China Green Carbon Fund

Guidelines for Carbon Accounting and Monitoring

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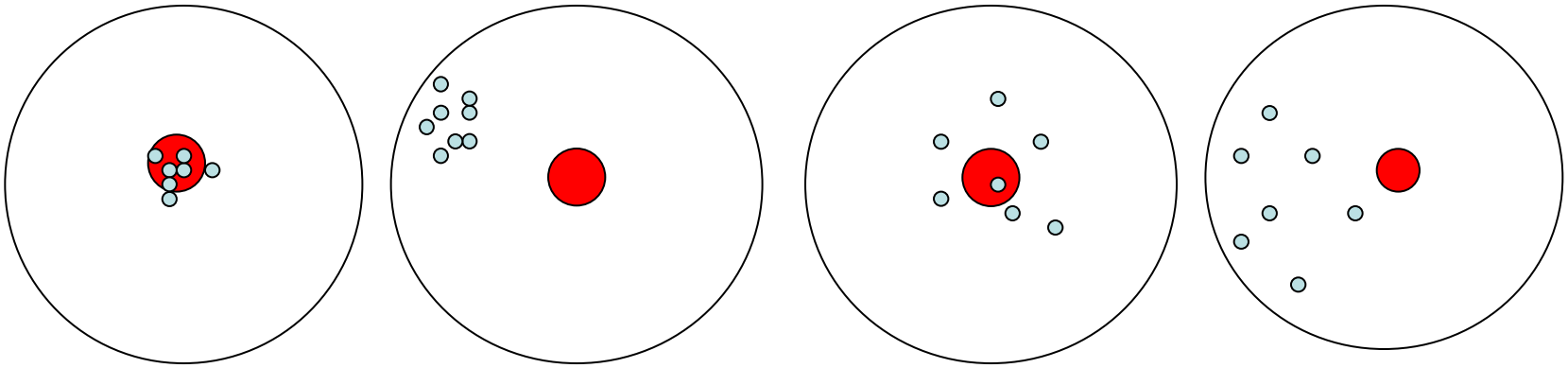
Overview

- **Objectives, Bases and Principles**
- **Project Boundary and Land Eligibility**
- **Carbon Pools and GHG Sources**
- **Methodology for Ex ante Estimation**
- **Monitoring Methodology**

1. Objectives, Bases and Principles

- **Objectives** :

  To ensure GHG removals accurate, reliable and verifiable



- **Bases**
  - ✓Regulations governing China Green Carbon Fund (CGCF) AR projects
  - ✓Technical Regulations for CGCF AR projects
  - ✓IPCC Methodologies：e.g., 2006 IPCC (2006 IPCC Guidelines for NGGI-AFOLU), IPCC-LULUCF (IPCC GPG LULUCF)
  - ✓Other technical Guidelines for LULUCF：e.g, by Winrock International
  - ✓approved CDM AR methodologies and tools

- **原则Principles**
  - ✓**Conservativeness**：conservative if: (i) overestimate baseline net removals, or (ii) underestimate project net removals, or (iii) overestimate project emissions
  - ✓**Transparency**：Activity data and parameters accessible for public except for business secret
  - ✓**Comparability**：Parameters are comparable. Justification shall be made if parameters selected are outside the ranges of IPCC or national default values

- ✓ **Reducing Uncertainty**：Make efforts to reduce uncertainty and conduct uncertainty assessment.
- ✓ **Cost-effectiveness**：Given that cost for carbon accounting and monitoring increases with the increasing precision level and accuracy, selection of carbon accounting methods and parameters shall be cost-effective.

2. Project boundary and land eligibility

- **Requirements for Land eligibility**：

  ①non-forested lands since Jan 1st 2000

  ②Economic unattractive, technical barriers, lack of natural regeneration ability

  ③Acceptable site quality to ensure good growth and carbon sequestration

④ Benefits to local biodiversity conservation, soil erosion control and livelihood of local communities

⑤ Unlikely to be included in national or local governmental AR programme and other public or private AR plans.

⑥ No confilct of land ownership and land tenures

- **Land eligibility demonstration：**

Applying approaches in “Tool for the Demonstration and Assessment of Additionality in A/R CDM Project Activities” approved by CDM EB 35

- Project Boundary
  - ✓ Ex ante boundary is determined by：
    - Geographical positions for each corner of polygon land using GPS；
    - Read from satellite images, aerial photos, land use/cover maps, etc., with accessible resolution；
    - Conservative on-site drawing on landform maps with scale over 1/10,000；
    - Forestry zoning maps at county or township level (compartment or sub-compartment boundary).

3. Carbon pools and GHG emission by sources

- AGB,BGB,Litter, DW and SOC. Can be negligible for pools not a net source.
- Cost-effectiveness, uncertainty and conservativeness shall also be taken into consideration in the selection of carbon pools.

- Living biomass pools are mandatory in any case
- Litter and DW can be conservatively neglected
- SOC is considered following “Procedure to determine when accounting of the soil organic carbon pool may be conservatively neglected in CDM AR project activities” approved by CDM EB 33

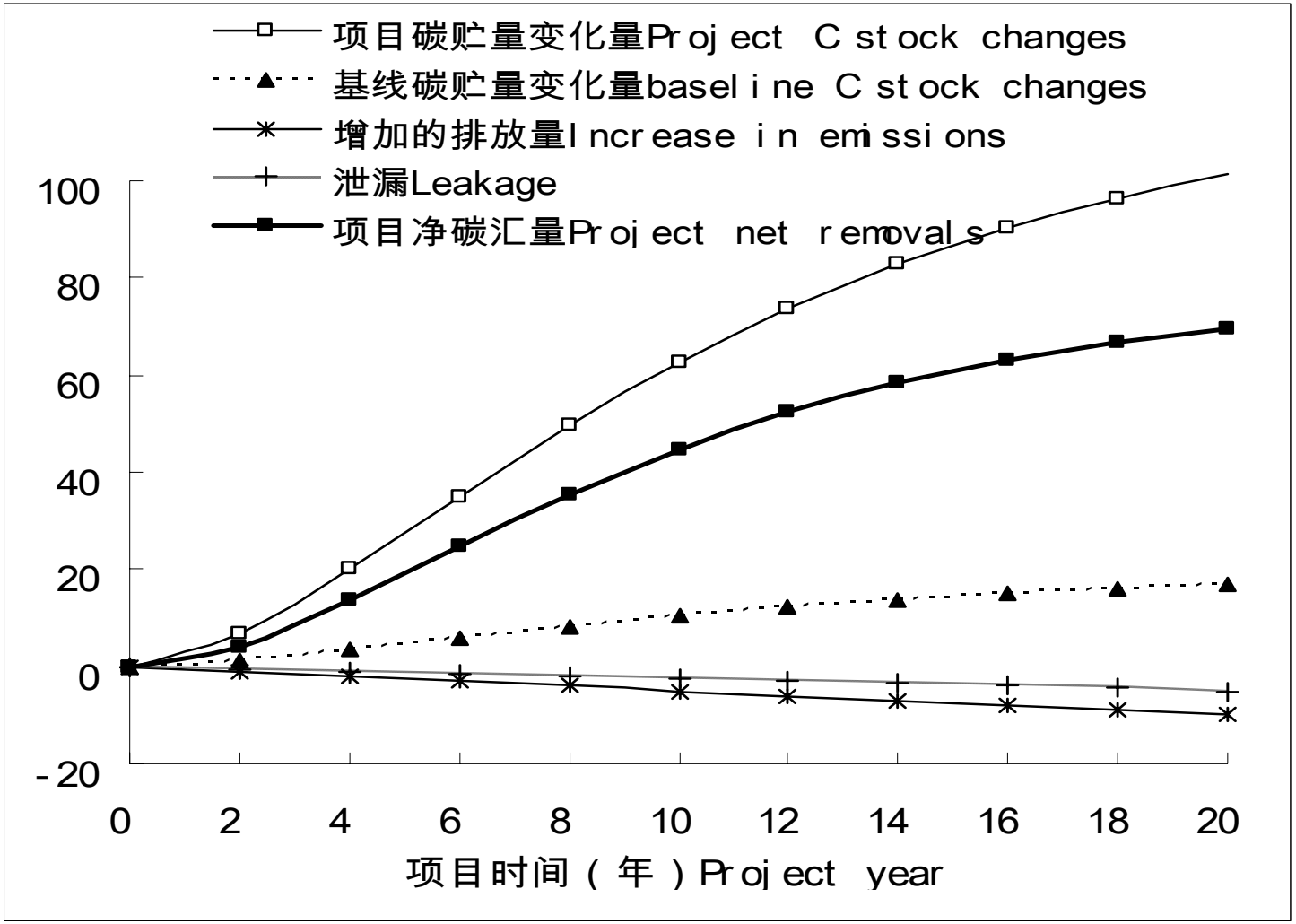
- **Emissions by sources：**
  - Burning of fossil fuel including：
    - Vehicle use
    - Machinery。
  - N Fertilization
  - Forest fire：C stock changes from forest fire are accounted in living biomass pools, and N2O and CH4 emissions are accounted as project emissions.
- Not acounting and monitoring：
  - N-Fixing species
  - Fodder production
  - Activity displacement
  - Using of wood post

Determination of key emissions by sources

Sources	emissions	relative contribution	Cumul. contribution	key sources
Source 1	20	0.344	0.344	√
Source 2	15	0.258	0.601	√
Source 3	12	0.206	0.808	√
Source 4	8	0.137	0.945	√
Source 5	2	0.034	0.979	Non-key sources
Source 6	1	0.017	0.997	
Source 7	0.2	0.003	1.000	
total	58.2			

4. Ex ante carbon accounting

$$C_{\mathrm{Pr}oj,t} = \Delta C_{\mathrm{Pr}oj,t} - GHG_{E,t} - LK_t - \Delta C_{BSL,t}$$



- **Stratification**
  - Ex ante stratification
  - Ex post stratification
  - Baseline stratification:

  Based on pre-project vegetation：
    - species and age of pre-project living trees: bases for baseline carbon stock changes
    - Non-tree vegetation including types, height and crown cover of pre-project living shrubs

- **Ex ante project stratification**：Based on AR model and management practices including
  - Species and combination
  - Planting time
  - Thinning practices
  - Fertilization
  - Harvest rotation

Climate and site conditions are usually taken into account when selecting tree species and management practices.

Ex ante estimate of baseline C stock changes

- Assuming C stock changes in litter, DW and SOC is zero, accounting only for AGB and BGB

$$\Delta C_{BSL,t} = \sum_{i=1}^{I} (\Delta C_{BSL,AB,i,t} + \Delta C_{BSL,BB,i,t}) \cdot 44/12$$

- Collecting, or building if unavailable, Volume-age equations
- Estimating volume of pre-project living trees for project lifetime
- Converting volume to C stock in AGB and BGB：

$$C_{BSL,AB,i,t} = \sum_{j=1}^{J} (V_{ij,t} \cdot N_{ij} \cdot WD_j \cdot BEF_j \cdot CF_j) \cdot A_i$$

$$C_{BSL,BB,i,t} = \sum_{j=1}^{J} (V_{ij,t} \cdot N_{ij} \cdot WD_j \cdot BEF_j \cdot CF_j \cdot R_j) \cdot A_i$$

Ex ante estimate of project C stock changes

- For the purpose of ex ante accounting, C stock changes in litter, DW and SOC are assumed to be zero, accounting only for AGB and BGB

$$\Delta C_{PROJ,t} = \left[\sum_{i=1}^{I} \sum_{j=1}^{J} \sum_{k=1}^{K} (\Delta C_{PROJ,AB,ijk,t} + \Delta C_{PROJ,BB,ijk,t}) - \sum_{i=1}^{I} (\Delta C_{LOSS,AB,i,t} + \Delta C_{LOSS,BB,i,t}) \right] \cdot 44/12$$

- **Biomass of trees**

Collecting volume-age growth curve or yield table that represents local climate and site conditions, or if unavailable establishing such curve based on plot data from national or local forestry inventory, followed by converted volume to carbon stock in AGB and BGB

$$C_{PROJ\_Tr,AB,ijk,t} = V_{ijk,t} \cdot WD_j \cdot BEF_{j,v} \cdot CF_j \cdot A_{ijk}$$

$$C_{PROJ\_Tr,BB,ijk,t} = C_{PROJ\_Tr,AB,ijk,t} \cdot R_{jk}$$

- **Bamboo and Shrubs**

Given that it is impossible to account for biomass using biomass conversion factors, it is assumed that the biomass of bamboo and shrubs reach steady-state at a certain age, then.

$$\Delta C_{PROJ\_EBS,AB,ijk,t} = \frac{C_{PROJ\_EBS,AB,ij,Max}}{T_j} \cdot CF_j \cdot A_{ijk}$$

$$\Delta C_{PROJ\_EBS,BB,ijk,t} = \frac{C_{PROJ\_EBS,BB,ij,Max}}{T_j} \cdot CF_j \cdot A_{ijk}$$

Loss of pre-project biomass

- It is assumed that all pre-project biomass will be died out after AR, so that the biomass loss equals to biomass of pre-project biomass.

$$C_{BSL,t=0} = \sum_{i=1}^{I} (C_{BSL,Tree,i,t=0} + C_{BSL,NTree,i,t=0}) \cdot 44/12$$

- CDM EB 36 “Tool for estimation of emissions from clearing, burning and decay of existing vegetation” can be followed to neglect the loss of pre-project biomass

- **Pre-project trees**

Two methods, with priority for method 1

  - **method 1: allometric equation**

    Using allometric equations to estimate biomass based on measured DBH and height of pre-project trees

$$C_{BSL,AB,Tree,i,t=0} = \sum_{j=1}^{J} f_{AB,tree}(DBH, H) \cdot N_{ij} \cdot A_i \cdot CF_j$$

$$C_{BSL,BB,Tree,i,t=0} = \sum_{j=1}^{J} f_{BB,tree}(DBH, H) \cdot N_{ij} \cdot A_i \cdot CF_j$$

$$C_{BSL,BB,Tree,i,t=0} = C_{BSL,AB,Tree,i,t=0} \cdot R_j$$

– **Method 2: BEF method**

When biomass allometric equation is unavailable, estimating volume from DBH and H, followed by converting to carbon stock in AGB and BGB

$$V = a_1 \cdot DBH^{a_2} H^{a_3}$$

- Non-tree vegetation

Either from literatures or direct measurement if data from literature unavailable

Project emissions

- For the purpose of ex ante accounting, only N2O emission due to N-fertilization and CO2 emissions from fossil fuel combustion are accounted.

$$GHG_{E,t} = E_{Equpment,t} + E_{N\_Fertilizer,t}$$

- **N2O emissions from N-fertilization:** Following CDM EB 33 tool “Estimation of direct nitrous oxide emission from nitrogen fertilization”

- Emissions from fossil fuel combustion: Following CDM EB 33 tool “Estimation of GHG emissions related to fossil fuel combustion in A/R CDM project activities”

Leakage

- Emissions from Vehicle: Following CDM EB 33 tool "Estimation of GHG emissions related to fossil fuel combustion in A/R CDM project activities" :

$$LK_{Vehicle,t} = \sum_{f} \left(EF_{CO_2,f} \cdot NCV_f \cdot FC_{f,t} \right)$$

$$FC_{f,t} = \sum_{v=1}^{V} \sum_{i=1}^{I} n \cdot (MT_{f,v,,i,t} / TL_{f,v,i}) \cdot AD_{f,v,i} \cdot SECk_{f,v,t}$$

5. Monitoring

- **Monitoring of project boundary**
- **sampling design**
- **C stock change monitoring**
- **Project emission monitoring**
- **Leakage monitoring**
- **QA/QC**
- **Uncertainty analysis**

- Project boundary
  - Using GPS or other spatial data to define actual project boundary。
  - Lands outside designed boundary shall not be included in the actual boundary
  - If deforestation occurs during project lifetime, the deforested land shall be taken out of the project boundary

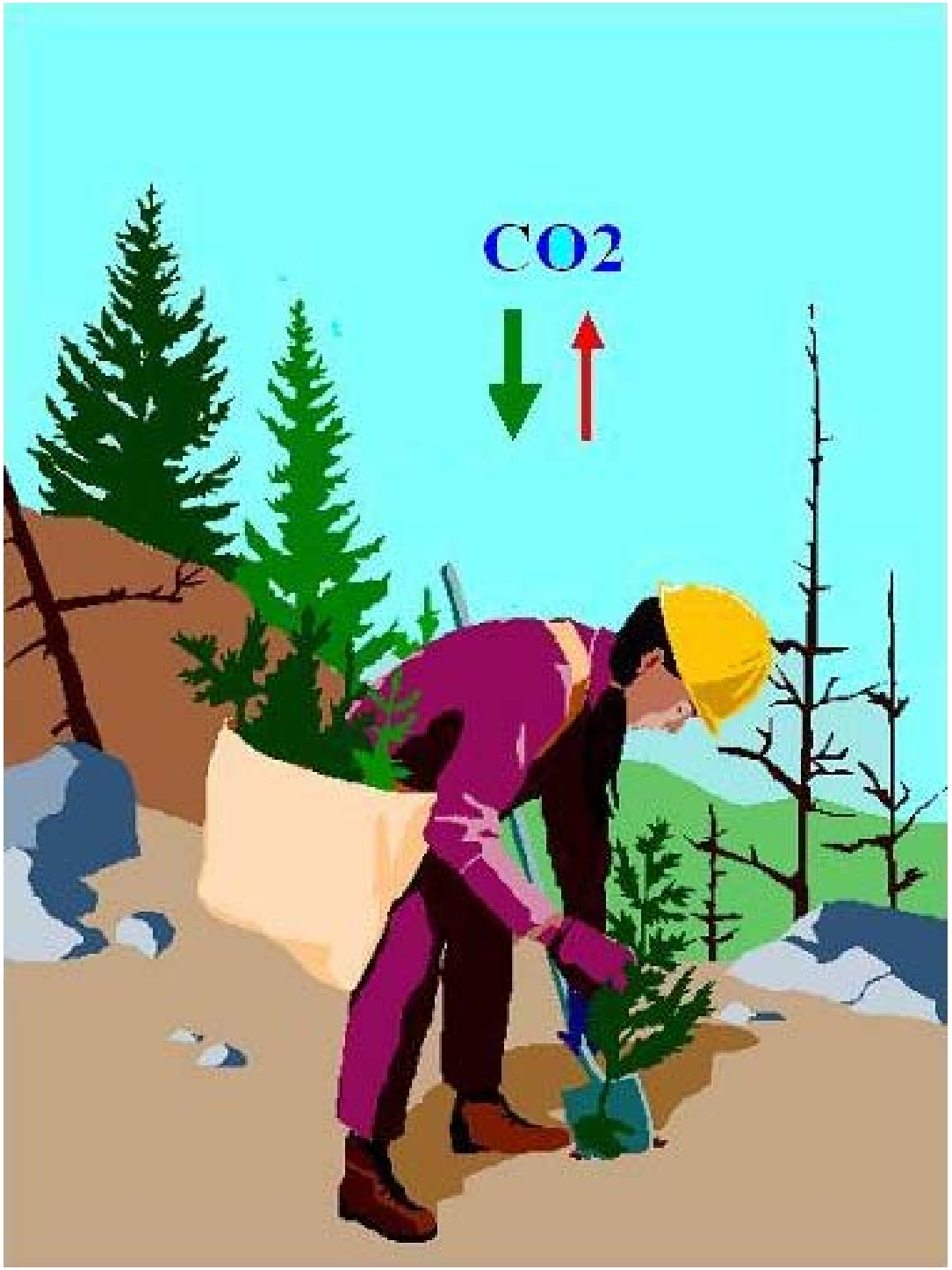
Sampling design

- **Ex post stratification** :
  - Based on ex ante stratification, stratifying in terms of climate, site conditions, actual tree species, planting time and management practices
  - Defining strata boundary using GPS or appropriate spatial data such as satellite images.

- Post stratification shall be conducted at each monitoring event
  - Strata with >10% standard error shall be further stratified into two or more strata
  - Strata with similar C stock and changes can be merged
  - Modifying strata if project boundary changes.

- Number of sampling plot:Following EB 31 tools "Calculation of the number of sample plots for measurements within A/R CDM project activities"
- **Locating and establishing plots**
  - Rectangular or circular plot that can include 100 trees at minimum
  - Plots are distributed systematically with random start.
  - Record name, GPS, tree species and model, planting time, etc

- Monitoring frequency
  - 5 year interval for biomass, litter and DW, 10 years for SOC
  - Monitoring event shall not coincide with peak time of the carbon stock



谢谢大家

Thanks for your attention