FCX: the Forest Carbon Xplorer App
CMS Workshop: November 2015

Presented by:
Ian Hanou, Owner/Principal, Plan-It Geo

http://forestcarbonx.umn.edu/
During the talk:
- What is your work? What are the decisions that you make in your work? ** Forest-related tools/techs; strategic tree planting for multiple goals/outcomes
- Are these internal/organizational decisions, or are they policies you are required to respond to? ** both
- What is the timeline for these decisions? ** N/A
- Which data do you already use to make decisions? ** FIA, land cover, i-Tree ecosystem services, census, GIS, LiDAR
Urban Forest Cloud Software

Tree Plotter®

Work Order Management®

Canopy Planner®

Park Plotter®

Custom Apps

Native Apps

www.planitgeo.com | info@planitgeo.com
Project Background

- Funding from US Forest Service and University of Minnesota
- A simple app for smartphones, tablets, and desktop use to explore the extent and value of the nation’s forest carbon
- **Methods**: by GPS location, by county (in map or in tables), and by radius (draw in map)
- **Outputs**: charts, graphs, tables of carbon (tonnes/$s)
Project Background

❖ Resources:
✓ Forestry Research: http://www.cbmjournal.com/content/8/1/1
✓ Data: http://www.fs.usda.gov/rds/archive/Product/RDS-2013-0004
✓ EPA GHG Equivalencies Calculator
✓ Interagency Working Group on Social Cost of Carbon (2013)
✓ State of CA Air Resources Board
✓ http://www.fia.fs.fed.us/

Welcome to the Forest Carbon Xplorer

Where does the data come from?
Forest Inventory and Analysis National Program

Where can I find more about the data?
Barry Tyler Wilson's Publication on Forest Carbon Stock

Where can I download the data?
Imagery Data for Forest Carbon Stock Publication

Where can I learn more about forest carbon?
USFS Forest Inventory and Analysis Carbon Page

The forest data in the app only covers the lower 48 states.
About the Data

- USFS Forest Inventory and Analysis (FIA): systematic inventory of forests for primary source of national statistics and supports informed forest management
- Data analyzed to provide wall-to-wall spatial GIS rasters of forest carbon estimates by pool (lower 48 states)
About the Data

- 7 individual carbon “pools” and total (8 rasters), 250m res.

### Definitions of Carbon Pools

<table>
<thead>
<tr>
<th>Pools</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboveground live tree</td>
<td>Live tree carbon that is above ground</td>
</tr>
<tr>
<td>Belowground live tree</td>
<td>Live tree carbon that is below ground</td>
</tr>
<tr>
<td>Understory vegetation</td>
<td>Carbon in the living vegetation that is not considered a tree, both above and below ground</td>
</tr>
<tr>
<td>Standing dead tree</td>
<td>Biomass in standing dead trees</td>
</tr>
<tr>
<td>Forest floor</td>
<td>Detritus on the forest floor including leaves, decaying material, and fine twigs</td>
</tr>
<tr>
<td>Downed dead wood</td>
<td>Dead wood that is lying on the ground such as logs</td>
</tr>
<tr>
<td>Soil organic carbon</td>
<td>Carbon in mineral soils</td>
</tr>
</tbody>
</table>
Technologies and Requirements

• Web browser-based
  ✓ Web connection required
  ✓ Some offline capability
  ✓ No download/install

• Technologies:
  ✓ Open Layers API
  ✓ PostgreSQL / PostGIS
  ✓ GeoServer
  ✓ Responsive JS libraries
  ✓ Red Hat Linux (UMN)
  ✓ HTML5, CSS, etc.
“Get Carbon”

- ✔ Wizard
- ✔ By GPS location
- ✔ By county (in map)
- ✔ By county (in tables)
- ✔ By radius (draw in map)
“Get Carbon” by County (via the Wizard)

Choose Counties

If states you want are not listed, close this window and scroll to another area.

State
Colorado

Counties
Logan, Clear Creek, Jefferson, Delta, Summit

Counties you selected:
Jefferson, Colorado, Delta, Colorado, Summit, Colorado

Back  Done
“Get Carbon” (by County in map)
“Get Carbon” (draw radius in map)
## Reported Carbon Values (tons)

### Carbon Summary

<table>
<thead>
<tr>
<th>Carbon Source</th>
<th>Density per hectare</th>
<th>Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aboveground live tree:</td>
<td>70.3968</td>
<td>132,122,186</td>
</tr>
<tr>
<td>Downed dead wood:</td>
<td>11.7345</td>
<td>22,023,585</td>
</tr>
<tr>
<td>Standing dead tree:</td>
<td>6.4073</td>
<td>12,025,281</td>
</tr>
<tr>
<td>Soil organic carbon:</td>
<td>60.1075</td>
<td>112,810,901</td>
</tr>
<tr>
<td>Forest floor:</td>
<td>26.7967</td>
<td>50,292,669</td>
</tr>
<tr>
<td>Understory vegetation:</td>
<td>2.3575</td>
<td>4,424,637</td>
</tr>
<tr>
<td>Belowground live tree:</td>
<td>15.8814</td>
<td>29,806,544</td>
</tr>
</tbody>
</table>

Total: 363,505,993 Tonnes (Metric) of carbon across 1,876,820 ha of land
Reported Carbon Values ($)

Carbon Summary

<table>
<thead>
<tr>
<th>Amount</th>
<th>Value</th>
<th>Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Carbon Value</td>
</tr>
</tbody>
</table>

$50,647,290,005

**Social value of carbon:** the economic damages associated with an increase in carbon dioxide (CO2) emissions in a given year.

$1,344,972,174

**Market-based value of carbon:** Economic value of forest carbon based on current market conditions.

How are these values arrived at?

Social value of carbon is based on information in a 2013 White House paper.

Market-based value of carbon is based on a California Air Resources Board auction in 2014.
Reported Carbon Values ("Equivalents")

<table>
<thead>
<tr>
<th>Amount</th>
<th>Value</th>
<th>Equal To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>280,626,627 Cars</td>
<td>Yearly greenhouse gas emissions from cars</td>
<td></td>
</tr>
<tr>
<td>150,127,975,109 Gallons</td>
<td>CO2 emissions from gas consumed</td>
<td></td>
</tr>
<tr>
<td>121,774,508 Houses</td>
<td>CO2 emissions from homes’ energy use for one year</td>
<td></td>
</tr>
<tr>
<td>3,089,800,941 Barrels</td>
<td>CO2 emissions from oil consumed</td>
<td></td>
</tr>
<tr>
<td>7,270,120 Train Cars</td>
<td>CO2 emissions from coal burned</td>
<td></td>
</tr>
</tbody>
</table>

These values are derived from the EPA Greenhouse Gas Equivalencies Calculator
Where to Now?

- Export/save/print forest carbon reports
- Separate rasters for each carbon pool
- Show trends/changes based on fires, pests, etc.
- Other metrics displayed/summarized in ‘focused’ apps
- Xplore ... *Go “Get Carbon”!*
Parting Thoughts

• A baseline to compare your field estimates to
• Not supplant what we’re measuring on the ground
• Research products, enable user access
• Expands on county tables and FIA “e-Validator tool” with spatial outputs
• New paradigm: phone ➔ GPS location ➔ forest attributes
In Closing:
- What C science info (e.g. biomass, canopy cover, flux estimates, ocean biomass, etc.) do you need/want for your org’s decision framework? **we’re not making decisions but applying data in tools/models**
- What timeframe, spatial scale, and frequency of data updates? **depends on the project or app/tool**
- When/how should the C science info be delivered? **diverse interactive ways for tech and non-tech users**
- Are there any CMS products that you would like to learn more about? **TBD/UNK**
Acknowledgements

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