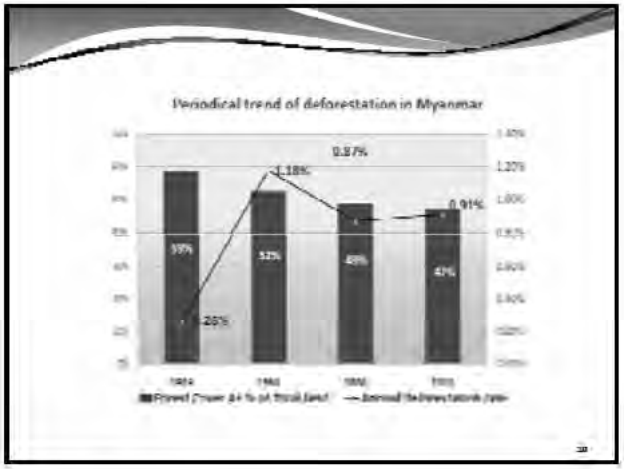

III. Concept of REDD plus

What is REDD+? Definition:

Reducing **E**missions from **D**eforestation and Forest **D**egradation; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks

+ = conservation, SFM and enhancement of stock

- **Why interested in REDD**

- It is commonly seen as a significant, cheap, quick and win win-way to reduce GHG emissions:
- **Significance** because of one-fifth of global GHG comes from deforestation and forest degradation;
- **Cheap** because much of the DD is only marginally profitable, so, reducing GHG emissions from forests would be cheaper than most other mitigation measures;
- **Quick** because large reductions in GHG emissions can be achieved with "stroke of the pen" reforms and other measures not depend on technological innovations;
- **Win-Win** because the potentially large financial transfers and better governance can benefit the poor in developing countries and provide other environmental gains on top of the climate benefits.

Global negotiation on REDD+

- COP 11 in Montreal in 2005 started REDD as a fundamental milestone.
- COP 13 in Bali, Indonesia in 2007 formulated a Bali Action Plan: comprehensive approach to mitigate climate change
- COP 14 in Poznan, Poland in 2008 made progress on a number of important ongoing issues including: **adaptation; finance; technology; REDD); and disaster management**.
- COP 15 in Copenhagen, Denmark in 2009 recognized the crucial role of REDD+
- COP 16 in Cancun, Mexico in 2010 - financing mechanisms.
- COP 17 in Durban, South Africa in 2011
- **2012 - Rio+20 (Earth Summit) - Green Economy-Green Growth-Sustainable Development**

Outcomes of Copenhagen: REDD-plus

- **There are five "activities" under REDD**
  (para 3 of FCCC/AWGLCA/2009/L.7/Add.6)

1. Reducing emissions from deforestation (RED); | "D"
2. Reducing emissions from forest degradation; | "D"
3. Conservation of forest carbon stocks; |
4. Sustainable management of forest; and | +
5. Enhancement of forest carbon stock (AR). |

- **Capacity building and readiness efforts in developing countries are requested.**

- identification of the drivers and the means to address deforestation, etc.;
- application of IPCC guidance and guidelines;
- establishment of national monitoring systems;
- preparation and implementation of relevant policies and plans associated with related capacity building; and
- support from the international community to promote such efforts.

The Cancun Agreements related to REDD-plus

- Parties undertaking REDD-plus should
- Address drivers of deforestation and forest degradation,
- land tenure issues,
- forest governance issues,
- gender considerations and
- the safeguards
- Ensure full and effective participation of relevant stakeholders, inter alia, indigenous peoples and local communities
- Parties undertaking REDD-plus should:
- Be provided with adequate and predictable financial and technical support
- Develop a national strategy or action plan
- Develop a national forest reference emission level and/or/forest reference level
- Develop a robust and transparent national monitoring system

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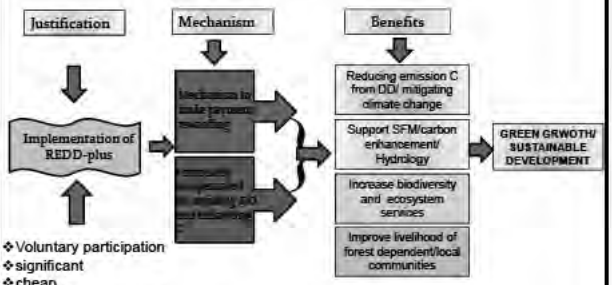
REDD-plus for sustainable development



- Voluntary participation
- significant
- cheap
- Quick implementation
- fair
- win-win conditions

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Major tasks for REDD+

What is MARV?

Measurement	Data from Field Sampling, Remote Sensing
Assessment	Results from analyses and models, including quality measures
Reporting	National communications to UNFCCC using IPCC standards
Verification	Formal review and verification of reports

DEFINITION OF Reference Emission Level (REL)

- Future projection of emissions from deforestation and forest degradation under the absence of REDD
- A reference for measuring reductions in emissions from deforestation and forestation degradation

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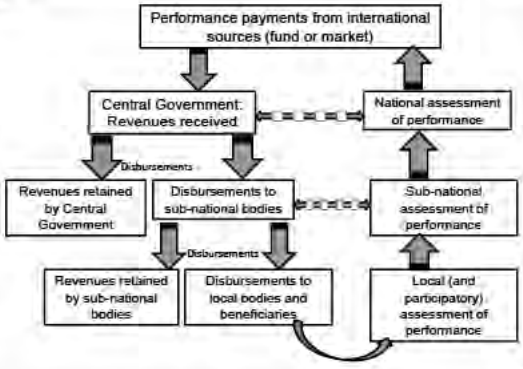
Free Prior Informed Consent (FPIC) Implementation

Lessons: Benefit Distribution System



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UN – REDD program

What is UN-REDD?

- Collaborative programme: FAO/UNDP/UNEP (One-UN)
- Launched September 2008
- To help countries and the international community gain experience with REDD
- Contribution to the UNFCCC process
- Coordinated with other initiatives, e.g., FCPF
- "Quick Start": $83M contribution by Norway; now also Denmark and Spain (total $110M)

30

1. National Programmes

- Capacity building for readiness
- 9 countries
  - **Africa:** DRC, Tanzania, Zambia
  - **Asia & Pacific:** Indonesia, PNG, Vietnam
  - **LA & Caribbean:** Bolivia, Panama, Paraguay
- $3-6 million per country

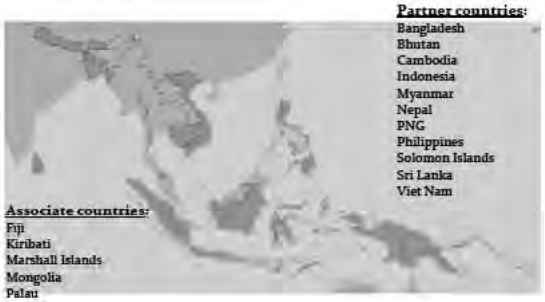
2. Global Programme

- Guidelines, advice, regional/ international dialogue, analyses

⇒ that support country action

⇒ that support the UNFCCC process on a global scale

- total budget:$6.9M



Partner countries:
Bangladesh
Bhutan
Cambodia
Indonesia
Myanmar
Nepal
PNG
Philippines
Solomon Islands
Sri Lanka
Viet Nam

Associate countries:
Fiji
Kiribati
Marshall Islands
Mongolia
Palau
Samoa
Tonga

IV. Current activities of REDD plus in Myanmar

Project

"Mitigation of climate change impacts through Restoration of degraded forests and REDD plus activities in Bago Yoma region, Myanmar"

Implementing organizations

AR/CDM REDD Core Unit members from Forest Department

Donor

Korea Forest Service (KFS)

Project area

Taungoo Division, Yedashe townships, Yoma unclass XII

Village near the project area

Zayepauk village, Yengan village group, 68 households, 294 people

Project period

1 year (2011 November to 2012 October)

Budget

100,000 US$

Objectives

- To implement pilot project for forest and ecosystem conservation to mitigate climate change
- To develop the carbon storage measurement activity
- To develop the capacity building on REDD+ and ecosystem conservation and to improve knowledge

The main activities conducted during the project

- ❖Development of capacity building on REDD+
- ❖Reforestation and forest conservation
- ❖Research on forest carbon measurement, deforestation and species composition
- ❖Educational activities on REDD+
- ❖Development of local communities in villages

Training on capacity building

1. Training on forest carbon measuring/monitoring, reporting and verification (MRV) and forest inventory

- To improve knowledge and capacity building on REDD-plus and carbon measurement
- To develop Measuring, Reporting and Verification (MRV) systems
- To support the implementation of national REDD-plus programs
  - ✓ The training was held from 16 to 27 January, 2012.
  - ✓ 20 trainees

2. Capacity Building Training on REDD+

- To understand the concept and implementation method of REDD+
- To understand economical and environmental benefits of REDD+
- To support sustainable forest management
- To support the implementation of national REDD-plus programs
  - ✓ from 26 to 30 March, 2012
  - ✓ 20 trainees of staff officers/ range officers

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Study tour to Vietnam

From July 30, 2012 to August 4

Meeting on capacity building

- Forest Research Institute
- Nan Chun training school
- CFDTC

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Reforestation and Forest conservation activities

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Arboretum – 25 acres
(6 ft x 6 ft, 25 species)

- Community woodlot (trees) – 13 acre
  (9 ft x 9 ft, 13 species)
- Community woodlot (bamboo) – 1.5 acre
  (15 ft x 15 ft), 2 species)

Natural forest conservation – 13 acres

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Forest inventory

Reserved forests in Taungoo Division, Yedashe township

Study on major drivers for deforestation

- Collection of reports, books and records
- Socio-economics survey in 40 villages from Yedashe, Taungoo, Oktwin and Phyu townships

Special talk on climate change, forests value and REDD+

Zaye pauk, 6 mile, 7 mile, 8 mile and 9 mile villages

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Local development Activities

Donation of desks, books and raincoats to students

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preliminary study on above ground biomass estimation

Flow Chart for Methodology of AGB

Calculation of Normalize Different Vegetation Index (NDVI) from Landsat ETM+

⇩

Classification of Vegetation Density

⇩

Set up representative Samples in each Vegetation Density

⇩

Field Inventory

⇩

Estimation of AGB using equation

⇩

Mulitple Linear Regression using PASW 18 & Spatial Analysis in ArcGIS 9.3 + accuracy check

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Preparation for REDD+ Readiness

- **First National Workshop on REDD in Myanmar**
  - April 7, 2010, Ingyin Hall, Forest Department, Nay Pyi Taw, jointly organized by the FD and UNDP
- **Second National Workshop on Disaster Risk Reduction and REDD**
  - December 20-21, Ingyin Hall, Forest Department, Nay Pyi Taw, jointly organized by the FD and UNDP.
- **Regional workshop and Capacity Building Training on REDD-plus (Korea Forest Service)**
  - Training Course - 10th-11th May, 2011 at FRI, Yezin (Line Min:)
  - 12th – 13th May, 2011 at Ingyin Hall, Forest Department, Nay Pyi Taw
  - Over 100 participants from ASEAN Member States, UN-REDD program, UNDP, UN-HABITAT, FAO, JICA, KOICA, WCS, 22 Government Ministries, NGOs and private companies attended the workshop.

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Preparation for REDD+ Readiness

- Forming core unit under the Forest Department for REDD+
- Establishing coordination mechanism among stakeholders including concerned Ministries, NGOs, Academic Institutions, local authorities
- Awareness raising about REDD+ and capacity building through workshops, trainings and Journal
- Participating international REDD+ meetings, forum, training and workshops
- Myanmar became a Partner Country of UN-REDD Programme.

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REDD-plus roadmap

No.	National REDD+ Road Map	Time Frame								
		1st Year		2nd Year		3rd Year		4th Year		5th Year
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	
1	Phase I									
2	Phase II									
3	Phase III									⇨

Phase I: Preparation Phase
Phase II: Readiness Phase
Phase III: Implementation Phase

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Challenges for REDD+ readiness

- Financing for preparation of REDD+ readiness
- Capacity building and institutional strengthening
- National baseline data of carbon stock
- Setting reference level of emission (national level)
- Establishment of MRV system (national level)
- Benefit distribution system
- Policy adjustment for REDD+

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On-going project for the preparation of REDD+ Readiness

Korea Forest Service
- Mitigation of climate change impacts through restoration of degraded forests and REDD-plus activities in Bago Yoma Region, Myanmar (2011-12 and 2012-13)

Norwegian Government
- Myanmar REDD+ Readiness Assessment with the technical support of UNREDD

Programme and RECOFTC (9 months)
- Preparation of REDD+ Readiness Roadmap and National Strategy;
- Financing for the future

Asia Air Survey Co. Ltd.,
-The study on the strengthening methodological and technological approaches for reducing deforestation and forest degradation within the REDD implementation framework: application in Myanmar (1 year) (2012-2013)

ITTO
- Capacity building for developing REDD-plus activities in the context of sustainable forest management (3 years project) 2012-15

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REDD+ can

- Get income from forest conservation activities
- Conserve Biodiversity
- Control water circulation
- Control soil erosion
- Stable the Ecosystem
- Increase income for local communities

• V. Conclusion

- REDD started as a global initiative.
- REDD has the potential to generate substantial benefits in addition to the reduction of greenhouse gas.
- It is an important elements of a future climate change scenario that integrates the role of forests and forestry.
- Myanmar has many enabling conditions for the implementation REDD-plus.
- There are many things to prepare for the Readiness of REDD-plus. Myanmar has been trying our best with our capacity.
- At the same time, international cooperation is needed for capacity building, demonstration activities, policy reforms and strengthening governance.
- We warmly welcome potential partners for the implementation of REDD-plus readiness activities

Thank you for your attention !!