



Valuing Ecosystem Services on Public Lands – A U. S. Forest Service Perspective

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Implementing Florida's Land Conservation Programs in the Next Decade
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A special thanks to Sarah Hines, Beth Larry, Rich Birdsey, Mark Nechodom , and FMSC, USFS

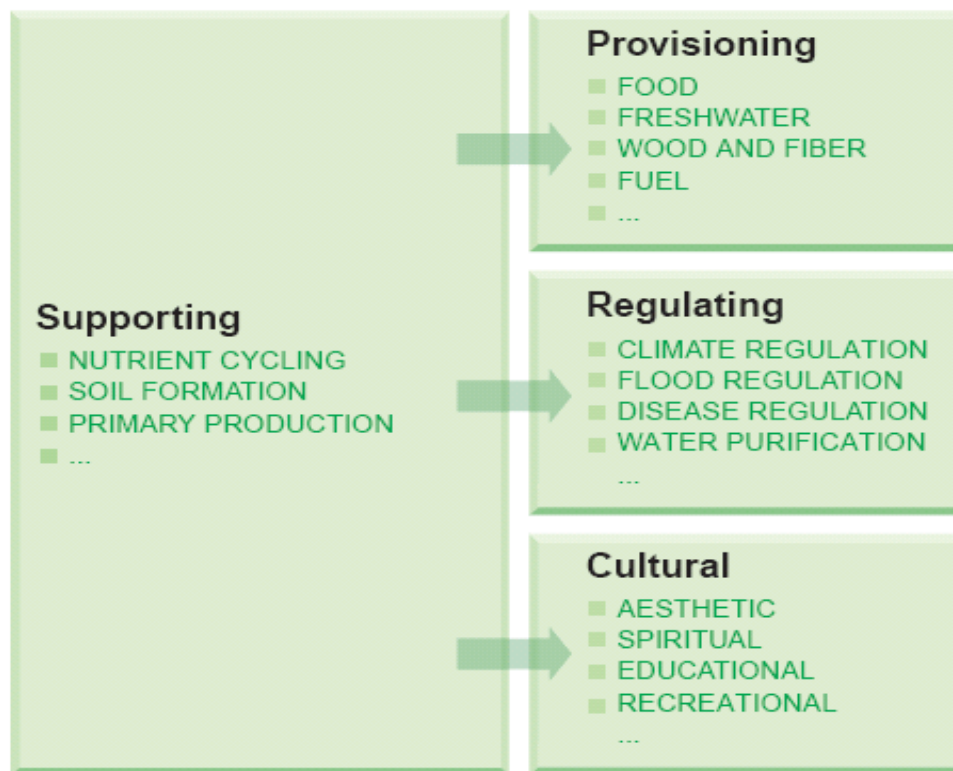


VALUING NATURE'S CAPITAL

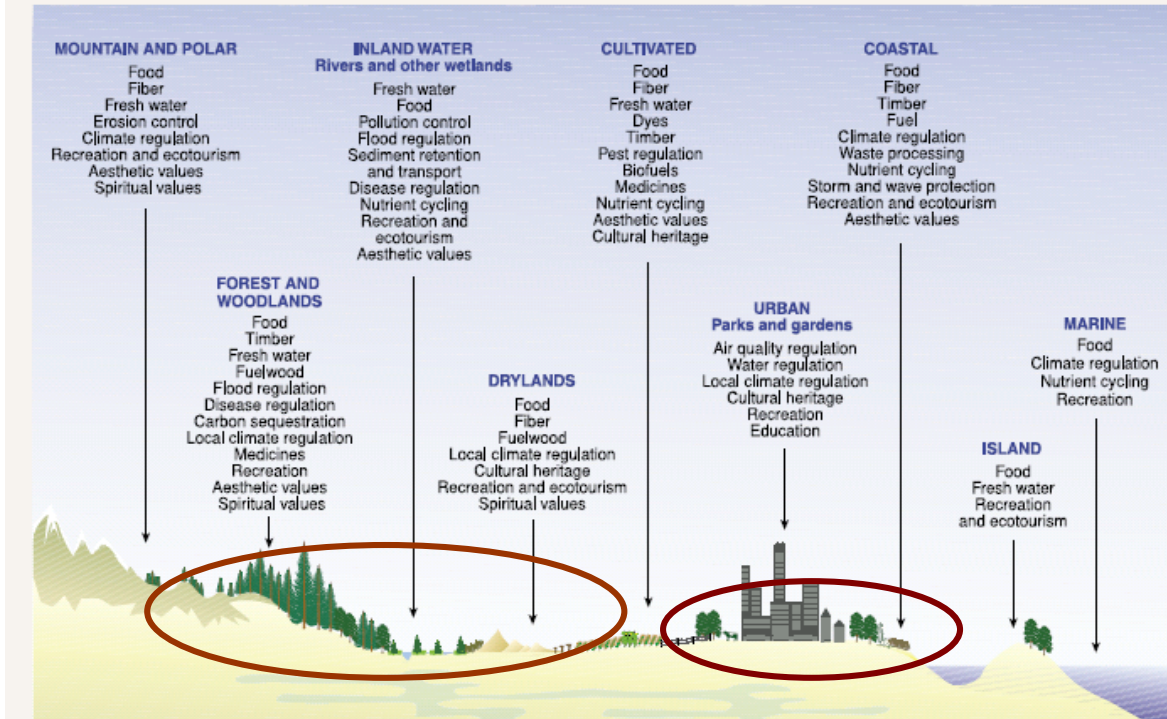
What are ecosystem services?

The benefits **people** obtain from **ecosystems**...

ECOSYSTEM SERVICES



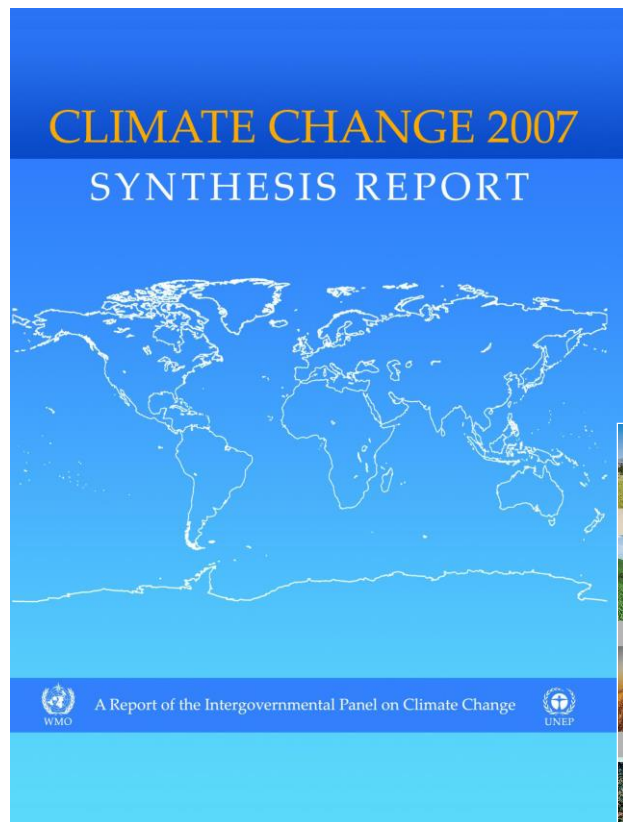
Source: Millennium Ecosystem Assessment



Global environmental services are over US\$ 33 trillion annually
(Costanza, 2005)

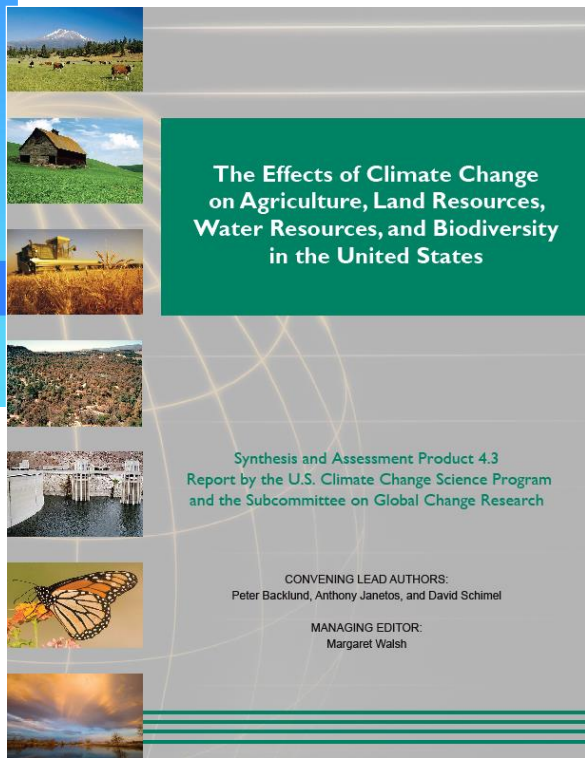


Source: Millennium Ecosystem Assessment



“Climate change impacts on ecosystems will affect the services that ecosystems provide, such as cleaning water and removing carbon from the atmosphere (*very likely*)...”

SAP 4.3 executive summary



The Mission of the U. S. Forest Service

Sustaining the health, productivity, and diversity of the nation's forests and grasslands to meet the needs of present and future generations.

Restoration and resilience

Stressors and drivers

Climate change adaptation

Ecosystem services



DRIVERS of ECOSYSTEM DECLINE

climate change
increases in population, wealth
globalization
disconnect between people & nature
etc..

Management CHALLENGES

wildfire & extreme events
pests & invasives
loss of open space
water scarcity & decline
recreation pressures
etc..

Management OPPORTUNITIES

climate mitigation
new ecosystem markets
alternative energy
sustainable operations
collaboration; new partners
etc..

Ecosystem MANAGEMENT

restoration
fuels treatments
biomass utilization
demonstration projects
etc..

Ecosystem SERVICES protection & enhancement

cleaner air and water
species diversity
climate adapted forests
flood control
cultural & educational values
etc..

An ECOSYSTEM SERVICES perspective...



Forest Service Snapshot

1. Certainty to the marketplace.
2. Provisions for reliable and trusted information.
3. Experiment and learn on the National Forests.
4. Become market savvy.
5. Reduce our own environmental foot print.
6. Leadership in research.
7. Refresh our language.
8. Integration of ecosystem services into forest planning.
9. Foster dialogue and avoid jumping on bandwagons without thinking.
10. Learning.



Custer Project



Carbon Reporting

Using the Forest Vegetation Simulator



USDA Forest Service
Forest Management Service Center
Forest Vegetation Simulator Staff

FVS Stand Carbon Report

- **Converts biomass of all stand components to carbon**
 - - live/dead tree biomass (above and below ground)
 - surface biomass (ddw, forest floor, herbs and shrubs)
 - soil carbon is not calculated
- **Carbon metrics**
 - dry tons per acre (tC/ac) / dry metric tons per hectare (tC/ha)
- **Carbon calculations**
 - tC/ac of stand components = $0.5 * \text{biomass}$ (Penman and others, 2003)
 - tC/ac of Forest floor = $0.37 * \text{tons/acre of forest floor biomass}$ (Smith and Heath, 2002)

FVS Stand Carbon Report

- Computes total Carbon within stand over time
- Computes total Carbon removed from the stand over time

2007

Stand=370210078 Year=2007 Inventory conditions



64.5 tons/ac

Thinning

Stand=370210078 Year=2007 Post cutting

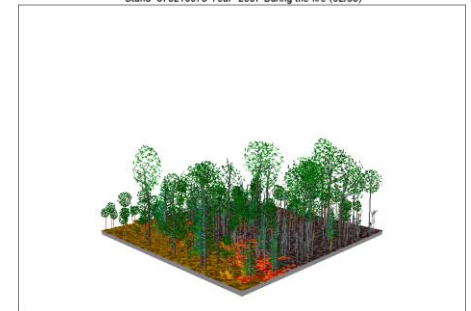


19.4 tons/ac

removed

Prescribed Burn

Stand=370210078 Year=2007 During the fire (02/03)



5.6 tons/ac

removed

FVS Example #1

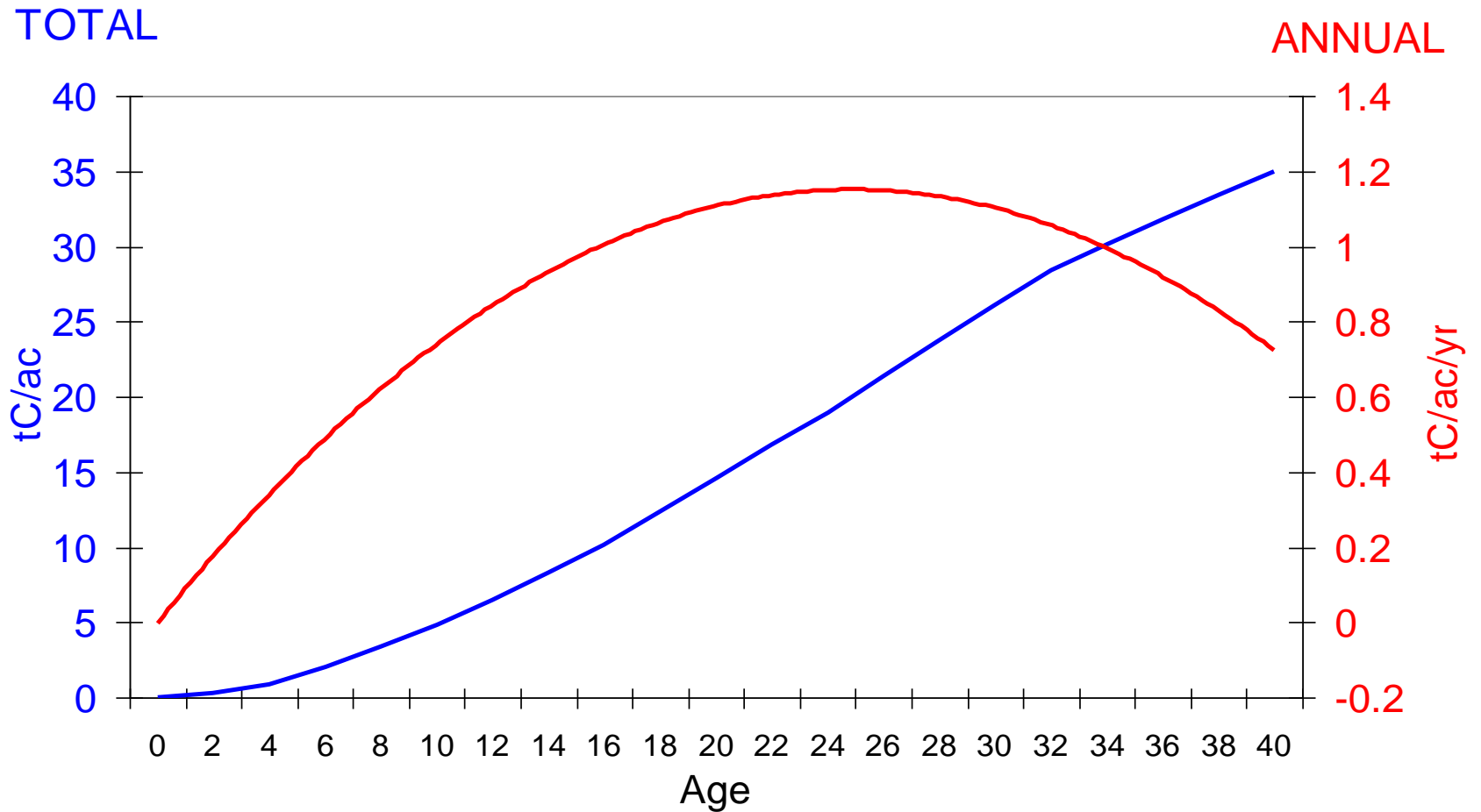
How much carbon can a specific forest stand sequester?

- *Objective: forestation of abused land in Southern U.S.*
- *Management Alternative*
 - *plant 400 loblolly pine per acre*
 - *grow for 50 years*
- *Look at total and annual growth* of tC/ac*

**annual growth of tC can be sold on the Chicago Climate Exchange*

FVS Example #1

Total and Annual Carbon Sequestration of Example Loblolly Pine Stand



*Carbon Benefits of Fuels Treatments & Biomass
Energy:*
The Alder Springs Project

Nicholas Martin, **Winrock International**
Mark Nechodom, **USDA Forest Service – Pacific
Southwest Research Station**



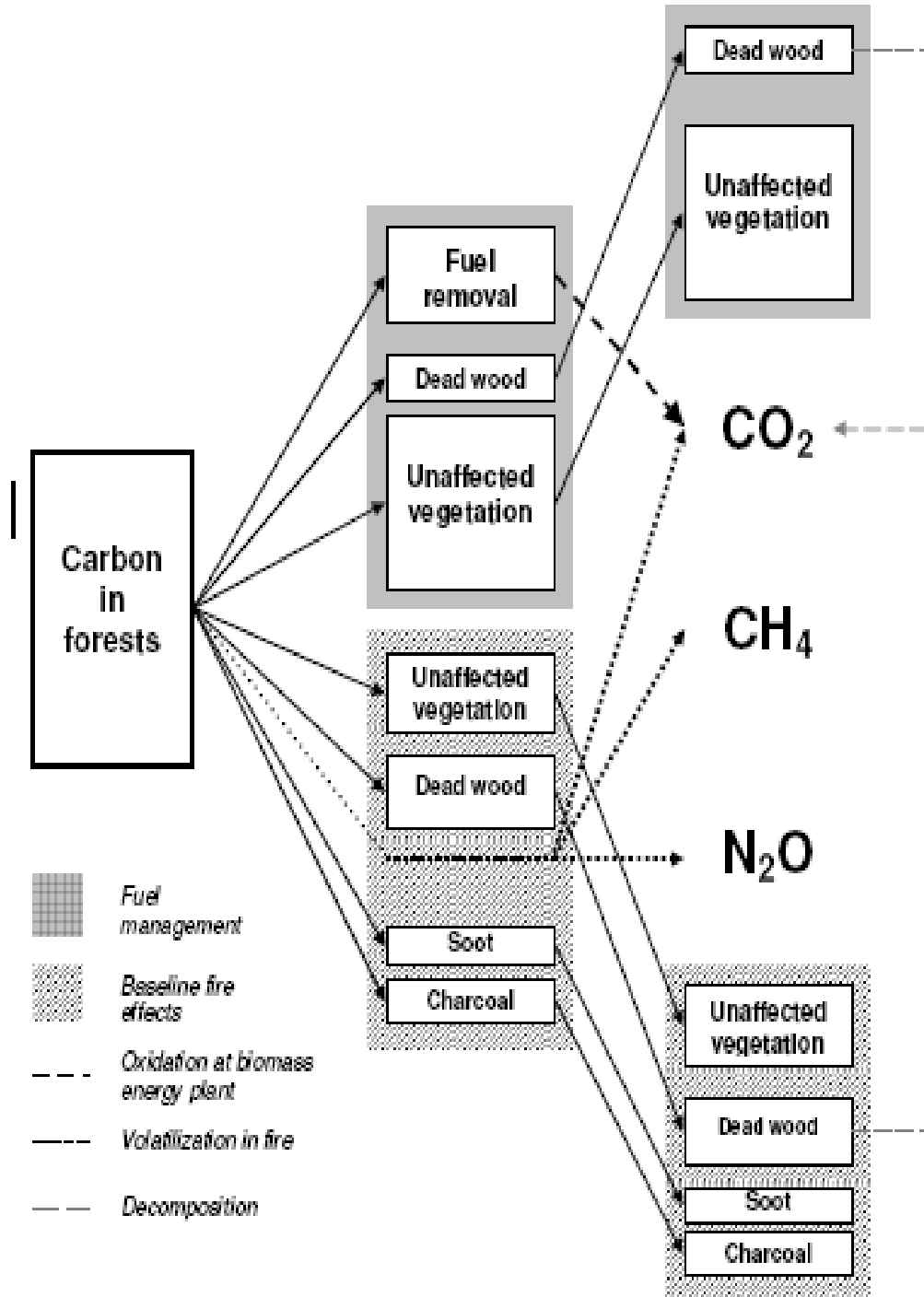
Quantify net GHG benefits



Objectives

1. Quantify the net carbon benefits of fuels reduction and bioenergy
2. Classify lands for treatment based on range of costs and values including timber, carbon, biomass fuel, renewable energy incentives
3. Provide protocols to help USFS incorporate carbon values into project design, appraisal and contracting
4. Provide a framework for reporting and/or hypothetical sale of CO₂ credits from fuel reduction on National Forests
5. Analyze impacts of fossil fuel prices, RPS targets and REC markets, and cellulosic biofuel development on economics of fuel treatments

Compare area burned, fire behavior and emissions in baseline vs. project scenarios



Wetlands Banking

Recent EPA and Army Corps of Engineers Rule

<http://www.epa.gov/wetlandsmitigation/>

Identifies methodologies for evaluating potential mitigation and restoration strategies
Identifies potential environmental benefits (i.e., mitigation credits)

National Forest Demonstration Projects – will explore methods for calculating the benefits of wetlands banks or support refinement of wetlands banking protocols



Water Quality Trading

Market based approach to improve water quality

<http://www.epa.gov/owow/watershed/trading.htm>

Trading Programs – Allow facilities with high costs to meet obligations by purchasing pollution reductions from another source at a lower cost

National Forest Demonstration Projects – will explore methods for calculating the water quality benefit of different management techniques or explore development and/or refinement of water quality trading protocols





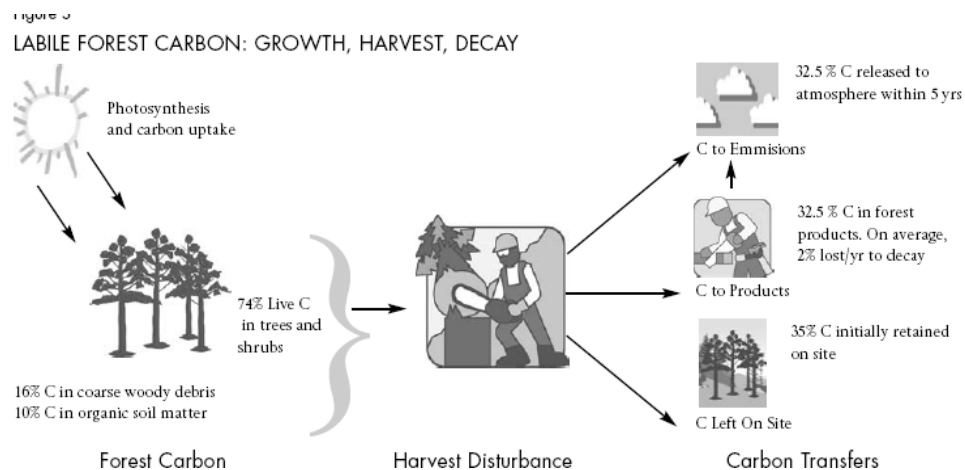
What US Forest Service Monitors and Reports: Carbon Pools in Forest Ecosystems

	<i>Summarized estimates for default tables</i>	<i>Summarized estimates for reporting</i>
Live trees: above-ground	Live trees	Ecosystem carbon
Live trees: below-ground		
Tree seedlings	Understory vegetation	
Shrubs, herbs, forbs, grasses		
Standing dead trees: above-ground	Standing dead trees	
Standing dead trees: below-ground		
Down dead wood	Down dead wood	
Stumps and dead roots		
Fine woody debris	Forest floor	
Litter		
Humus		
Soil carbon	Soil carbon	



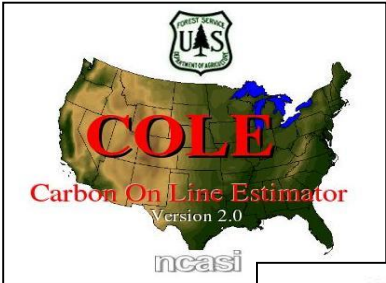
What US Forest Service Monitors and Reports: Carbon Pools in Harvested Wood Products

- Products in use
 - (wood and paper; forest sector)
- Products in landfills
 - (wood and paper; forest sector)
- Emitted with capture
 - (concomitant energy capture; energy sector)
- Emitted without capture
 - (combustion or decay; forest sector)



US Forest Service Decision-Support for Forest Carbon Management

- What is needed:**
- Regional estimates
 - Forest Management
 - Urban Forestry
 - Wood Products
 - Natural disturbance
 - Need more help?



WOODCARB

<http://nrs.fs.fed.us/carbon/tools>



A Few Definitions...

- **Offset v.** A specific activity or set of activities that reduce, remove, or sequester GHG emissions from the atmosphere.
- **Offset (carbon offset) n.** A greenhouse gas (GHG) offset is generated by the reduction, avoidance, or sequestration of GHG emissions from a specific project. Offsets are so named because they counteract or offset greenhouse gases that are emitted into the atmosphere; they are a compensating equivalent for reductions made at a specific source of emissions. Examples of offsets would include forestry and agricultural activities that absorb carbon dioxide, and reductions achieved by entities that are not regulated by a greenhouse gas control program.
- **Credit (carbon credit) n.** Formally accredited offsets that can be traded in a regulatory or voluntary climate change program.
- **“Real, Measurable, Verifiable, Additional,”** Terms commonly used to confirm the validity and legitimacy of offsets. “Real” indicates that a reduction in GHG emission has taken place; “measurable” indicates that it can be quantified; “verifiable” indicates that it can be registered and tracked; and “additional” indicates that it represents a scenario/action that is above and beyond what would have typically happened in a “business as usual” scenario.



Critical Accounting Elements

Issue 1: Permanence - Will the carbon stay out of the atmosphere?

- Potential solutions:
 - Assign liability, hedge risks, require continuous reporting
 - Temporary credits, long-term credit “leasing”
 - Discounting
- Verifying the existence of carbon stocks is easier over time
 - Cumulative aggregation of carbon is easier to detect than year-to-year fluctuations

Critical Accounting Elements

Issue 2: Leakage – Will emissions be produced elsewhere as a result of projects?

– Potential solutions:

- Discount credits from entities at higher risk of activity shifting leakage
- Reporting requirements: certify that changes did not occur elsewhere
- Exclude certain forest management activities
- Accept leakage as a risk (adjust national goals)

Critical Accounting Elements

Issue 3: Additionality – Would the emissions occur anyway?

– Potential solutions:

- Limit entry (categorical exclusions)
 - Exclude forests (EU)
 - Exclude deforestation & forest management (several US registries)
- Document justification
 - Reporting requirements (CCAR)
 - Barrier tests
- Discount credits
 - Proportional additionality
- Accept difficulty of establishing (adjust national goals)

Critical Accounting Elements

- **Issue 3.5: Baselines – What are we measuring benefits against?**
 - Options:
 - **Historic**
 - Base year/period carbon stocks
 - Base year/period carbon fluxes
 - The actions of others (comparable management on similar lands)
 - **Expected**
 - Projections of business-as-usual
 - Projections of expected improvements
 - Projections of expected average business practice

Measurement: Cost-Accuracy Tradeoffs



Less costly, less precise

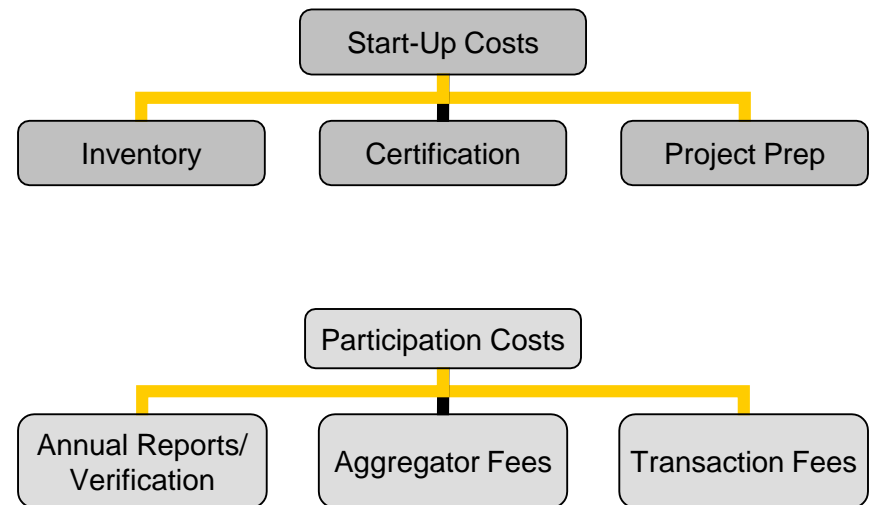
e.g. lookup tables

More costly, more precise

e.g. on-site measurement

Annual Costs per Forested Acre

- Start-up (Fixed): \$0.28
- Participation (Variable): \$1.26
- Total \$1.53



Estimates courtesy of Forecon; <http://www.foreconinc.com/>



Farm Bill: Facilitate market-based approaches for enhanced environmental benefits...

Sec 2709 - Authorizes USDA to create a Federal framework to establish private Ecosystem Services markets

- 1. Develop uniform standards*
- 2. Foster market confidence and validity*
- 3. Strengthen and promote investments in markets*

