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THE POWER OF TREES

Carbon Offsets

Monetizing Regreening for Climate Mitigation

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Rewinding the Climate Clock

300 million years ago trees fell in the forest, but no humans heard them. Trees were more like horsetails and ferns, 30-meters high with 2-meter diameter trunks. They piled up in swamps, decomposed, and compressed into peat. We find similar peat bogs today – but then ocean levels were 300 meters higher as it was too warm for glaciers. Birds and mammals were a distant future.

Peat mining

Fast forward a few hundred million years. Trees kept taking carbon dioxide out of the air, falling in the forest, and turning into peat. Continents shifted taking the peat underground and compressed it into oil, coal, and natural gas, making fossil fuels. Temperatures and oceans dropped. Humans came into existence. Cities were built – mostly close to oceans. Now those fossil fuels from ancient trees are extracted and burnt – returning CO2 back to the atmosphere. Ocean levels have started rising as glaciers melt and temperatures rise globally.

People are there to see it. Climate is at a tipping point. We need to stop putting fossil carbon back in the air and remove what we put there. Trees are still the best way to do it. This is the logic of carbon cap-and-trade credits. These market incentives encourage climate-saving behavior. This includes investment returns on regrowing and protecting forests. Will we act in time?

Carbon Cap-and-Trade Compliance Markets

Carbon credit and offset standards originated in the 1980s with a conceptual cap-and-trade system to control carbon emissions. In 1997, the Kyoto Protocol[1] set caps on greenhouse gas[2] emissions of ratifying countries. Nations were assigned emission targets and corresponding allowances – called Assigned Amount Units (AAUs). To generate "mandatory" offset credits, the Protocol established project-based mechanisms: Clean Development Mechanism (CDM) and Joint Implementation (JI). The EU Emissions Trading System[3] (EU ETS) takes this a step further by allowing the EU and other nations to trade offsets with each other.

The Regional Greenhouse Gas Initiative[3] (RGGI) is the first mandatory market-based program in the United States to reduce greenhouse gas emissions. RGGI is a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia to cap and reduce CO2 emissions from the power sector. RGGI does not currently support other forms of offset.

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[1] 1997 United Nations Framework Convention on Climate Change (UNFCCC), it was eventually replaced by the Paris Agreement. Under the treaty, a group of industrialized countries and countries with economies in transition (EIT) made legally binding commitments to reduce their overall GHG emissions to 5% below 1990 levels during the period 2008–2012. Each country also has a separate target that ranges between an 8% reduction to a 10% cap on increases in emissions. Countries must meet their targets in a defined time by reducing their own emissions; and/or trading emissions allowances with countries that have a surplus of allowances; and/or meeting their targets by purchasing carbon offset credits.

[2] Greenhouse gases include several gases, of which CO2 is primary.

[3] https://www.rggi.org/

Organizations can become certified to verify compliance/mandatory offsets. As of this writing there are around 30 organizations approved for this work. They are known as Designated Operating Entities[4] ("DOE").

Voluntary Markets

"Voluntary" markets function outside of compliance markets and enable companies and individuals to purchase carbon offsets on a voluntary basis with no intended application for compliance purposes. However, California, Mexico, and some countries in South America have recognized compliance offsets issued under some voluntary certification programs.

Voluntary carbon markets enable businesses, governments, nonprofit organizations, universities, municipalities, and individuals to offset their emissions outside a regulatory regime. These entities can purchase offsets that were created either through the voluntary or compliance markets. Trading and demand in the voluntary market are created only by voluntary buyers (corporations, institutions, and individuals) whereas, in a compliance market, demand is created by a regulatory mandate to cap and trade emissions/offsets.

Because voluntary offset credits cannot be used in compliance markets, they tend to be cheaper. Because voluntary offsets are typically purchased in coordination with public relations efforts to present a company or organization as a climate actor, many factors can influence a buyer's interest in a project to best present this image. Pricing in voluntary offset markets reflects this reality, in which buyers have varied objectives in purchasing carbon offset credits. Voluntary market credits differ in price based on project charisma and potential for marketing, project type, location, and co-benefits beyond climate impact that match with buyers' preferences.

The voluntary offset market includes a wide range of programs, entities, standards, and protocols.[5] Offsets generated through voluntary markets have been promoted as an opportunity for experimentation and innovation. They have the general advantage of lower transaction costs than offsets generated for use in mandatory compliance programs. Voluntary markets also serve as a niche for micro-scale projects that are too small to warrant the administrative burden of compliance offset programs or for projects currently not covered under compliance schemes.

[4] DOEs: https://cdm.unfccc.int/DOE/list/index.html

[5] Certified voluntary offsets are available from several sources: http://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/comparisons-of-offset-programs/program-administration-and-authority/

Add-On Credits

There are a number of “add-on” certifications for carbon offset credits. Some of these certify social benefits achieved by offset projects[6]. Others verify that offset credits are exclusive to the retail buyer claiming the credit[7], and not claimed by other organizations.

[6] Climate, Community & Biodiversity Standards: https://www.climate-standards.org/
Social Carbon Standard: http://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/add-on-standards/socialcarbon-standard/
[7] Green-E Climate: https://www.green-e.org/programs/climate

Forecasting and Calculating Carbon Offset Credits

Determining the appropriate carbon offsets has a few components:

Markets

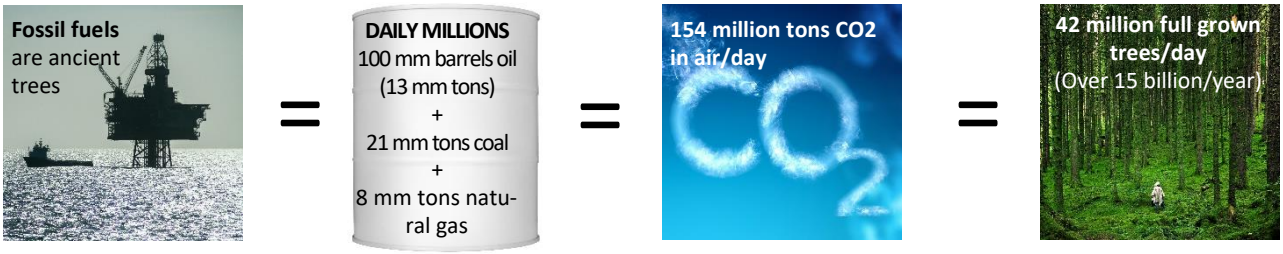
1. The project selects mandatory and/or voluntary offsets to be applied to the project.
2. With that selection the project determines the jurisdiction(s) and standards(s) to be applied. These may include a preference for multiple jurisdictions that are finalized at the time of sale.

Project characteristics

3. The species of trees involved and their local conditions. Different trees sequester variable amounts of carbon and are affected by local temperatures, light, water, etc.
4. The expected time allocated for the trees to grow since the carbon offset could be sold at different times.
5. The technologies to be applied to survey project information. For example, once the trees are large enough, satellite imagery can be highly accurate and affordable.
6. Other carbon related aspects of the project. For example, there may be energy efficient stoves for local use.

Calculations

7. Budgetary calculations are conducted to determine interest in a project. There are sources to do this, including on-line systems.[8]
8. As described herein, third-party auditors authorized for the jurisdictions conduct the calculations. These audits may be conducted to verify budgets, at the completion of project deliverables, and at the time of sale.
9. For sales, markets are frequently surveyed for pricing. Commodity brokers may be engaged to manage a sale.



[8] For example: https://winrock.org/flr-calculator/

Tree-Carbon Financial Examples

The following example lays out what a 10,000-hectare project might look like financially from a tree- based carbon perspective. Carbon values currently range from $6 to $20 per ton and are expected to rise; a $15 valuation is applied here. Actual returns will vary, as the example shows. The ranges depicted are typical not absolute and can be narrowed much more tightly given project specifics.

EXPENSES	**Trees per Hectare**	**Total Hectares**	**Cost Each (USD $)**	**Total Cost ($millions)**	**Future Carbon Value**
Habitat (several pioneer species, self-multiplying, meaningful girth in 15-100 years, high density carbon/hectare)	1100 that self-multiply to 2500	3000	1.00 to 4.00 (without free multiplication)	9	112
FMNR (managed coppicing of existing tree stumps for habitat, timber or fuel, 5-15 years, may be pioneer species, often best start in arid areas, fastest carbon/hectare)	200 to 1000	2000	1.5	2	18
Timber (3-6 species, meaningful girth in 15-100 years, harvest wood value)	1100	3000	0.25 to 1.0	2.1	4.5
Orchards (1-4 species, little or much carbon depending on species, harvests start in 4 to 12 years)	800	1000	1-15	6.4	3.6
Mangroves (1-4 species, 10-15 years, highest density carbon/hectare)	2000	1000	0.20 to 0.50	0.7	30
TOTAL				**20.2**	**168.1**

Additional expenses include: the example ignores a distribution of revenue among stakeholders, including landowners that would have some rights. It also excludes cost to manage the asset over time and the time value of money.

Additional revenues include: the example ignores value generated besides carbon, which may be significant. For example, no value of timber, fruit, or nuts is considered. There may also be opportunity for REDD+, biodiversity credits, and water rights.

Averages for this example: Trees cost an average of $1.90 each – excluding free trees from self-multiplication. It cost about $2000 per hectare to reforest, yielding a value of carbon of around $16,000 per hectare.