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# AMERICAN ELECTRIC POWER: INVESTING IN FOREST CONSERVATION

*The main driver for generating offsets and the whole economic rationale is that, given where we are today, it may be cheaper to reduce a ton of carbon by protecting a forest in Peru than by paying for carbon capturing technology in a power plant in Ohio.*
—David Antonioli, Chief Executive Officer, Voluntary Carbon Standard Association[i]

## INTRODUCTION

As Diane Fitzgerald, managing director of environmental affairs at American Electric Power (AEP), zipped up her laptop case in July 2009, she reflected back on her recent meeting with The Nature Conservancy (TNC). TNC had approached AEP with the opportunity to invest in one of the world's first projects for Reducing Emissions from Deforestation and Forest Degradation (REDD). The proposed plan was to protect 812,000 hectares of rich, biologically diverse forest land, known as Bosque Rojo, in central Peru.[ii]

This project would address the two issues targeted by REDD by ending both *deforestation* from the local communities' conversion of land from forest to farmland and forest *degradation* from commercial logging. REDD projects offered a substantial opportunity to mitigate climate change, as deforestation and forest degradation contributed approximately 15-20 percent of global greenhouse gas (GHG) emissions.[iii] [iv] Protecting Bosque Rojo could prevent the release of millions of tons of carbon dioxide ($CO_2$). The project partners and investors would obtain certified offset credits equivalent to the reduction in emissions over the 30-year project lifetime.

Among U.S. power companies, AEP had one of the highest levels of $CO_2$ emissions. It estimated its 2009 emissions would reach 150M metric tonnes. With climate change legislation on the horizon, it wanted to set an example for Congress to show that REDD offsets could lead to cost-effective reduction in GHG emissions, and also gain experience in the international REDD scene. Fitzgerald's boss, Dennis Welch, executive vice president of environment, safety & health and facilities, pushed Fitzgerald to examine several REDD projects of which Bosque Rojo

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Sara Gaviser Leslie prepared this case with Professors Gretchen Daily and Erica Plambeck as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

was the most promising. Welch's message to Fitzgerald was one that AEP's CEO, Michael Morris, had been sharing over the last year: "We've got to find a way to reduce our compliance costs and REDD looks like a good option." AEP expected to have to substantially reduce its own emissions (e.g. by substituting wind power for coal in electricity generation) or obtain offset credits either on the open market or through direct participation in external emission reduction projects. Welch believed that REDD projects would be much cheaper than any of its other options to obtain offset credits. To confirm Welch's belief, Fitzgerald needed to calculate a net present value (NPV) for the project, understand the project's risks, and determine if Bosque Rojo was, indeed, the best use of company funds.

## HISTORY OF GREENHOUSE GAS EMISSIONS AGREEMENTS AND LAWS

### Kyoto Protocol

The Kyoto Protocol, introduced in 1997, was an international agreement to limit GHG emissions. The protocol became legally binding on February 16, 2005 after two conditions were met: it was ratified by at least 55 countries and by countries emitting at least 55 percent of the world's GHG emissions.[v]

The U.S. did not ratify the Kyoto Protocol because President George W. Bush and a majority of U.S. Senators opposed it. They believed it would do too much damage to the U.S. economy and criticized the protocol for not limiting the emissions of developing countries such as China and India.[vi]

#### *Emissions Trading*

Under the Kyoto Protocol, each participating country was given a limit for its GHG emissions in units of metric tonnes $CO_2$ equivalent ($tCo_2e$). A country could have actual emissions above its limit and comply with the Kyoto Protocol by purchasing offset credits for those emissions from a country with actual emissions below its limit. (Emissions of each specific GHG were to be measured in terms of its contribution to global warming, with the warming contribution of a tonne of $CO_2$ as the standard unit.) As $CO_2$ was the principal GHG, people spoke of "trading in carbon" and referred to the commodity market as the "carbon market".

#### *Clean Development Mechanism*

The Clean Development Mechanism (CDM) gave participating countries the opportunity to implement emission-reduction projects in developing countries. For instance, a German automobile manufacturer could build a wind-powered energy plant in Bolivia in order to earn saleable certification emission reduction (CER) credits. CERs, worth one $tCO_2e$, were standard emissions offset instruments. CERs enabled industrialized countries to meet their emissions limits in a cost-effective manner while supporting the economy of a developing country.

#### *Joint Implementation*

Like the CDM, joint implementation (JI) projects allowed a country with an emission reduction or limitation obligation to earn emission reduction units (ERUs) from an emission reduction or emission removal project in another country. One ERU was equal to one $tCO_2e$ reduced. The difference between CDM and JI was that JI projects took place in another country that had emissions limitations under the Kyoto Protocol, mainly Central and Eastern Europe, as an alternative to reducing emissions domestically. An example of a JI project was a French company replacing a coal-fired power plant in Poland with a more efficient plant. The sponsoring government, in this case France, received credits that could be applied to its emissions targets while Poland gained foreign investment and advanced technology (but not credit towards meeting its own emissions limitations).[vii] In order to lower the cost of compliance, the goal was for JI projects to take place in the country where the cost of the reduction was lowest.

The Kyoto Protocol was set to expire in 2012. In December 2009, world leaders would meet in Copenhagen to discuss climate change and a new policy framework to follow on from the Kyoto Protocol.

### Waxman-Markey Bill/American Clean Energy and Security Act

On June 26, 2009, the U.S. House of Representatives passed the American Clean Energy and Security Act (ACES), also known as the Waxman-Markey bill, crediting its formulators, Congressmen Henry Waxman and Edward Markey. The aim of Waxman-Markey was to deploy clean energy resources, increase energy efficiency, cut global warming pollution, and transition the U.S. to a clean energy economy.[viii] Though the Senate had yet to pass matching legislation, it was likely that the U.S. would soon regulate emissions through a cap-and-trade system similar to that developed under the Kyoto Protocol.

## THE CARBON OFFSETS MARKET IN 2009

In general, the worldwide carbon offsets markets could be divided into two segments: the regulatory (compliance) markets and the voluntary markets. Compliance markets were created and regulated by mandatory regional, national, and international carbon reduction regimes, such as the Kyoto Protocol. The European Union Emission Trading System (EU ETS) was the largest multinational emissions trading market in the world. The amount of offsets traded in all of the compliance markets increased by 84 percent in 2008 to reach $118 billion.[ix]

### Voluntary Markets

Some companies, particularly in the U.S., chose to voluntarily reduce their carbon footprints through operational changes and the purchase of offsets. At the broadest level, the voluntary carbon markets themselves could be divided into two main segments: the Chicago Climate Exchange (CCX), and a more informal, company-to-company offset market commonly referred to as "over-the-counter" (OTC). While the CCX was a structured and monitored voluntary membership-based cap and trade system, OTC transactions were not driven by emissions caps and did not generally trade on a formal exchange. In OTC trades, both the buyer and seller had accounts on one of the registries and the credits moved from one account to the other. In order to have assurance that the credits being traded were unique and would not be resold, registry systems gave each credit its own serial number.

The voluntary markets were active. In 2008, an estimated 123 million tonnes of carbon offsets, at a value of $705 million, were traded on the CCX. This was roughly double the amount traded in 2007.[x] The average cost of a CCX offset in 2008 was $4.43 per $tCO_2e$ and the average cost of an offset in the OTC market was $7.34 per $tCO_2e$.[xi] The difference in the prices was due to the fact that transaction costs associated with the transfer of credits between parties increased the prices of OTC offsets.[xii] Additionally, higher quality standards tended to increase prices for OTC offsets relative to CCX-traded offsets.

## The Voluntary Carbon Standard Association

The nonprofit Voluntary Carbon Standard Association (VCS) provided a platform for the creation of offsets for sale to companies or individuals who were voluntarily reducing their emissions. It sought to ensure that the offset credits represented genuine reductions in emissions that were "additional" (would not have occurred in the absence of an offset credit market). VCS defined the rules for a third-party certifier to calculate the number of offset credits generated by a project, issued offset credits, and managed a registry system to track those offsets. Although detailed regulations governing carbon credits in the U.S. had not been finalized, there was a chance that, under Waxman-Markey, credits generated under a voluntary system like VCS would be counted towards emissions reductions.

## AMERICAN ELECTRIC POWER

AEP, headquartered in Columbus, Ohio, ranked among the nation's largest generators of electricity, owning nearly 39,000 megawatts of generating capacity in the U.S. AEP also owned the U.S.'s largest electricity transmission system, which served about 10 percent of the electricity demand in the Eastern Connection (the interconnected transmission system that covered 38 eastern and central U.S. states and eastern Canada) and approximately 11 percent of the electricity demand in Texas. AEP earned $1.301 billion in 2008 and achieved $14.4 billion in revenues. Its assets were valued at $45.2 billion. [xiii]

## Greenhouse Gas Reduction Activities

Despite not having legally-mandated emission reduction targets, as one of the world's biggest emitters of greenhouse gases, AEP's management and stakeholders felt an obligation for the company to move forward and take the first steps towards GHG reduction. AEP was a founding member of the Chicago Climate Exchange and was committed to cumulatively reduce or offset 48 million metric tons of $CO_2$ emissions from 2003 to 2010. This number was approximately 1/3 of AEP's annual emissions in 2008 and based on the company's terms of commitment with the Chicago Climate Exchange. The anticipated approval by the Senate of a bill similar to Waxman-Markey would require more drastic cuts soon thereafter.

As David Antonioli, chief executive officer of VCS, explained, under a cap-and-trade system, power companies like AEP would first consider projects that would reduce their own emissions. They would rank these projects on a cost curve from least (replacing a boiler to improve efficiency of a coal fired plant) to most (capture and storage of $CO_2$[xiv]) costly. They would also consider buying emissions offsets on the open market. The legislated limits for GHG emissions, legal limitations on offsets , and the market price for offsets would determine how far they would go along the cost curve to change their internal operations before choosing to buy emissions offsets.

## THE NATURE CONSERVANCY

The Nature Conservancy (TNC) was a nonprofit organization with the mission to "preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive."[xv] Since its founding in 1951, TNC had protected nearly 120 million acres of land and 5,000 miles of rivers worldwide. It worked in partnership with indigenous communities, business, governments, multilateral institutions and other non-profits to find pragmatic solutions to conservation challenges.[xvi] In particular, TNC was active in catalyzing REDD activities around the world, with the complementary goals of preserving local biodiversity and mitigating climate change. In 2009, it approached AEP to fund a REDD project to preserve a biologically diverse forest, Bosque Rojo, in central Peru, in exchange for a 50 percent share of the future carbon offsets.

## CARBON CREDITS FOR AVOIDED DEFORESTATION AND AVOIDED FOREST DEGRADATION

During photosynthesis, trees take in $CO_2$ from the atmosphere. With energy from the sun, they convert $CO_2$ and water into cellulose, which they store in their trunks, branches, leaves and roots. As a byproduct of this photosynthesis, trees return oxygen back to the atmosphere. A tree's mass is constituted of approximately 25 percent carbon (drawn from atmospheric $CO_2$) and 75 percent water (drawn from the soil); a tree draws only very small amounts of nitrogen and minerals from the soil. In a natural forest, the carbon remains in the soil for long after a tree falls, but is eventually returned to atmospheric $CO_2$ by microbial processes. (See **Exhibit 1** for an illustration of the forest carbon cycle.) In 2009, the amount of carbon stored in Earth's plants and soil (primarily its forests) was more than six times the amount in the atmosphere.

In 2009, McKinsey estimated that business-as-usual forestry activities would account for more than 10 percent of annual worldwide emissions from 2009 to 2030 if nothing was done to alter these practices. Furthermore, these forestry-related emissions could be substantially reduced much more cheaply than most emissions from fossil fuel burning. McKinsey estimated that overall emissions could be reduced by 38 Gigatons $CO_2$ annually at an average cost of only €4 ($5.41 on 6/30/07) per $tCO_2$, and that changes in forestry practices accounted for more than 20 percent of this low-cost reduction opportunity.[xvii] (See **Exhibit 2** for an illustration of carbon storage over time by a forest managed for timber production.)

Under the Kyoto Protocol, only activities that removed $CO_2$ from the atmosphere through afforestation (planting a new forest on land that had not been forested in the past 20 yrs) and reforestation (reestablishing forest cover on recently deforested lands) could earn tradable carbon credits. REDD projects that preserved an existing forest to prevent emissions to the atmosphere were not eligible. Nevertheless, governments, conservation organizations, investors and standards bodies like VCS that believed in the potential of forest preservation began participating in voluntary offset projects that furthered this goal.[xviii] When Waxman-Markey endorsed a market-based mechanism for REDD, it further increased interest in these projects. Existing VCS protocols for measuring forest carbon had a good chance of becoming the standard under a U.S. bill.

In particular, VCS and Waxman-Markey would recognize only REDD projects in designated developing countries with tropical forests.[xix] Economic, political and biophysical factors favored REDD investment in those areas. Emissions could be reduced by a larger amount and at lower cost in developing countries than in developed countries, because most deforestation was occurring in developing countries (notably in Indonesia and the Amazonian regions of Brazil, Bolivia and Peru). Investment in developing countries represented a politically desirable mechanism for wealth transfer. Further, tropical forests tended to increase cloud cover and thus reduce global warming by reflecting solar radiation. This was in contrast to forests at high latitudes, which were net contributors to global warming because they absorbed incoming solar radiation in winter, rather than allow snow to reflect that radiation back to space. [xx]

Early REDD projects, like Bosque Rojo, sought to prevent human activities such as forest conversion to agriculture and timber extraction, in order to reduce $CO_2$ emissions. However, forest loss had the chance of occurring even after prevention of those human activities. Climate change and ecological factors, such as invasive plants and animals or limited sources of seed, could prevent the growth of native forest species. Forest fires linked to climate change also could cause losses of carbon to the atmosphere and contribute to a site's degradation by increasing erosion and nutrient loss.

### The Price of Carbon Offsets

The market price of carbon offsets would depend on the stringency of the emissions limits set by U.S. legislation, amount and type of offsets allowed, technological innovation, and U.S. economic growth. The EPA estimated that under Waxman-Markey, the price per $tCO_2e$ would range from $20 to $50 in 2015, to $160 to $200 in 2050.[xxi] (See **Exhibit 3** for EPA's estimated range of carbon prices.) A survey of individuals at companies with carbon trading operations (3,319 responses from 116 countries) generated a wider range of estimates for the price of carbon offsets.[xxii] (See **Exhibit 4** for a summary of respondents' expected carbon prices.) Researchers at the Stanford Graduate School of Business estimated an upper bound of $30 per $tCO_2e$ on the price of carbon offsets, based on the potential for adoption of Carbon Capture and Storage (CCS) technology for coal-fired power plants. CCS could potentially reduce emissions from generating electricity with coal by approximately 85 percent, which would dramatically reduce demand and, hence, the price for offset credits. [xxiii] However, CCS was as yet unproven.

Although AEP generated a majority of its electricity from coal in 2009, it estimated that investing in new wind-powered generation and transmission capacity (necessary to carry the electricity from remote windy sites to where it was needed) would be substantially cheaper than CCS. However, AEP anticipated that its best opportunities for wind-power generation would be limited. It would need to purchase offset credits on the market (or invest directly in projects like Bosque Rojo) in order to comply with impending emissions limitations.

## PROJECT DESCRIPTION

### Location and Measurements

The Bosque Rojo forest was located in remote, central Peru and measured 812,000 hectares.

## Project Partners

TNC had conceived of the project, motivated in part by the exceptional biodiversity in Bosque Rojo. The government of Peru would designate Bosque Rojo a national park. Fundación Amigos de la Naturaleza (FAN), a REDD project specialist firm, would implement the project, serve as a liaison between the Peruvian government and AEP, and arrange for an independent firm to verify the offset credits. AEP would pay for the project.

## Project Costs

AEP's costs associated with the Bosque Rojo project would include payments to guards and other costs to protect the site; payments to the Peruvian government; payments to FAN for research, carbon monitoring and third-party verification; and capital investments in the local community. (See **Exhibit 5** for a list of project expenses from AEP's Bosque Rojo model.)

AEP would make an initial endowment payment of $4,000,000 and make small annual payments in the first 9 years of the project. TNC and FAN would administer those funds to protect Bosque Rojo over the project's 30-year time horizon. Any portion of these funds that remained at the end of project would be used to help protect and maintain the Bosque Rojo national park.

### *Community Development*

Prior to the Bosque Rojo project, the local people subsisted on timber extraction and agriculture. To protect the forest, the project would need to provide new economic opportunities for them. Some local people would be employed in site protection, but their involvement in the project would not be sufficient to motivate the entire community to protect the forest. To create other opportunities, AEP would invest in education and infrastructure for ecotourism and biocommerce. It would also pay for the local people to secure legal status and land tenure over their traditional lands near the Bosque Rojo Park and develop plans for sustainable management of that land. TNC would monitor the community development activities to ensure that the project brought positive changes to the community.

AEP's capital investments in the local community would be concentrated in the initial stages of the project, notably in construction of cabins for tourists and purchase of loggers' equipment to help prevent future timber extraction in Bosque Rojo. AEP did not intend to take any revenue from its business investments in the local community (e.g., ecotourism and biocommerce ventures). It expected its costs of carbon monitoring and verification to increase over time due to local economic development and corresponding increases in labor costs.

## Offset Credits

AEP and the government of Peru would split the carbon offset credits generated from the project. The government of Peru committed to return half of its revenue from the sale of credits to the local community, thereby helping to sustain the economic development of the region and motivate the local people to refrain from logging and farming in Bosque Rojo and the surrounding areas.

The project would generate offset credits at the end of each year according to the following rule:

**Offset credits = Avoided Emissions – Leakage Deduction – Impermanence Deduction**

where the amount of emissions avoided within Bosque Rojo would be estimated according to:

**Avoided Emissions = Baseline Emissions – Actual Emissions**

"Baseline Emissions" was the best estimate of the amount of emissions that would have occurred under business-as-usual conditions, in the absence of the project. This baseline would be verified by an accredited third-party verifier every five years. It would be calculated each year as a complex function of the realized price of timber in Peru and the status of survey plots near Bosque Rojo. FAN would calculate "Actual Emissions" by surveying the conditions within Bosque Rojo. (See **Exhibit 6** for an illustration of the project's baseline vs. avoided emissions.) In calculating the emissions avoided within Bosque Rojo, FAN would address *degradation* and *deforestation* separately.

The primary cause of degradation was the selective harvest of valuable tree species, such as mahogany, from within the forest. The baseline rate of emissions from degradation would increase with realized world timber prices according to a complex econometric model. (As timber prices increased, the incentive to log increased in concert.) In addition to economic parameters, the model accounted for the difference in regrowth between selectively logged and unlogged areas, the density and carbon content of the valuable tree species in Bosque Rojo, and carbon storage in harvested wood products. The model did not account for the possibility that local changes in climate or invasive species might cause forest degradation. The actual rate of emissions from degradation would be calculated based on observation of Bosque Rojo.

The primary cause of deforestation was clear-cutting or burning a forest for conversion to agriculture. The baseline rate of emissions from deforestation would be calculated from a model based on nearby historical deforestation, observed via satellite. It predicted the likelihood that various parts of Bosque Rojo would be cleared based on factors such as distances to roads, rivers, towns and the forest edge. The baseline emissions resulting from that clearing would be calculated based on the carbon content in the various parts of Bosque Rojo, which would be estimated by direct measurement of tree diameter and soil samples. The actual rate of emissions from deforestation would be calculated based on observation of Bosque Rojo and the same data on carbon content.

FAN would monitor both degradation and deforestation in unprotected comparison plots near Bosque Rojo, as a check on its models for baseline emissions. It would re-evaluate and, if necessary, update the models for baseline emissions every five years to account for changes in government policy, socioeconomic conditions, and other determinants of degradation and deforestation.

Emissions "leakage" occurs when a carbon offset project causes an increase in emissions elsewhere. Offset credits must be deducted from a project to account for such leakage (if they can be measured and attributed to the project). Leakage from the Bosque Rojo project could arise *directly*, by local people shifting their farming and timber extraction activities from Bosque

Rojo to immediately adjacent areas, or through *market effects*. VCS would require accounting for any direct leakage. However, it would require accounting for market leakage only within the country hosting the project and only for substantial impacts on timber harvesting (not for any leakage through reduced supply and, hence, increased prices of other agricultural commodities).

FAN estimated that direct leakage would be zero, because it believed the proposed investments in community development and payments from the Peruvian government to local people from its sale of offset credits would prevent the local people from illegally extracting timber or clearing the forest to farm around Bosque Rojo. Nevertheless, FAN would monitor a 15 km buffer zone around Bosque Rojo and deduct offsets if leakage were observed.

To estimate market-based leakage of emissions from timber production, TNC and FAN commissioned the development of an econometric model, which predicted leakage of only 15 percent of the avoided emissions from forest degradation.

To account for the possibility of "impermanence" (flooding, fire, insect infestation or human activities destroying the forest after the 30-year project), VCS required every investor in a REDD project to deposit between 15 and 35 percent of its carbon credits into a common pool. The specific percentage reflected the probability that the forest would be destroyed after the project, as estimated by a third-party verifier using guidelines from VCS (See **Exhibit 7** for a list of project risk factors.) It would be updated over time based on changes in the project's risk level and the failure rate of similar projects. The total number of carbon credits in the common pool was meant to exceed the amount of carbon that would eventually be emitted to the atmosphere due to impermanence among all the projects. [xxiv]

TNC and FAN believed that the permanence of carbon benefits from the Bosque Rojo project would be safeguarded by the designation of Bosque Rojo as a national park and AEP's investments in local community development. These investments would provide new income opportunities, land tenure adjacent to the park, and a plan for sustainable management of that land, thus motivating the local people to conserve the park in perpetuity. Furthermore, TNC and FAN planned to conserve a substantial portion of the endowment payment from AEP to fund protection and management of the national park after the 30-year project ended. Therefore, FAN had given the Bosque Rojo project an overall risk rating of "medium," which would, initially, require the deposit of only 20 percent of the carbon offset credits into the impermanence pool.

**Policy Risk**

Even if VCS ended up serving as the guide for GHG programs in the forthcoming climate bill, it was expected that the bill would allow for a transition period for credits earned before the bill was passed, likely three years. Any credits that were earned through a program that was created by state or tribal legislation or regulation would be automatically admitted into the system. Most industry experts believed that REDD projects created under VCS would probably be included in the climate legislation. Nevertheless, there was a risk that the credits could disappear after the transition period. This was a dangerous proposition for developers and investors, as Antonioli explained:

> You could invest $10 million in a project and think that the project would generate 100,000 credits a year based on the methodology and the accounting framework. Then, just three years later, the EPA could say, 'Sorry, you're only going to get 10,000 credits.' All of a sudden, you're out of pocket a lot of money.

The lack of clarity surrounding future regulations meant that businesses faced great difficulties in planning their investments in emissions reductions. Though most experts believed VCS was the strongest voluntary standard, it was not a given that VCS would be automatically accepted for compliance markets. In order to exert more control over their future planning, over 30 leading U.S. companies and organizations, including TNC formed a coalition called U.S. Climate Action Partnership (USCAP) to specifically call for climate legislation.

## THE BOSQUE ROJO NPV MODEL

Diane Fitzgerald needed to build a model to estimate the net present value of the Bosque Rojo project. Before she presented her findings to Welch, she ran the deal by Bruce Braine, GSB '80 and vice president of strategic policy analysis. Braine's group was responsible for the environmental and energy policy analysis and had other models, tools and insights that could be helpful in evaluating the deal.

Based on Braine's guidance, she started building her model. AEP had already negotiated, with TNC and FAN, its payments into the project. She quickly input those costs to her spreadsheet "*BosqueRojoNPV.xls*". The challenge was to estimate the value of carbon credits generated by the project. She decided to assume that the project would fully protect Bosque Rojo so that actual emissions would be zero, and to use FAN's initial estimates of baseline emissions from degradation and deforestation over the 30-year project lifetime. (These initial baseline estimates were based on carbon content data from other tropical forests because direct measurement of the carbon in Bosque Rojo would be costly and time-consuming.) Thus, for each year of the project, Fitzgerald calculated the avoided emissions. Finally, she deducted 15 percent for leakage (from degradation only) and 20 percent for impermanence to obtain the number of offsets. She would run a Monte Carlo simulation to account for uncertainty in the market price of offsets. Fitzgerald knew that the number of carbon offsets would vary with the price of timber (among other uncertain factors) and suspected that timber prices would be positively correlated with the market price of offsets. However, she decided not to attempt to represent the complex uncertainty in her calculation of offsets.

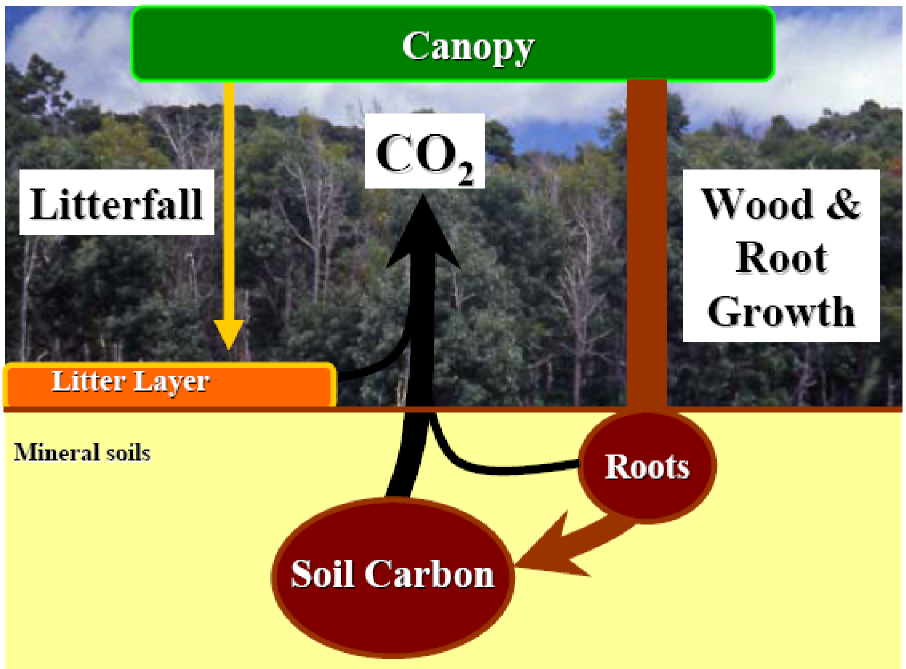
As environmental policy was still being formulated, AEP did not yet have urgent use for the credits. Nevertheless, Fitzgerald assumed that the legislation would be enacted by the end of the first year of the project. AEP would use the credits, generated over 30 years, to offset its GHG emissions and reduce its purchases of offsets on the market, accordingly. Hence, she could calculate the NPV as if AEP were selling the offset credits on the market. She assumed that credits from the project would be taxed at AEPs corporate tax rate of 35 percent, so she could simply focus on pretax net profit.

AEP's cost of capital was 9 percent, nominal, so Fitzgerald assumed 9 percent as the discount rate in her model.

## CONCLUSION

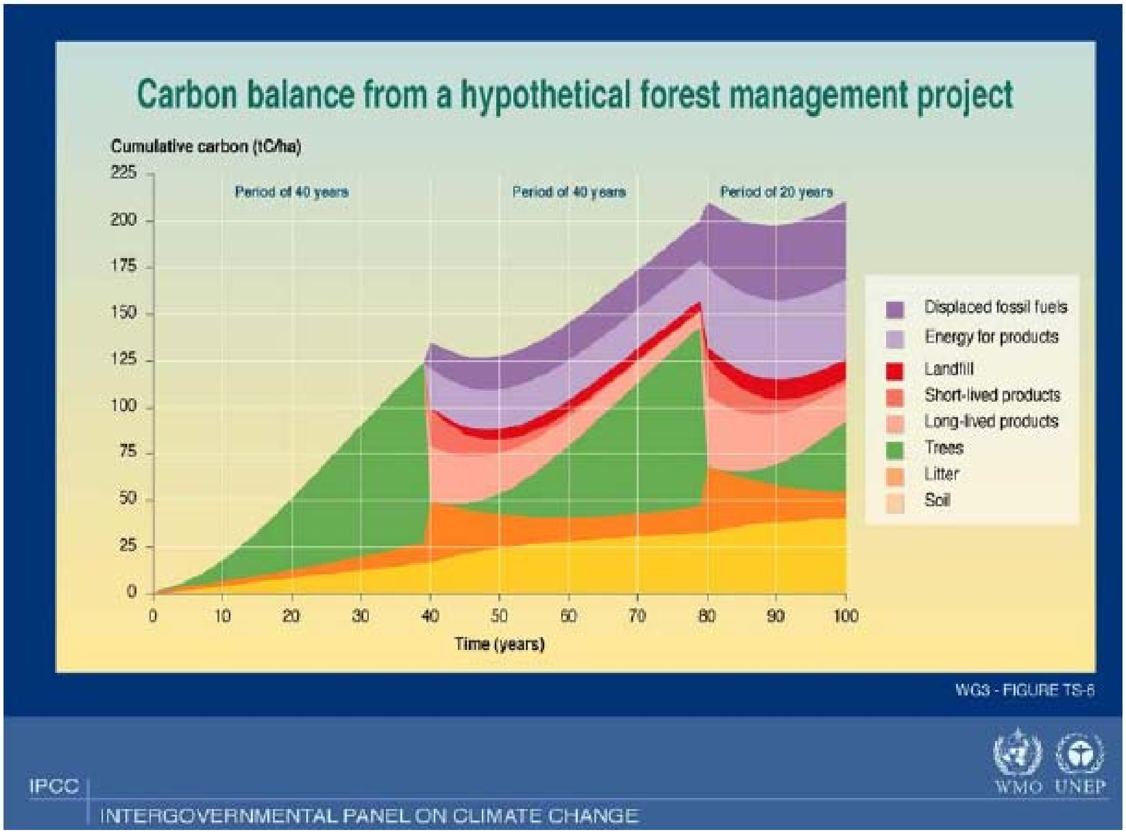
Fitzgerald felt that the Bosque Rojo project was promising. She had told Welch, “Forestry offsets will be at a lesser cost and, therefore, reduce AEP’s overall compliance costs and keep prices lower to consumers. The fact that the project involves preserving biodiversity is an added bonus.” Once she reported on the Bosque Rojo project’s NPV and associated risks, the company would make a decision as to its involvement in Bosque Rojo.

**Exhibit 1:**
**The Carbon Cycle in Forests**




Source: Conte, M.C., C. Giardina, N. Hannahs, J.B. Friday, and J.S. Greenwell. 2009: The Emission-Reduction Potential of Native Forest Restoration in Hawaii. [Daily, G.C., J.H. Goldstein, and J. Kaulukukui (eds)] Report to the Greenhouse Gas Emissions Reduction Task Force. Submitted 14 August 2009. Honolulu, HI. 46 p.

**Exhibit 2:**
**Cumulative Carbon in Forest Management**




In this hypothetical example of carbon storage through afforestation, the trees are harvested every 40 years, and harvested material is used to produce both short and long-lived solid wood and wood-derived products and to displace fossil fuel and energy intensive products (e.g., through electricity generation or production of liquid biofuels or bioplastics). The wood products store carbon while being used or residing in landfills. Without harvest, there is a potential on better sites to sequester twice the carbon as in the above example.

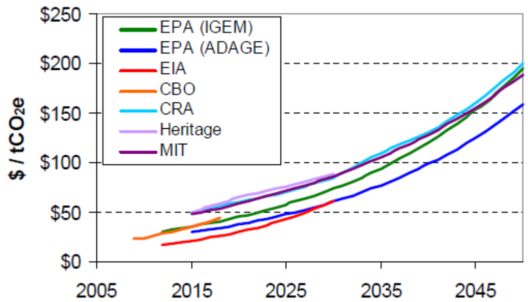
Source: IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H. L. Miller (eds.)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.

**Exhibit 3:**
**EPA Data on Future Carbon Offset Prices**

## Comparing EPA and Other Analyses of Lieberman-Warner (S.2191)

- Comparing the results of EPA's analyses of previously proposed climate legislation (S.2191) to a variety of other modeling approaches and assumptions shows that they produce similar estimates of allowance prices and GDP impacts.

**Comparison of Allowance Price Estimates for Lieberman-Warner S. 2191 in the 110th Congress**




**Comparison of Estimates for the Change in GDP for Lieberman-Warner S. 2191 in the 110th Congress (% Change from Reference)**

| | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| EPA (IGEM) | -2.6% | -3.8% | -5.2% | -6.9% |
| EPA (ADAGE) | -0.7% | -0.9% | -1.4% | -2.4% |
| EIA | -0.3% | -0.3% | | |
| CRA | -1.1% | -1.0% | -1.6% | -3.5% |
| Heritage | -1.4% | -2.2% | | |

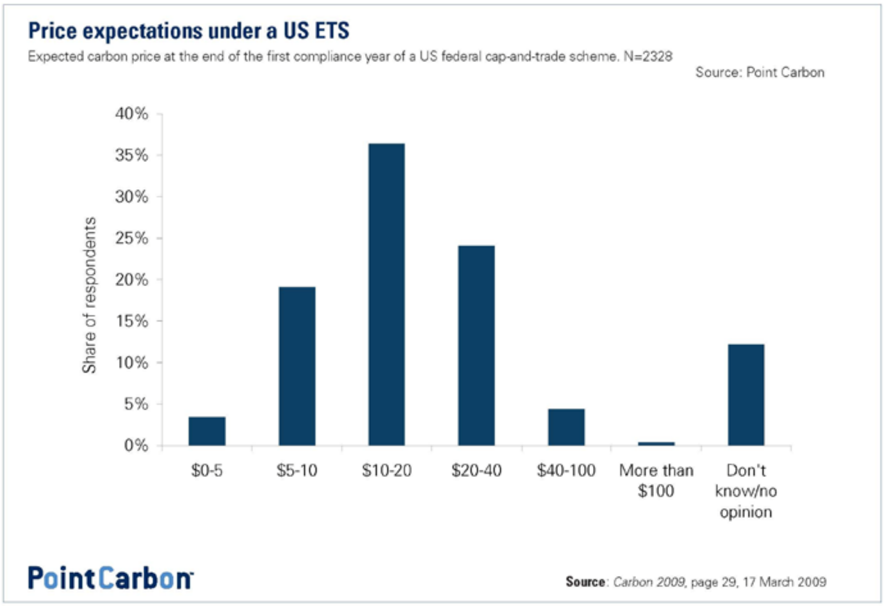
- EPA and other models produce a similar rise in allowance prices. The cost of allowances rises from $20-$50 per ton in 2015 to $160-$200 in 2050.
- The drop in GDP compared to the baseline is similar across models and rises over time from 0.3%-2.6% in 2020 to 2.4%-6.9% in 2050.
- The two EPA models produce different results because of different approaches to modeling the compensated elasticity of labor supply.

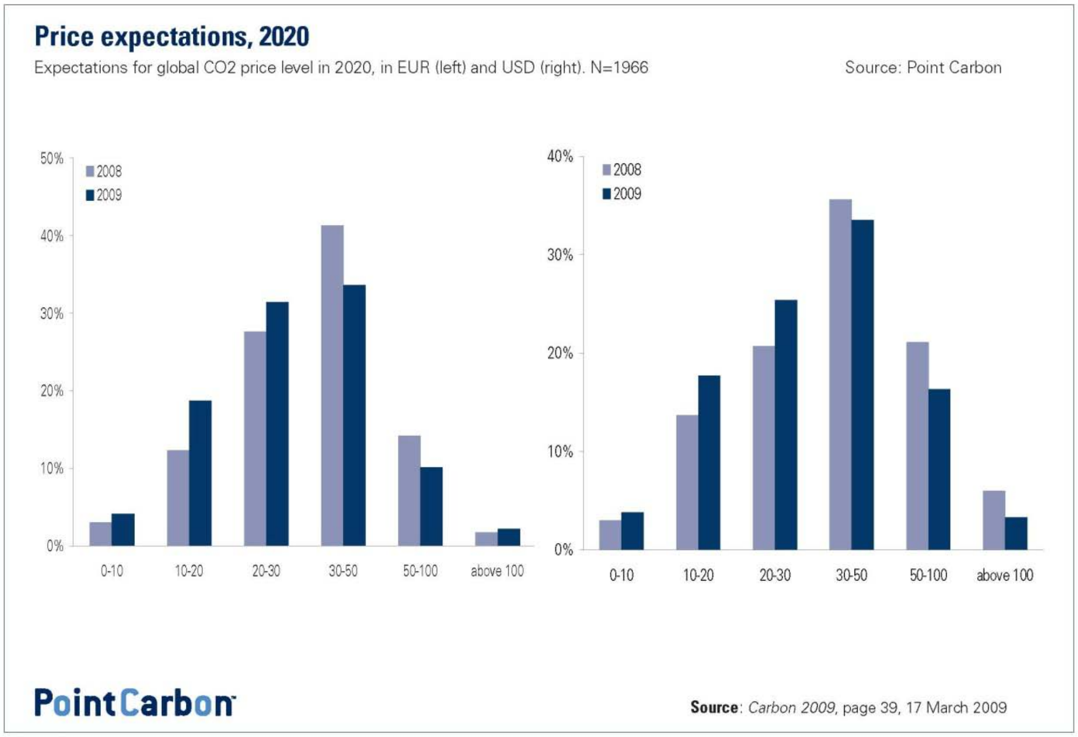
Please note that EPA has not included the MIT analysis in its comparison of GDP impacts. While the cost estimates and allowance prices from MIT's analysis are valid, the authors are re-estimating forecasted GDP impacts due to a recently discovered anomaly in the calculations. The National Association of Manufacturers also conducted an analysis of this bill, but EIA's review of the analysis indicated that they did not use a consistent set of assumptions between the baseline and the policy scenario, so the impacts could not be appropriately compared.

EPA Analysis of the Waxman-Markey Discussion Draft 36

Source: U.S. Environmental Protection Agency

**Exhibit 4:**
**Point Carbon Data on Future Carbon Offset Prices**



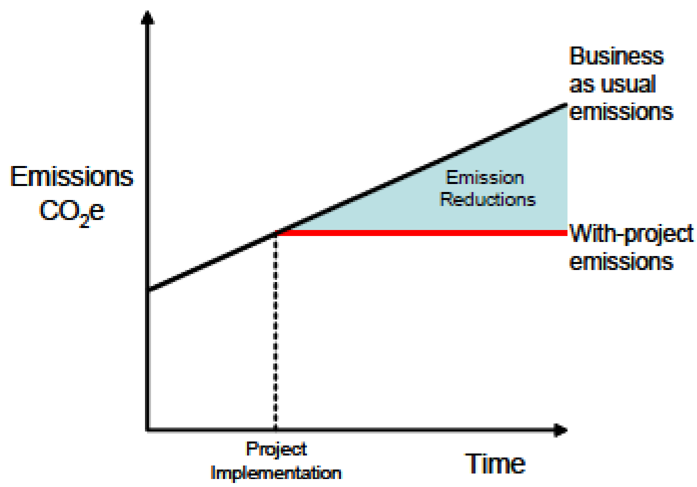

Source: Copied with permission from Point Carbon.

**Exhibit 5:**
**AEP's Bosque Rojo Model (years 0-5)**

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| **Expense Calculation** | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Administrative/Overhead | $ 200,000 | $ 150,000 | $ 100,000 | $ 50,000 | $ 25,000 | $ 20,000 |
| Community Development | $ 50,000 | $ 200,000 | $ 150,000 | $ 100,000 | $ 50,000 | $ 50,000 |
| Government Budget Support | $ 500,000 | $ 250,000 | $ 250,000 | $ 100,000 | $ 100,000 | $ 50,000 |
| Carbon Monitoring & Verification | $ 75,000 | $ 76,875 | $ 78,797 | $ 80,767 | $ 82,786 | $ 84,856 |
| Ecotourism/BioCommerce | $ 200,000 | $ 100,000 | $ 100,000 | $ 100,000 | $ 75,000 | $ 50,000 |
| Site Protection | $ 750,000 | $ 500,000 | $ 50,000 | $ 25,000 | $ 10,000 | $ 10,000 |
| Research | $ 100,000 | $ 75,000 | $ 50,000 | $ 50,000 | $ 50,000 | $ 50,000 |
| Endowment for Long-Term Operation | $ 4,000,000 | $ - | $ - | $ - | $ - | $ - |
| | | | | | | |
| **Total Cost** | **$ 5,875,000** | **$ 1,351,875** | **$ 778,797** | **$ 505,767** | **$ 392,786** | **$ 314,856** |

Source: AEP

**Exhibit 6:**
**Project Emissions Reductions**




Source: TNC

# Exhibit 7:
# Project Risk Factors

| Risk factor | Risk rating for APD | Risk rating for AFUDD and AUMDD |
|---|---|---|
| **Land ownership / land management type** | | |
| Land owned by private or public forest conservation organization with a good track record in forest conservation activities and able to obtain and enforce nationally recognized legal protection of the land | Very low | Very low |
| Privately owned land | Low-Medium | Low-Medium |
| Uncertain land tenure | Not applicable | Medium-High |
| Land legally protected | Not applicable | Low-Medium |
| Land not protected by laws or protected with weak enforcement | Medium | Medium-High |
| **Technical capability of project developer/implementer** | | |
| Proven capacity to design and successfully implement activities that are likely to ensure the longevity of carbon benefits (e.g., creating sustainable livelihood alternatives and/or effectively managing protected areas) | Very low | Very low |
| No previous experience in the design and implementation of activities that may ensure the longevity of carbon benefits | Medium | Medium-High |

(continued)

| | | |
|---|---|---|
| **Net revenues/financial returns from the project to ALL relevant stakeholders (e.g., project developer, deforestation agents, national to local governments)** | | |
| Lower than pre-project or lower than alternative land-uses | • Low if project developer a conservation group<br>• Medium to **high** for other developer types | • Low if project developer a conservation group<br>• Medium to **high** for other developer types |
| Similar to pre-project or similar to alternative land-uses | • Low if project developer a conservation group<br>• Medium for other developer types | • Low if project developer a conservation group<br>• Medium for other developer types |
| Higher than pre-project or higher than alternative land-uses | Very low | Very low |
| **Infrastructure and natural resources** | | |
| High likelihood of new road(s)/rails being built near the REDD project boundary | Low-Medium | Medium-**High** |
| Low likelihood of new road(s)/rails being built near the REDD project boundary | Very low | Low |
| High-value non-forest related natural resources (oil, minerals, etc.) known to exist within REDD project area | Low to High depending on who owns the project lands and their mission (private company or conservation organization) and who owns (or is likely to own in the future) the mining right if separate from land ownership | Low to High depending on who the project developer is and their mission (private company, indigenous group, conservation organization) and who owns (or is likely to own in the future) the mining rights |
| High hydroelectric potential within REDD project area? | Same as above | Same as above |
| **Population surrounding the project area** | | |
| Decreasing or increasing, but with low population density (e.g., <50 people/km²) | Very low | Low |
| Stable and medium-high population density (e.g., 50-150 people/km²) | Very low | Low |
| Increasing and high population density (e.g., >150 people/km²) | Low to medium | Medium to High |
| **Incidence of crop failure on surrounding lands from severe droughts, flooding and/or pests/diseases** | | |
| Infrequent (<1 in 10 years) | Very low | Low |
| Frequent (>1 in 10 years) | Low | Medium-High |
| **Project financial plan** | | |
| Credible long-term financial strategy in place (e.g., endowment, annuity-paying investments, and the like) | Low | Low |
| Credible long-term financial strategy absent | Medium | High |
| Legal easement for ongoing protection tied to land title in place | Very low | Very low |

Source: Copied with permission from the Voluntary Carbon Standard's *AFOLU Guide*, November 2008.

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[i] All quotations taken from the authors' interviews in the fall of 2009 unless otherwise indicated.

[ii] "Bosque Rojo" is a fictitious project name but this case is closely based on an actual REDD project, Noel Kempff, initiated by TNC in 1996 and executed with Fundación Amigos de la Naturaleza. The case and NPV spreadsheet assume TNC approached AEP as a sole investor. In the real Noel Kempff project, two other U.S. electric utilities eventually partnered with AEP in the investment, though AEP provided a majority of the funds. The numbers in the NPV spreadsheet are representative but not exact.

iii G. R. van der Werf, et al, "CO2 Emissions from Forest Loss," *Nature Geoscience*," November 15, 2009, http://www.nature.com/ngeo/journal/v2/n11/full/ngeo671.html, (December 8, 2009).
[iv] Denman, K. L. et al. *IPCC Climate Change 2007: The Physical Science Basis* (eds Solomon, S. et al.) (Cambridge: Cambridge Univ. Press, 2007), pp.499-587.
[vi]David Sanger, "Bush Will Continue to Oppose Kyoto Pact on Global Warming," *The New York Times*, June 12, 2001, http://www.nytimes.com/2001/06/12/world/bush-will-continue-to-oppose-kyoto-pact-on-global-warming.html?scp=3&sq=bush+kyoto+rejection&st=nyt (September 30, 2009).
[vii] "FAQs", *C Trade*, http://www.ctrade.org/FAQs.html, (September 30, 2009).
[viii] Maria Bendana, "US Climate Bill Passes House of Representatives," Forest Carbon Portal, June 26, 2009, http://www.forestcarbonportal.com/article.php?item=681, (July 27, 2009).
[ix] "Carbon Market Worth $118B in 2008," *ClimateBiz*, http://www.climatebiz.com/news/2009/01/11/carbon-market-worth-118b-2008, (January 11, 2009).
[x] "2008 Voluntary Carbon Offset Markets Worth $705M," *ClimateBiz*, http://www.climatebiz.com/news/2009/05/20/2008-voluntary-carbon-offset-markets-worth-705m, (July 27, 2009).
[xi] Ibid
[xii] "Carbon and Land-Use: The Economies of Cocoa, Timber and Agriculture," *Katoomba Group*, 2009, p. 20.
[xiii] "About Us," *American Electric Power*, http://www.aep.com/about/, (December 7, 2009).
[xiv] Carbon capture and storage (CCS) is a process that involves stripping carbon dioxide from fossil fuels before or after they are burnt to produce energy. The carbon dioxide is then piped back into the earth to a depth of at least 800 meters. Theoretically, the pressure of the earth would keep the gas in a liquidized form where it stays for thousands, if not millions, of years.
[xv] "How We Work," *The Nature Conservancy*, http://www.nature.org/aboutus/howwework/, (December 17, 2009).
[xvi] "About Us," *The Nature Conservancy*, http://www.nature.org/aboutus/?src=t5,
[xvii] Per-Anders Enkvist, Tomas Nauclér, and Jerker Rosander, "Executive Summary: Version 2 of the Global Greenhouse Gas Abatement Cost Curve," McKinsey & Company, 2009, pp. 9-11.
[xviii] Joanna Depledge and Farhana Yameen, *The International Climate Change Regime: A Guide to Rules, Institutions and Procedures* (Cambridge: Cambridge University Press, 2005), p. 180.
[xix]"Voluntary Carbon Market First to Embrace REDD," *Voluntary Carbon Standard*, http://www.v-c-s.org/181108redd.html, (December 14, 2009).
[xx] Chris Field, "Carbon-Climate System and the Terrestrial Biosphere," Carnegie Institution for Science, Stanford, CA, Presented February 14, 2009 at the American Association for the Advancement of Science Annual Meeting.
[xxi] U.S. Environmental Protection Agency, Office of Atmospheric Programs, "EPA Preliminary Analysis of the Waxman-Markey Discussion Draft," April 20, 2009, p.: 4.
[xxii] Among the respondents, 1,394 stated that they were involved in trading various compliance carbon allowances and credits, or owned such carbon instruments. In this group, the largest subset comprises clean development mechanism (CDM) project developers, aggregators and others involved in the primary CDM market – these make up 450 of the respondents. Second are companies with emissions regulated under the EU emission trading scheme (EU ETS), counting 385 respondents. Financial institutions, including banks, come in third at 220. Other groups are offset developers in the North American market (53), Joint Implementation (JI) project developers (44), governments (38), companies covered by CO2 regulation other than the EU ETS or the Regional Greenhouse Gas Initiative (RGGI, 27) and companies regulated by RGGI (11).
[xxiii] Ozge Islegen and Stefan Reichelstein, "CO2 Regulations and Electricity Prices: Cost Estimates from Coal-Fired Power Plants." *Stanford Graduate School of Business Research Paper Series*, #2033, July 18, 2009, P: 3.
[xxiv] "Tool for AFOLU Non-Permanence Risk Analysis and Buffer Determination," *Voluntary Carbon Standard Association*, November 18, 2008, p. 33.