



Best Practices for Including Carbon Sinks in Greenhouse Gas Inventories

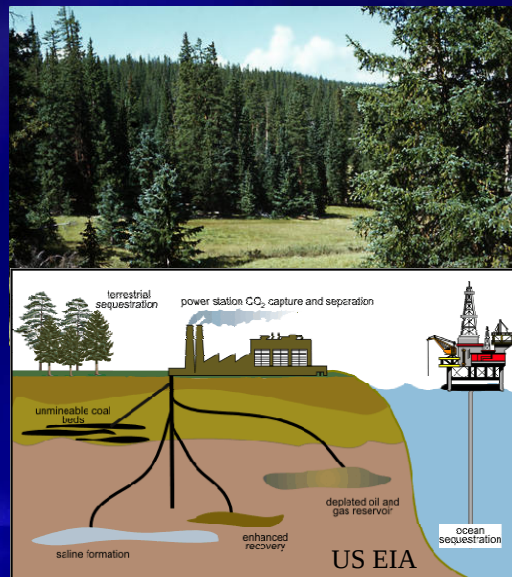
16th Annual International Emissions Inventory Conference

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May 15, 2007

What is Carbon Sequestration?

- ◆ The process of removing carbon from the atmosphere
- ◆ Commonly referred to as a “carbon sink”
- ◆ Biological: incorporating atmospheric carbon into plants, soils, and water
- ◆ Geological: piping carbon dioxide into underground storage



The Question

- ◆ How can organizations incorporate carbon sinks into their annual GHG emissions inventories?
 - ◆ Agencies and corporations with large forested land holdings
 - ◆ **Not as an offset** – but as an annual sink in corporate accounting
 - ◆ Individual organizations interested in counting carbon sinks against their annual emissions at the **entity level**
 - ◆ Carbon management and long-term planning opportunities

Topics to Cover

- ◆ Standards and Protocols:
 - ◆ The GHG Protocol
 - ◆ IPCC Guidelines and Methodology Reports
 - ◆ ICLEI-Local Governments for Sustainability
- ◆ Sequestration and Forest Carbon Sinks
 - ◆ Calculating Emission Sinks
 - ◆ Best Practices for Carbon Sinks Accounting

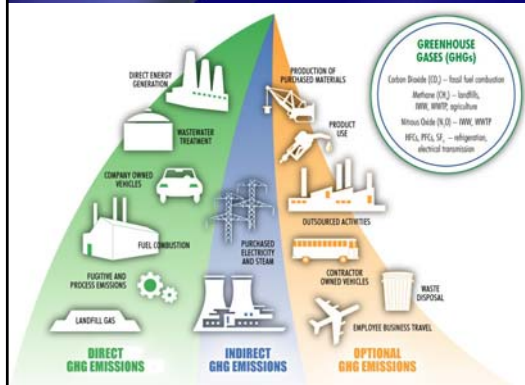


Standards and Protocols

Sources of Standards and Protocols

- ◆ The GHG Protocol (WRI/WBCSD)
- ◆ IPCC Reports and Methodologies
- ◆ ICLEI Toolkit (specific to cities and municipal agencies)

The GHG Protocol (WRI/WBCSD)



- ◆ Consists of two modules and 16 calculation tools
 - ◆ Corporate GHG Accounting and Reporting
 - ◆ Project GHG Accounting and Reporting
- ◆ CCAR forestry protocol and project accounting tools

IPCC Guidelines and Methodologies

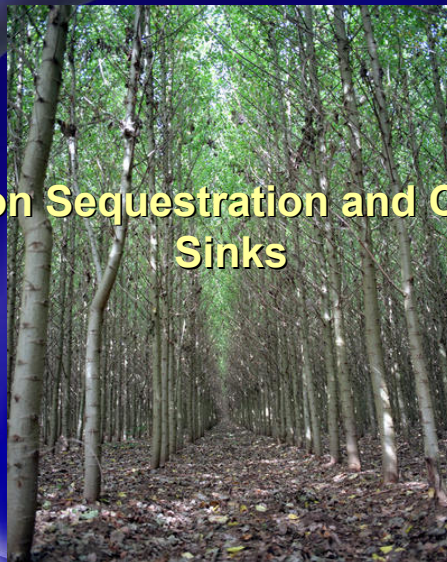
- ◆ Describing methodologies and practices for national GHG inventories
 - ◆ Good Practice Guidance and Uncertainty Management
 - ◆ Good Practice Guidance for LULUCF
 - ◆ Definitions and Methodological Options related to Inventory Emissions from Direct Human-Induced 'Degradation' of Forests and 'Devegetation' of other Vegetation Types

ICLEI Urban Forestry Toolkit

- ◆ Document provides guidance for local governments
- ◆ Focused mostly on urban tree management
- ◆ Case study examples of local actions to reduce GHG emissions through adding/management urban forest sinks



Carbon Sequestration and Carbon Sinks



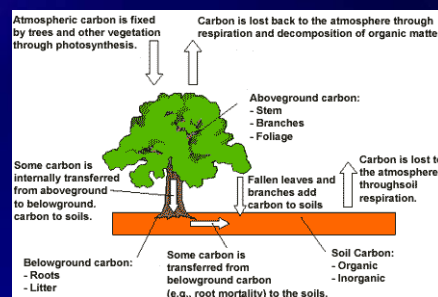
Practices and Process Sequestering Carbon

- ◆ Conservation of riparian buffers;
- ◆ Conservation tillage on croplands;
- ◆ Grazing land management;
- ◆ Afforestation;
- ◆ Reforestation;
- ◆ Forest preservation or avoided deforestation;
- ◆ Forest management;
- ◆ Underground geologic depositories; and
- ◆ Oceanic uptake.



Carbon Sequestration in Trees and Soils

- ◆ Primarily through photosynthesis – roughly 50% stored in woody biomass
- ◆ Carbon released during biomass decay
- ◆ Carbon pools dependent on plants, human-inputs, and management practices



From: U.S Environmental Protection Agency.
2007. *Carbon Sequestration in Agriculture and Forestry*

Calculating Emission Sinks - Forests

Key Forestry Practices	Typical definition and some examples	Effect on greenhouse gases	Carbon sequestration rate in U.S. Metric tons CO ₂ /acre/year	Time over which sequestration may occur before saturating
Afforestation	Tree planting on lands previously not in forestry (e.g., conversion of marginal cropland to trees).	Increases carbon storage through sequestration.	0.6 – 2.6 ^{b)}	90 – 120+ years
Reforestation	Tree planting on lands that in the more recent past were in forestry, excluding the planting of trees immediately after harvest (e.g., restoring trees on severely burned lands that will demonstrably not regenerate without intervention).	Increases carbon storage through sequestration.	0.3 – 2.1 ^{d)}	90 – 120+ years
Forest preservation or avoided deforestation	Protection of forests that are threatened by logging or clearing for development.	Avoids CO ₂ emissions via conservation of existing carbon stocks.	Based on existing carbon stock	Depends on age of existing carbon stocks
Forest management	Modification to forestry practices that produce wood products to enhance sequestration over time (e.g., lengthening the harvest-regeneration cycle, adopting low-impact logging).	Increases carbon storage by sequestration and may also avoid CO ₂ emissions by altering management. May generate some N ₂ O emissions due to fertilization practices.	0.6 – 0.8 ^{e)} 0.2 ^{g)}	If wood products included in accounting, saturation does not necessarily occur if C continuously flows into products

EPA 2007: <http://www.epa.gov/sequestration/rates.html>

GHG Protocol: LULUCF Guidance

- ◆ Focus on reforestation and forest management
- ◆ Several main components of carbon sink accounting are identified:
 - ◆ Assessment boundary definition
 - ◆ Baseline procedure assessment
 - ◆ ID baseline candidates
 - ◆ Baseline GHG removal estimation
 - ◆ Application of LU/Management trend factors
 - ◆ Estimating Carbon Stocks
 - ◆ Monitoring/Quantifying GHG reductions
 - ◆ Carbon Reversibility Management
 - ◆ Reporting

IPCC Guidance

- ◆ Guidance is primarily for national GHG inventories
- ◆ Estimation focuses on changes in land use over time
- ◆ First order approximations use:

$$\Delta C = \sum_{ijk} [A_{ijk} \cdot (C_I - C_L)_{ijk}]$$

- ◆ ΔC = carbon stock change in the pool
- ◆ A = Area of Land (ha)
- ◆ ijk = corresponds to climate type i , forest type j , management practice k , etc.
- ◆ C_I = rate of gain of carbon (tonnes C ha⁻¹ yr⁻¹)
- ◆ C_L = rate of loss of carbon (tonnes C ha⁻¹ yr⁻¹)

Emerging Opportunities

- ◆ **The Climate Registry**
 - ◆ “There is significant state or tribal interest in developing a rigorous accounting framework that could also quantify and characterize CO₂ removals from the atmosphere...*The Climate Registry* would develop a comprehensive framework for accounting and reporting for sink activities, from both a project and **entity approach**, as soon as reasonably feasible during implementation.”
- ◆ **Carbon Offsets**
 - ◆ **Marketable Commodities** developed in addition to any enforceable requirements.

Looking to the Future of Carbon Sinks Accounting

- ◆ At the organizational level, increasing opportunities for organizations with land holdings
- ◆ Data and information requirements can be extensive: be ready to create an extensive, detailed inventory
- ◆ Changes and updates are happening rapidly: check for recent versions of protocols and requirements

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