When New Carbon Markets and New Technologies Meet

NASA CMS Applications Policy Speaker Series
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Overview

• Who is Blue Source?

• Global carbon offset markets
• Forestry’s role in carbon markets
• Carbon project requirements, dynamics/economics
• Carbon measurement requirements, processes, costs
• Barriers to adoption of remote sensing solutions
• Speeding adoption

• Q&A
Who is Blue Source?

Founded in 2001, Blue Source is the oldest and largest offset project developer in North America

• 200+ Projects
• 100,000,000 offsets created
• Offset projects in nearly all 50 states and most Canadian provinces
• Most forest offsets generated

• Emphasis
  • Generating high quality, high volume GHG emission reductions
  • Motivating industry to action through leveraging carbon markets to provide financial incentives to reduce emissions
  • Simplifying carbon markets for those companies that wish to or are forced to address their carbon footprints
Global Carbon Offset Markets

A Carbon Offset is a reduction of greenhouse gases, measured in metric tonnes of CO$_2$ equivalent (mtCO$_2$e), meeting the following criteria, that is created by one entity, transferred to another, and ultimately retired.

- **Offset Criteria**
  - Real
  - Verifiable
  - Permanent
  - Surplus
  - Measurable
  - Additional

A carbon market is a group of companies and individuals looking for cost-effective means for reducing their environmental impacts, out of either internal motivations or regulatory requirements.
Voluntary, Compliance, Pre-Compliance Carbon Markets

- **North America**
  - Voluntary (VCS, ACR, CAR)
    - Internal Sustainability, CSR
    - Carbon Neutral Product or Supply Chain
  - Compliance
    - California, Quebec (Ontario?)
    - RGGI
    - Alberta
    - British Columbia
  - Pre-Compliance

- **International**
  - Voluntary
  - Kyoto Protocol Driven (EUETS, CDM, JI)
Forestry’s Role in Carbon Market

• **Voluntary Benefits**
  • Co-benefits
    • Biodiversity
    • Local water quality
    • Community
    • Community-economic

• **California Compliance Benefits**
  • High volume projects
  • Large potential reductions across industry
  • EHS Regulatory conformance

• **Disadvantages**
  • High cost of development
  • High degree of difficulty, long path to market
  • Complexity for buyers
  • 100-year landowner commitments
  • Monitoring Challenges

Source: American Carbon Registry
Forest Offset Project Requirements (California Cap and Trade)

- A/Reforestation (AR), Avoided Conversion (AC), Improved Forest Management (IFM)
- Lower 48 states and Alaska
- Natural forest management, sustainable harvesting (e.g. SFI, FSC, Tree Farm)
- Clear title/ownership of carbon credits, eased or un-eased

- ~100 year commitments: measurement, verification, reversals
  - Resample every 12 years, verify every 6 years, model and report annually
  - Compensate for intentional reversals (i.e. harvests)
  - Similar to a conservation easement with a termination option
    - Can subdivide and sell, but commitment transfers w/ownership
    - Can exit at any time if pay back all credits issued (+ 0-40% penalty)
  - Endowment may be set aside in first years to cover 100-year expenses
  - Also: 3-8 year invalidation risk (offset buyer is liable)

- See also VCS, ACR, CAR forest carbon project protocols

= Minimum Practical Size = 1,000 ac Avoided Conversion / 3,000 ac Improved Forest Mgt
Assumes

- 10,000 acres
- Carbon stocks 20% over average stock
- 50% annual growth harvested
- $10/ton carbon price
- 10 year crediting (25-100 year possible)
Project Dynamics/Economics: Avoided Conversion (AC)

Assumes:
- 2,500 acres
- 3 acre residential development avoided
- Carbon stocks 20% over average stock
- 50% annual growth harvested
- $10/ton carbon price
- 10 year crediting (25-100 year possible)
## Carbon Measurement Requirements, Costs, Potential Savings

<table>
<thead>
<tr>
<th>Estimated Costs</th>
<th>Initial</th>
<th>Ongoing</th>
<th>Frequency</th>
<th>Potential Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Feasibility Assessment (eligibility, volume)</td>
<td>$5-$15k</td>
<td>$0</td>
<td>one time</td>
<td>**</td>
</tr>
<tr>
<td>Legal (AC Only)</td>
<td>$0-$20k</td>
<td>$0</td>
<td>one time</td>
<td></td>
</tr>
<tr>
<td>Appraisal (AC Only)</td>
<td>$5-$30k</td>
<td>$0</td>
<td>one time</td>
<td>*</td>
</tr>
<tr>
<td>2 Forest Carbon Inventory</td>
<td>Varies</td>
<td>Varies</td>
<td>~one time</td>
<td>*</td>
</tr>
<tr>
<td>Inventory Methodology and Design</td>
<td>$30-$75k</td>
<td>$20-$100k</td>
<td>12 years (6?)</td>
<td>**</td>
</tr>
<tr>
<td>Inventory Sampling / Field Work</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Calculation of Carbon Benefits</td>
<td>$15-$80k</td>
<td>$0-$20k</td>
<td>6 years/harvests</td>
<td>*</td>
</tr>
<tr>
<td>Project Growth &amp; Yield models</td>
<td>$5-$50k</td>
<td>$0</td>
<td>one time</td>
<td>*</td>
</tr>
<tr>
<td>Baseline Scenario Harvest Model (legal, economic)</td>
<td>$5-$20k</td>
<td>$0-$10k</td>
<td>annual</td>
<td>**</td>
</tr>
<tr>
<td>Conversion of “Gross” to “Net” Carbon Benefits (credits)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>▪ Inventory confidence</td>
<td></td>
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<tr>
<td>▪ Leakage</td>
<td></td>
<td></td>
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<tr>
<td>▪ Wood products</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>▪ Reversal risk, e.g. fire, wind</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Project Design and Documentation</td>
<td>$10-$100k</td>
<td>$0</td>
<td>one time</td>
<td></td>
</tr>
<tr>
<td>5 Third-party Verification</td>
<td>$30-$75k</td>
<td>~80% Initial</td>
<td>6 years</td>
<td>**</td>
</tr>
<tr>
<td>Full (Site) Verification</td>
<td>$0</td>
<td>$7-$10k</td>
<td>when crediting</td>
<td>*</td>
</tr>
<tr>
<td>Desk Verification</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Registration</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7 Marketing, Sales, Contracting</td>
<td></td>
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<tr>
<td>8 Annual Monitoring and Reporting</td>
<td></td>
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<tr>
<td>9 Project Finance</td>
<td></td>
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</tbody>
</table>

- 12 month process
- Upfront Inventory, Verification Costs: $60-150k In Year 1
- 100 Year Monitoring, Verification, Inventory Costs: $100-200k Endowment
Barriers to Adoption

- Strong support “as long as the science is there”
- Differing prospects for inventory, monitoring, verification; pre/post-crediting
- Specific protocol requirements would need modification
  - Plot sampling parameters including dbh, height for volumetric equations
  - Sampling Error <5%-20% of mean at 90% confidence
  - Required pools, verification protocols, modeling requirements

### Table A.1. Requirements of carbon pool categories and determination of value for pool

<table>
<thead>
<tr>
<th>Category</th>
<th>Carbon Pool</th>
<th>Improved Forest Management</th>
<th>Reforestation</th>
<th>Avoided Conversion</th>
<th>Determination of Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living biomass</td>
<td>Standing Live</td>
<td>Required</td>
<td>Required*</td>
<td>Required</td>
<td>Sampled in Project</td>
</tr>
<tr>
<td></td>
<td>Shrubs and Herbaceous Understory</td>
<td>Excluded</td>
<td>Required</td>
<td>Excluded</td>
<td>Sampled in Project</td>
</tr>
<tr>
<td>Onsite dead biomass</td>
<td>Standing Dead</td>
<td>Required*</td>
<td>Required**</td>
<td>Required**</td>
<td>Sampled in Project</td>
</tr>
<tr>
<td>Soil</td>
<td>Soil**</td>
<td>Required/ Excluded**</td>
<td>Required/ Excluded**</td>
<td>Required/ Excluded**</td>
<td>Sampled in project</td>
</tr>
</tbody>
</table>

* Pre-existing trees must be distinguished from planted trees. Since pre-existing and new trees are easy to distinguish for several decades after tree planting, pre-existing trees do not need to be inventoried until the offset project first seeks verification of GHG reductions and GHG removal enhancements.
** Soil carbon is not anticipated to change significantly as a result of most Forest Project activities. Soil carbon is excluded except when specified in Section 5.

### Table 10.1. Minimum number of sample plots in sequence, as a function of project size.

<table>
<thead>
<tr>
<th>Test</th>
<th>Number of Strata Verified</th>
<th>&lt;100</th>
<th>100 - 500</th>
<th>501 - 5,000</th>
<th>5,001 - 10,000</th>
<th>&gt; 10,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired/Unpaired</td>
<td>Test</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Paired/Unpaired</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Paired/Unpaired</td>
<td>1</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
</tbody>
</table>

CA Air Resources Board: Compliance Offset Protocol U.S. Forest Projects Section 10, Appendix A, Appendix B
Other Potential Barriers / Questions

- Single tree selection yields uniform ht/canopy, yet carbon varies w/basal area?
- 2-3 age classes - ability to penetrate the canopy/measure understory?
- Differentiate between e.g. hard maple and soft maple?
- Mixed old and second growth have similar ht/canopy, very different dbh/carbon?
- What’s realistic expected reduction in plots (inv, verif)?
- Tradeoff in sampling uncertainty
Speeding Adoption

- Engage ARB to modify protocol; ACR/VCS/CAR to approve new protocol or module
  - Emphasize potential to reach small landowners, dramatically increase market potential
  - Post-crediting monitoring
- Use existing/ongoing project data for ground truthing (Hurtt-03)
- Just Do it: start using to support inventory, demonstrate benefits (# plots, frequency)
  - Inventory likely easiest initial path; verification provides ground-truthing / safety-net
- Identify areas of (relative) high stocking and potential new projects
  - Proof of concept, ground-truthing, revenue generation
  - Blue Source provides free eligibility assessments and revenue projection
Working hard to bring projects to market...

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