Monitoring Requirements for Greenhouse Gas Markets and Registries

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Overview

- Introduction to decision support needs
- Examples of reporting requirements and how uncertainty is accounted for
  - California Climate Action Registry (CCAR)
  - Regional Greenhouse Gas Initiative (RGGI)
  - The U.S. Greenhouse Gas Registry (1605b)
  - Chicago Climate Exchange (CCX)
  - Reducing Emissions from Deforestation and Degradation (REDD)
- Common approaches to estimating emissions reductions and sequestration
- Estimation and reporting issues
- Future needs and recommendations for NACP

Prospect for Cap-and-trade Has Increased

New Day Dawns in Carbon Market:

U.S. Poised to Mandate National Emissions Trading Scheme

Democrats Pen Principles for Climate-Change Bills

Senate Panel Sets Goal of Creating Cap-and-Trade System

By Juliet Eilperin
Washington Post Staff Writer
Wednesday, February 4, 2009; Page A02

Democrats on the Senate Environment and Public Works Committee yesterday unveiled a set of principles that will guide their efforts to craft legislation aimed at slowing global warming, firing an opening salvo in what is likely to be one of the year's central legislative debates.

The document released by Sen. Barbara Boxer (D-Calif.), who chairs the panel, was short on details but set a goal of creating a cap-and-trade system designed to reduce greenhouse gas emissions "to levels guided by science to avoid dangerous climate change."

"We know that we have to act, and we intend to act," Boxer said, adding that she and her Democratic colleagues are answering President Obama's "call to action."

Sen. Barbara Boxer said she and fellow Democrats are answering the president's call to action. (By Manuel Balce Ceneta -- Associated Press)

Goal: a transparent and accountable market-based system that efficiently reduces carbon emissions.

Greenhouse Gas and Climate Change Workforce Needs Assessment Survey

(Greenhouse Gas Management Institute 2009)

- There is a shortage of qualified greenhouse gas personnel and experts
- Significant business growth projected for greenhouse gas industry
- Carbon will be traded at volumes equivalent to or greater than other major commodities

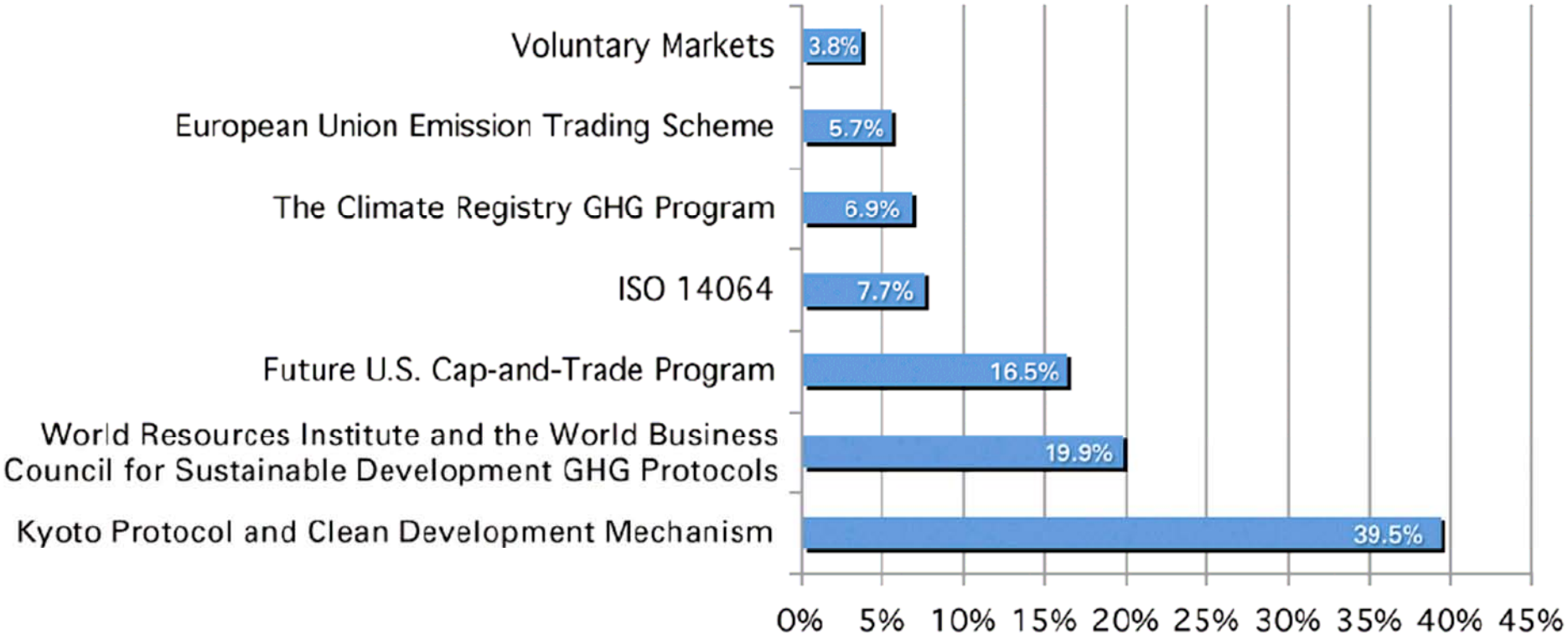
- Corporate / Organizational Inventories
- National Invetories
- Clean Development Mechanism (CDM projects)
- Local, state, or providential inventories
- Facility or plant-level inventories
- Joint Implementation (JI) projects

Kinds of inventories and projects

Greenhouse Gas and Climate Change Workforce Needs Assessment Survey

(Greenhouse Gas Management Institute 2009)

Importance of Greenhouse Gas Management Programs



What is Decision Support?

Decision Support Systems (DSS) are a specific class of computerized information system that supports business and organizational decision-making activities. A properly-designed DSS is an interactive software-based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions (from Wikipedia).

Decision support is:

- Capacity building
- Training
- Guidance

California Climate Action Registry

- Voluntary reporting registry
- Not to be confused with the CA Air Resource Board (CARB) mandatory reporting program
- Entity-wide reporting required
- Project protocols for some sectors (e.g., forestry projects)
- Uses emissions factors to calculate emissions
- Measurements required for some sectors (e.g., forestry)

Emission Factor: A unique value for determining an amount of a GHG emitted for a given quantity of activity data (e.g., million metric tons of carbon dioxide emitted per barrel of fossil fuel).

California Climate Action Registry: Reporting and Uncertainty

- No general statistical uncertainty requirement
- Reference scenario required to estimate reductions relative to baseline
- Independent verifier estimate must be within 5% of the reporter's estimate (focused on reported activity level rather than emissions factors)
- Forestry protocol: set aside portion of credits in an insurance fund. Portion depends on estimated risk of reversal.

Regional Greenhouse Gas Initiative

- RGGI is a cooperative effort by Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions
- Central to this initiative is the implementation of a multi-state cap-and-trade program with a market-based emissions trading system
- Focused on power generating sector (limited offsets allowed)

RGGI Regional Greenhouse Gas Initiative
An Initiative of the Northeast & Mid-Atlantic States of the U.S.

Regional Greenhouse Gas Initiative: Reporting and Uncertainty

- Reporting entities must have a monitoring plan (involves measurements)
- Formulas and some emissions factors provided
- Independent verification plus audits
- For afforestation offset, permanent easement is required
- Error allowance: +/- 10% with 95% confidence

The U.S. Greenhouse Gas Registry: DOE Energy Information Administration 1605(b) Program

- In 2002, the President directed Secretaries of Energy and Agriculture to revise older guidelines for reporting
- Registry designed to support a market for transferable credits
- Take into account emerging domestic and international approaches
- Program is voluntary
- Established standards now followed by other markets and registries

Under a cap and trade program for the U.S., the Environmental Protection Agency is likely to have responsibility for reporting requirements

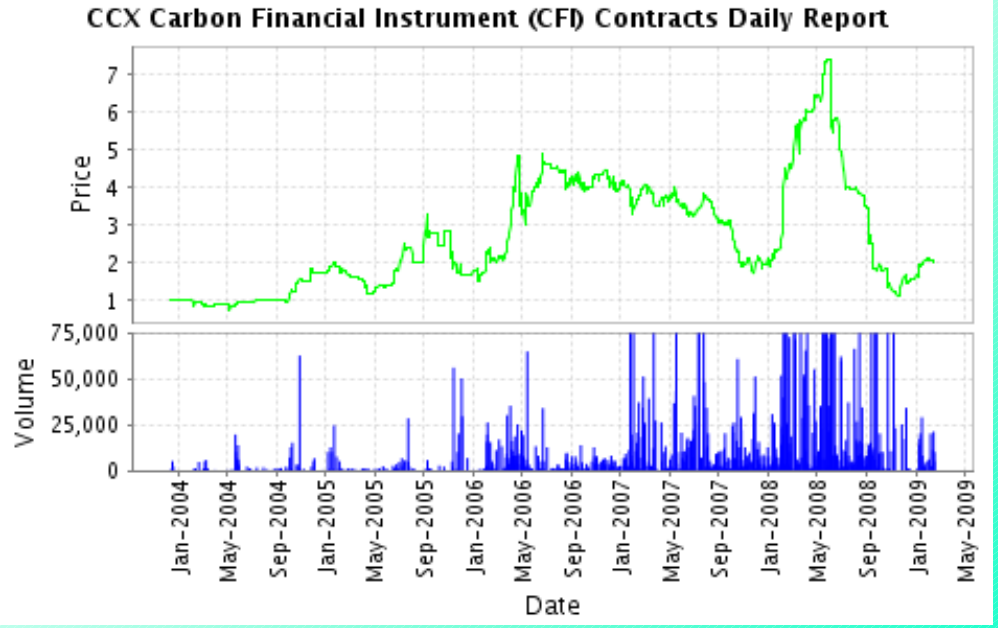
Estimation Method Ratings for the EIA 1605(b) Program

Rating	Points	Characterization	Typical Description
A	4	Most Accurate Available	Direct Measurement of actual emissions source multiplied by measured activity data – typical standard for estimate is +/- 10% at 95% confidence
B	3	Very Good accuracy	Emissions factor based on direct measurements of representative sample multiplied by measured activity data – this is a model
C	2	Adequate Accuracy	Default emissions factor multiplied by measured activity data – regional or global averages in lookup table.
D	1	Better than omitting the source	Default emissions factor multiplied by estimated activity data or static one-time equipment count – this is a guess.

Entities seeking to register reductions must maintain a weighted average rating of greater than 3.0

The Chicago Climate Exchange

- North America's only cap-and-trade system for all six greenhouse gases, with global affiliates and projects worldwide
- Members make a voluntary but legally binding commitment to meet annual GHG emission reduction targets.
- Those who reduce below the targets have surplus allowances to sell or bank; those who emit above the targets comply by purchasing CCX contracts

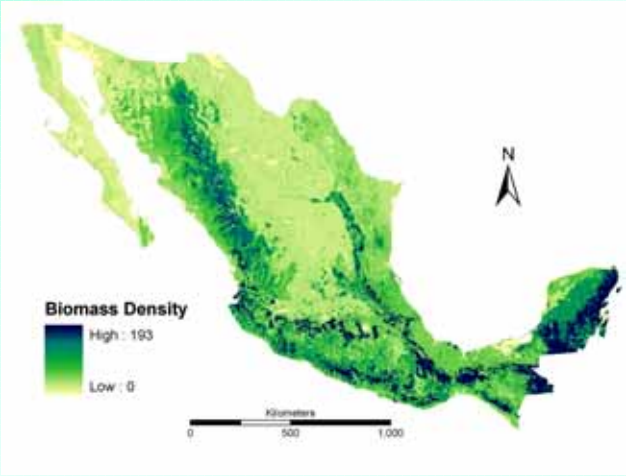


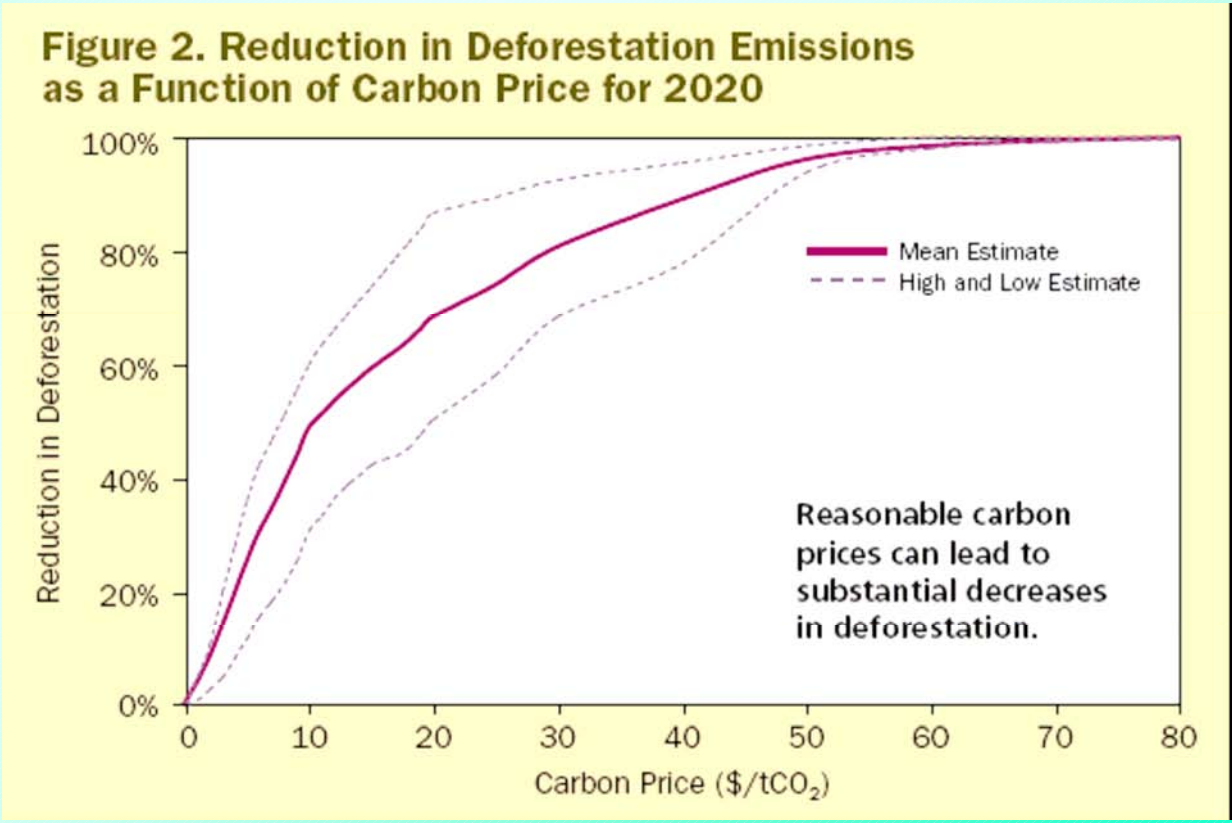
The Chicago Climate Exchange: Reporting and Uncertainty

- Large entities must conduct inventories
- Precision requirements for biomass inventory:
  - Error no greater than 10% at the 90% confidence interval
- Selected models may be used to augment or replace inventory
  - Estimates discounted for variance in model estimates by a minimum of 20% or two times the reported statistical error
- Small entities may use models or lookup tables
  - Estimates are reduced by 30%

Reducing Emissions from Deforestation and Degradation (REDD)

- For $5 billion a year, REDD can protect nearly 20 percent of the tropical forests in danger of deforestation, and $20 billion a year can protect about half.





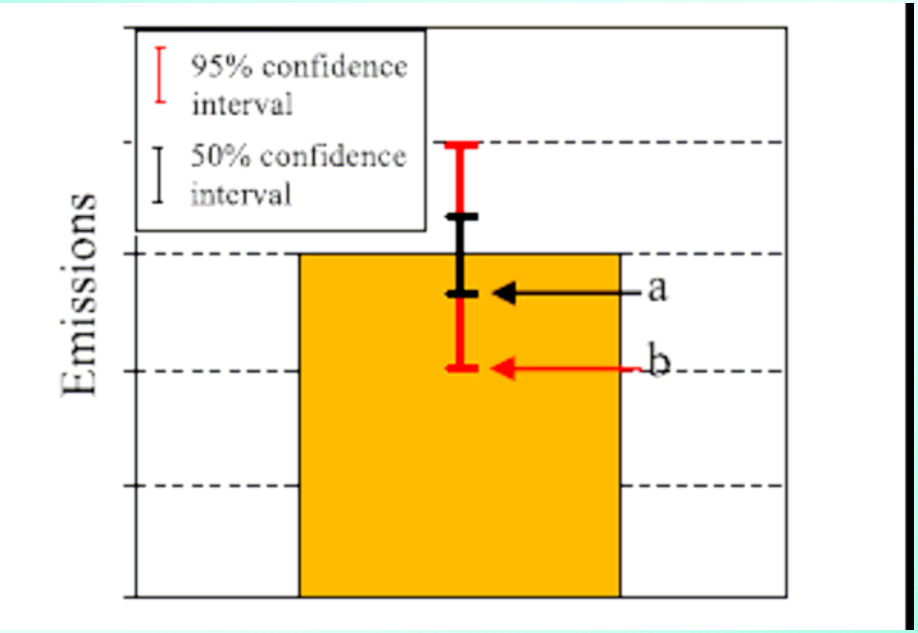
Union of Concerned Scientists 2008

Tropical Countries Getting Ready for REDD

- Countries will need nation-wide LU/LUC change monitoring system.
- Capacity improvements needed:
  - National GHG Inventory
  - Assessment of Deforestation and Degradation
  - Improvements in use of remote sensing
- Possible financing from institutions
  - E.g., World Bank “Biocarbon Fund”

Addressing Estimation Uncertainty in REDD – UNFCCC Approach

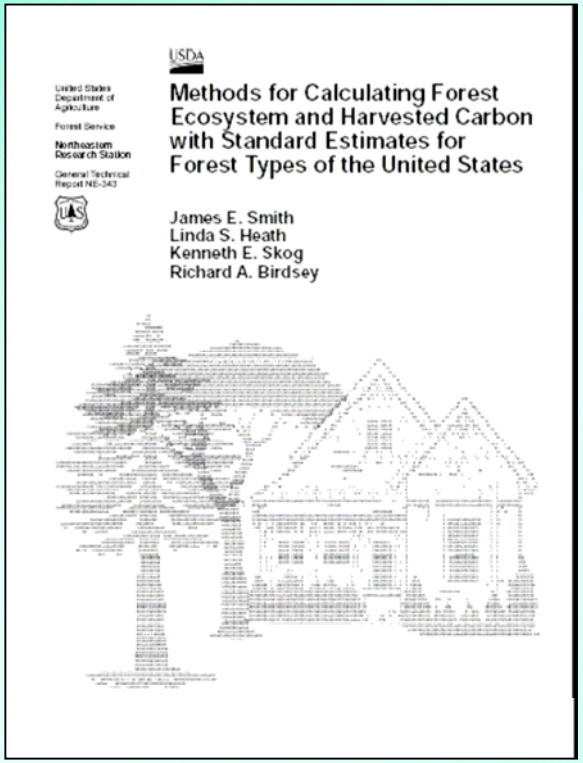
- Methodology and policy are closely integrated
- International accounting rules and guidelines are not yet established
- Existing UNFCCC and IPCC guidelines for monitoring and reporting are informative



Use of the confidence interval to address uncertainties in a conservative manner (from Grassi et al. 2008)

Summary of Approaches to GHG Estimates, Generally Ranked by Certainty

- Measurements **More Certain**
- Models
- Default factors


USDA

Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States

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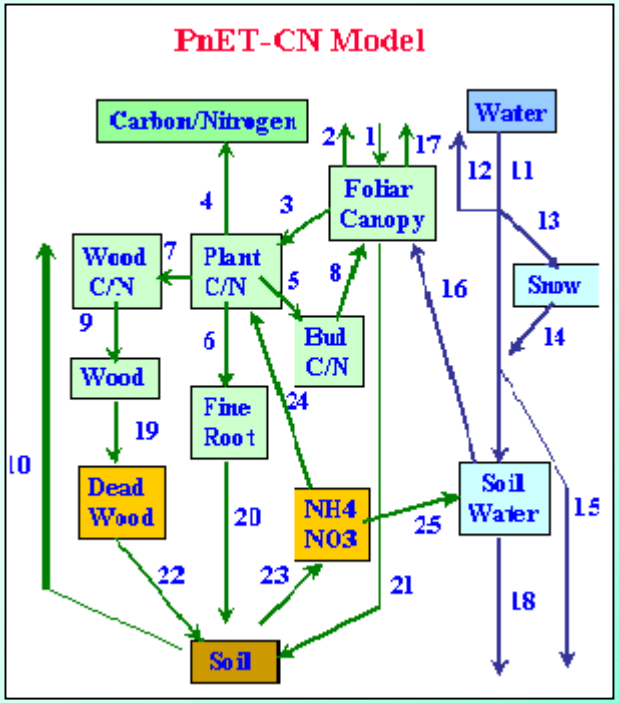
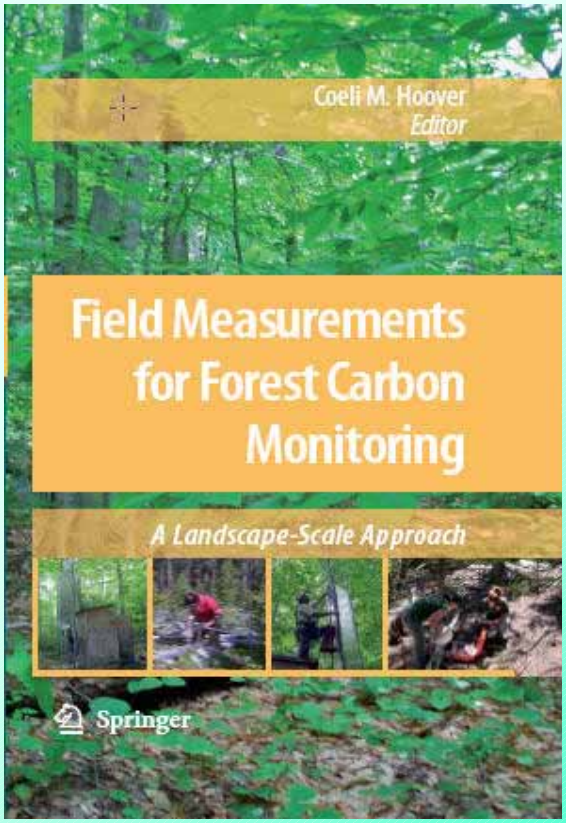
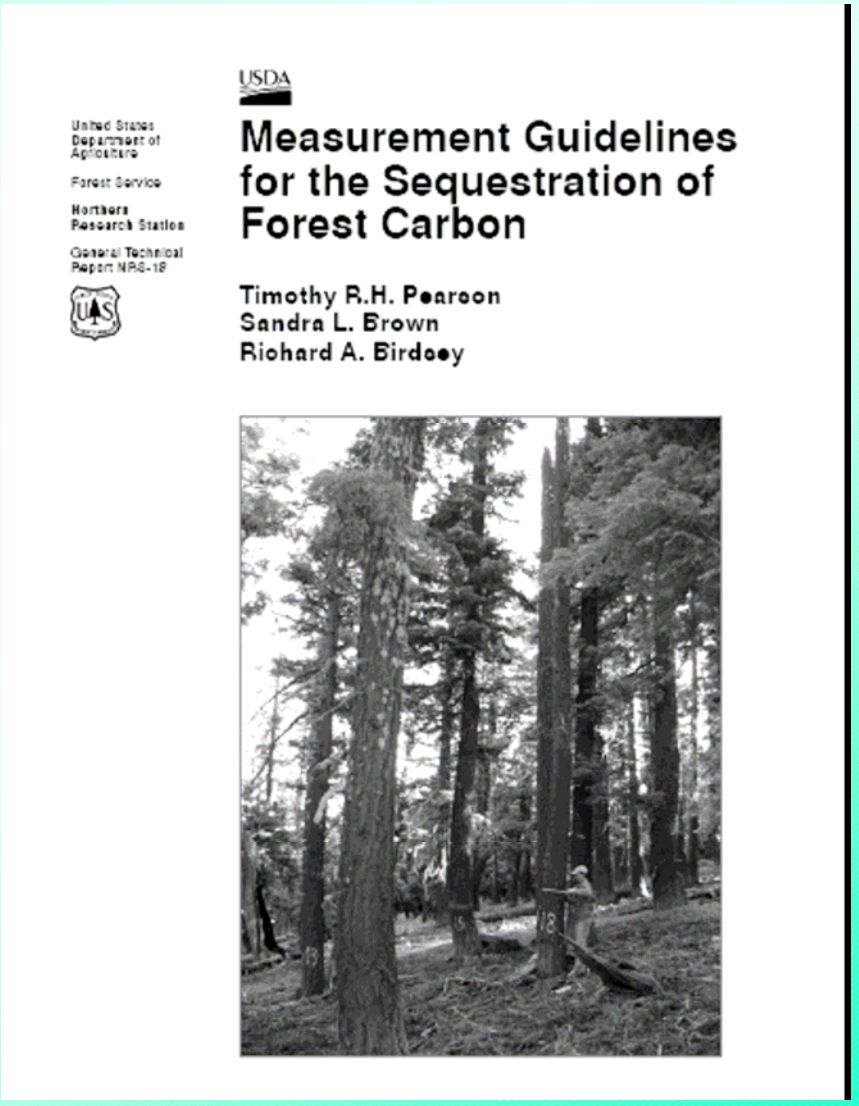
Richard A. Birdsey





Measurements

- Generally, direct measurement is preferred
- Methods must be efficient to keep costs low
- Attribution of effects to causes may be problematic (e.g., to “factor out” climate variability)


USDA

United States Department of Agriculture

Forest Service

Northern Research Station

General Technical Report NRS-18

Measurement Guidelines for the Sequestration of Forest Carbon

Timothy R.H. Pearson
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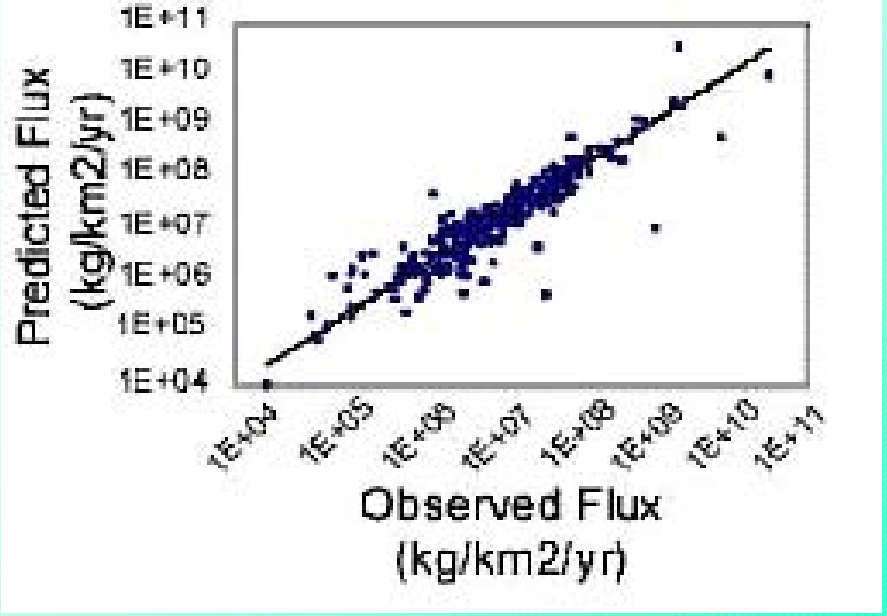
Models

- Accuracy more difficult to assess, but can be acceptable
- Often less costly than direct measurement
- Kinds of models – empirical and process
- May specifically account for more causes and unmeasurable carbon sources and sinks

<u>Guidance on use of models</u>

- Clearly define scope (domain) of model
- Adequate documentation and peer review
- Validate models with data (periodically)



From Prisley and Mortimer 2004

Emission Factors and Lookup Tables

- Work well when individual reports are summed over a large domains equivalent to that used for derivation of factors
- Tend to smooth over interannual variability over time
- Can be consistently applied at low cost to reporters and verifiers
- May not matter if estimates are consistently wrong (biased) as long as change is accurately estimated
- Reporting and verification burden shifts to documentation of “activity” levels

Combinations of Monitoring Methods Often Used in Practice

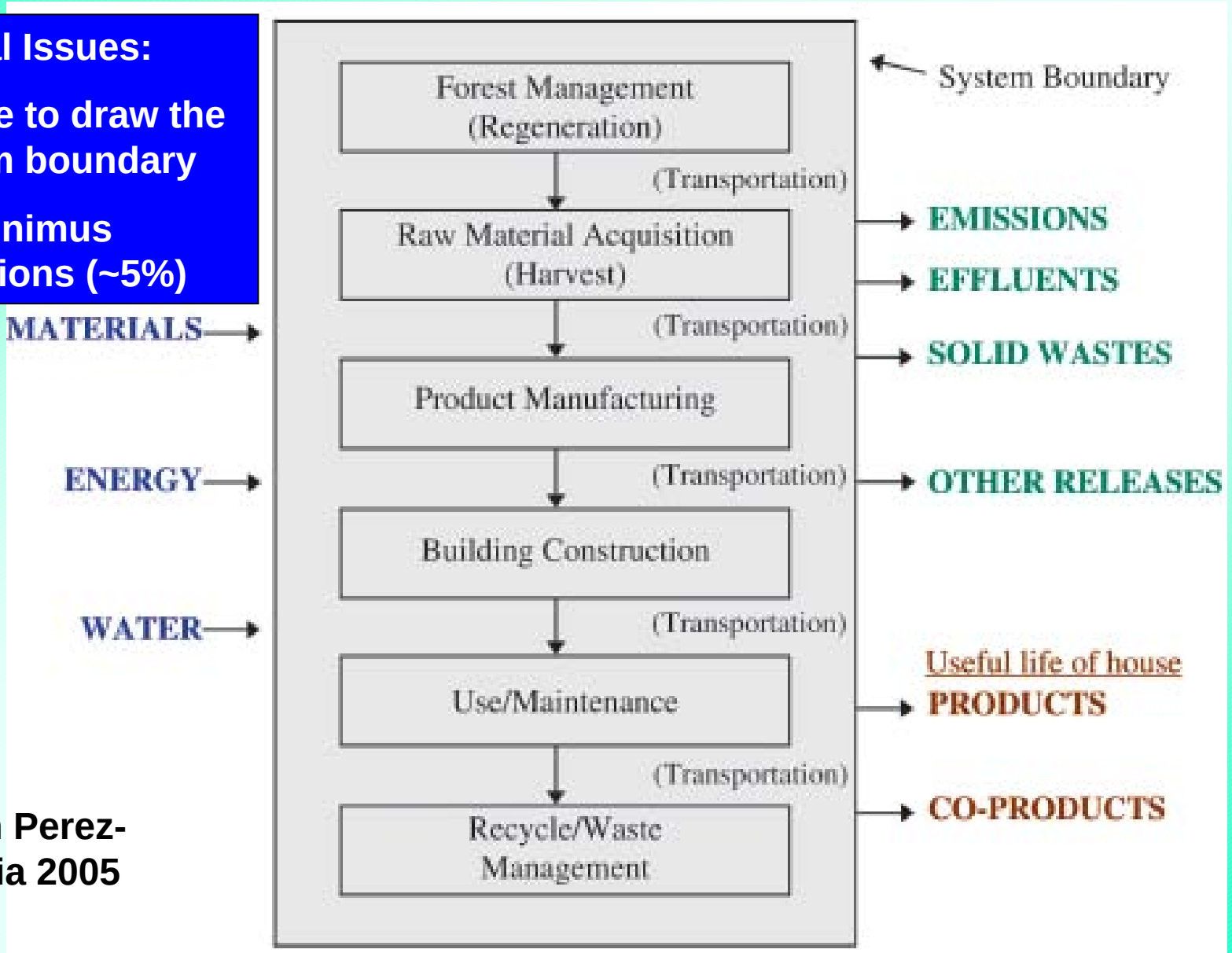
- Remote sensing combined with inventories is efficient and accurate (“multi-tier approach”)
- For annual reporting, periodic direct measurements may be supplemented with models
- Integrated model-data systems may be the best overall approach (NACP!!)
- But, in a global marketplace, is this technology ready for widespread application?

Other Issues: Full Accounting of Emissions Reductions and Sequestration

Critical Issues:

***Where to draw the system boundary**

***De minimus provisions (~5%)**



From Perez-Garcia 2005

Other Issues: Definitions!

- What is a forest?
- What is a degraded forest? →
- What is deforestation?
- What is a managed forest?
- And many more….

FRA 2000

Forest degradation. A reduction of the canopy cover or stocking within the forest through logging, fire, windfelling or other events, provided that the canopy cover stays above 10%. In a more general sense, forest degradation is the long-term reduction of the overall potential supply of benefits from the forest, which includes wood, biodiversity and any other product or service.

UNEP/CBD/SBSTTA 2001

A *degraded forest* is a secondary forest that has lost, through human activities, the structure, function, species composition or productivity normally associated with a natural forest type expected on that site. Hence, a degraded forest delivers a reduced supply of goods and services from the given site and maintains only limited biological diversity.

ITTO 2002 (adopted UNEP/CBD/SBSTTA definition with the following qualifier)

Degraded and secondary forests include all those forests and forest lands that have been altered beyond the normal effects of natural processes through unsustainable use.

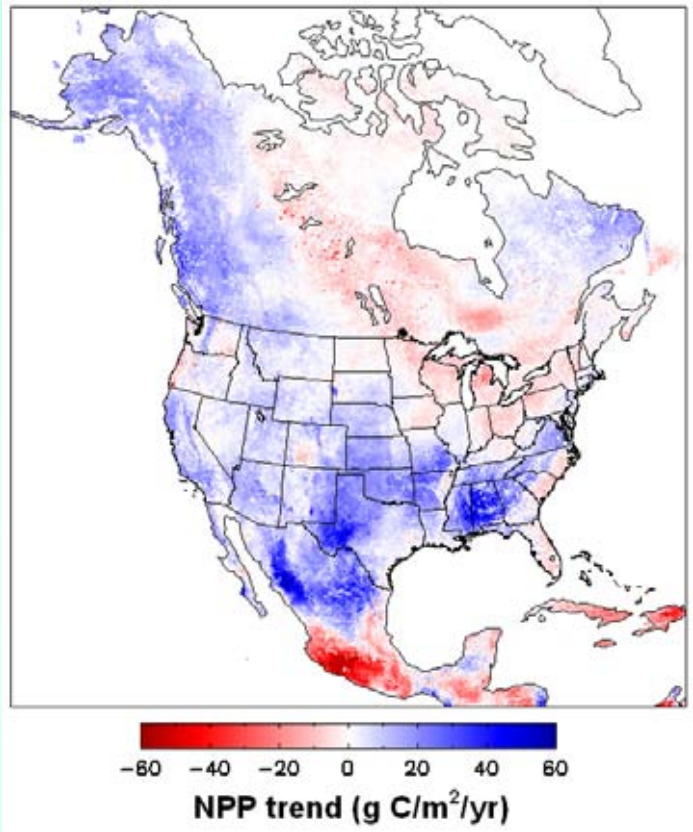
IPCC (draft version developed by a Task Force)

Degradation is a long-term reduction of tree crown cover towards but not exceeding the minimum accepted ‘forest’ threshold.

Issue: Spatial Scale Matters

- Information needs and approaches to use are dependent on scale
- Typical scales: country, region, state, project
- Example:
  - Reporting = bottom up; verification = top down
  - How to make top-down methods consistent with bottom-up methods

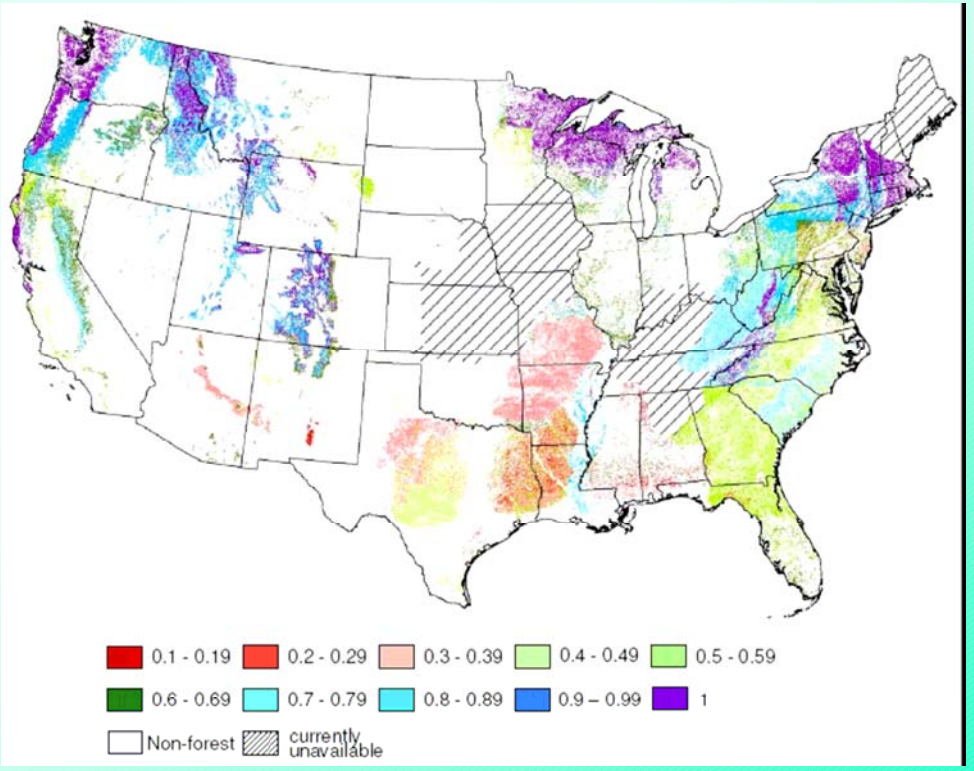
From Zhao et al. 2006



Issue: Temporal Scale Matters

- The baseline or starting point is critical for calculating additional emission reductions
- Need to characterize interannual variability in annual reports?
- What about "reversals"? →
- When does monitoring end?

Continental U.S. risk-scaled carbon value map



Hurteau et al. 2009

Issue: Definition of "Reporting Entity" Will Determine the Monitoring Approach

- Project-level reporting requirements
  - CCX requires direct measurement
- Entity-level reporting requirements
  - 1605(b) requires comprehensive entity-wide accounting and reporting
- Country-level reporting requirements
  - REDD is likely to require national-level monitoring

Performing Decision Support Using Decision-support Systems

- A decision-support system is not decision support
- A useful DSS will likely require:
  - Staff to maintain and update the system
  - Staff to answer user questions
  - Outreach and training to build calacity
- A continuing research function

Important Issues Regarding Uncertainty NOT Fully Addressed in this Talk

- Additionality and baseline setting
- Accounting for effects outside the reporting boundaries (leakage)
- Climate vs. CO_2 mitigation: full accounting for biophysical factors (reflectivity, evaporation, surface roughness)

Current/Future Monitoring Needs

- International protocols will continue to set the broad parameters for monitoring and verification
- Continued use of integrated remote sensing and surface measurements (technology widely available)
- Carbon models need to include expected effects of climate change (empirical →→ process)
- Improved accounting for risk
- Improved separation of causal factors (“factoring out”)
- Improved methods for baseline setting needed soon
- Extend accounting to include effects on global warming potential (longer term)

Conclusions and Recommendations for NACP

- Markets and registries are emerging and signal a large expansion of commodity trading
- Monitoring methods and greenhouse gas policies are inherently intertwined
- NACP methods can help reduce discounting of credits by providing more accurate estimates
- Advanced model-data products are required for baseline setting and attribution of effects to causes
- Cannot expect decision-support tools to be used without providing for decision support!...
- …but, who is responsible and where is the funding?