GUIDEBOOK FOR DOMESTIC FOREST LANDOWNERS IN THE EMERGING LOW-CARBON ECONOMY

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Table of Contents, Chapters:

Table of Contents, Boxes

Table of Contents, Figures

Appendix

Abstract

A new low-carbon economy is approaching. While the federal government provides needed incentives in the development of clean energy to stimulate this emerging economy, currently only states and regions have implemented a comprehensive program which sends to markets a signal as to the price of carbon.

However, when a federal program is enacted it will inherently have winners and losers, determined by market dynamics, regulatory structure and political preference. Forestry looks to be a winner as forest offsets – activities which sequester carbon in forested land beyond business-as-usual – will play a critical role. As such, educating landowners to the opportunities of offsets is a fundamental first step in the development a robust and effective climate change program.

This masters project, crafted from a literature review and informal interviews, develops an educational Guidebook which introduces U.S. forest landowners to the methodologies, responsibilities and costs of a possible federally administered forestry offset program, as based from the *Clean Energy Partnerships Act of 2009*, its likely legislative vehicle. The Guidebook also serves as the basis to develop a summary document to potentially be circulated by the U.S. Forest Service and the American Forest Foundation to landowners and foresters. It provides recommendations as to the content of the summary document as well as how to best facilitate its dissemination.

An Introduction to Ecosystem Services and their Markets for U.S. Forest Landowners

As a new century begins, forest landowners and farmers continue to manage and derive livelihood from their land and resources in much the same way as they did throughout the last. However, new financial incentives, resulting from the opportunities of a transforming economy, are changing the way our government views and interacts with environmental payment schemes. U.S. private landowners looking to harness competitive advantage from this new economy must first become familiar with these new schemes before they can benefit from them. Understanding these new concepts and utilizing new programs is the key to unlocking financial benefits for landowners and for developing an appropriate value for our natural resources.

> *"Business cannot function if ecosystems and the services they deliver—like water, biodiversity, fiber, food, and climate—are degraded or out of balance."*
>
> World Business Council for Sustainable Development[1]

Now more than ever business and enterprise are products of day-to-day decision making and short term incentives. The result has been a steady decay of the underlying ecological and physical services of the planet.[2] These services, widely known as *ecosystem services*, provide society with a wide range of critical, life-sustaining security, from clean air and water, pollination, productive and regenerative soil and climate regulation (See Box

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[1] "Ecosystems and Human Well-Being: Synthesis" Millennium Ecosystem Assessment (Washington D.C.: World Resources Institute, 2005).

[2] Gretchen Daily, Nature's Services: Societal Dependence on Natural Ecosystems, (Washington D.C.: Island Press, 1997).

1). These beneficial services are derived from *ecosystems*, which are "dynamic complexes of plants, animals, microbes, and physical environmental features that interact with one another."[3] All ecosystems, such as forests, grasslands and wetlands, provide different services to different segments of society. (See Figure 1)

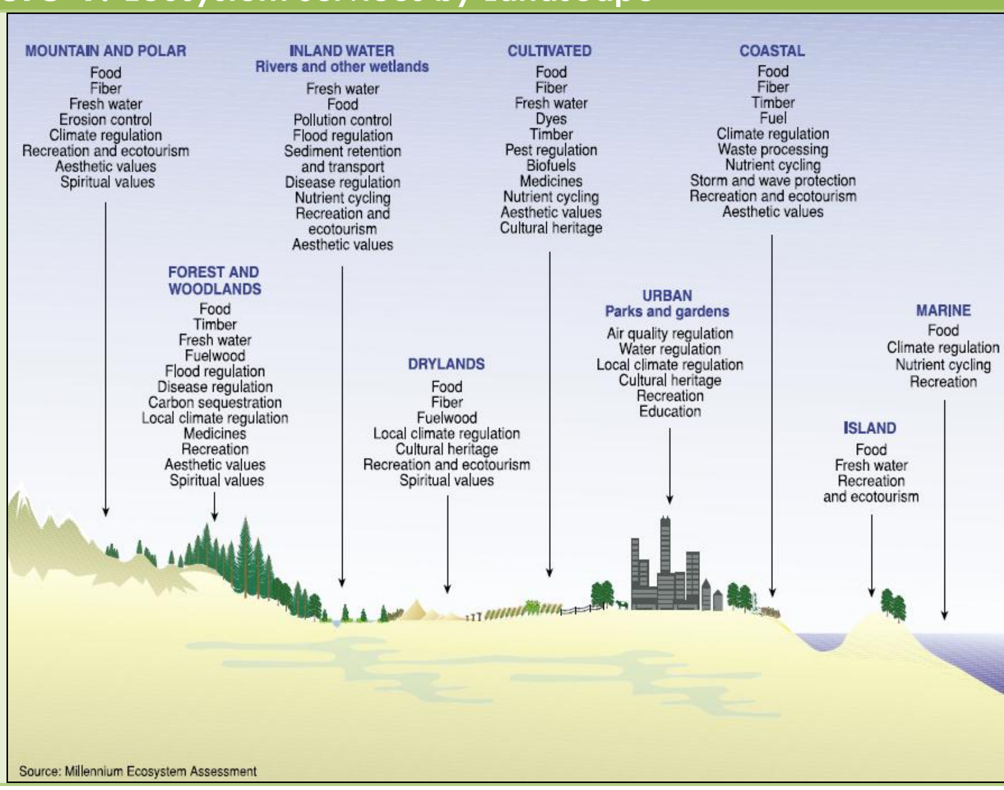
Modern markets however place no financial value or severely undervalue these ecosystems and the services they freely provide. As a direct result, the most comprehensive assessment of ecosystem service health – the Millennium Ecosystem Assessment – reports that over 60% of these services are being degraded faster than they can recover.[4]

For U.S. forest landowners and farmers reduced ecosystem health could result in higher input costs for operations, more disease, forest loss, declining quality and quantity of water tables, reduction of natural pollinators, among others. Further, in the response to increasing ecosystem degradation, these tenets of America's rural working lands will surely face changes in public policy, consumer preferences, supplier relationships and competitor strategies. Fundamentally, the declining quality of ecosystems results in reduced productivity of the lands that yield the goods America and the rest of the world rely upon.

[3] Ibid. Millennium Ecosystem Assessment, 2005
[4] Ibid. Millennium Ecosystem Assessment, 2005

Despite the severity of this ongoing ecosystem degradation, government enterprise, with responsive private partnerships, can create opportunities to build better use practices and improve resource use structures. “Innovation and technology to minimize the damage to ecosystems and to mitigate impacts already occurring are creating significant new business opportunities for those who are aware and prepared”.[5] New markets and product opportunities are emerging, chiefly around Payments for Ecosystem Services (PES) schemes.

Figure 1: Ecosystem Services by Landscape[6]



[5] Ibid. Millennium Ecosystem Assessment, 2005
[6] Ibid. Millennium Ecosystem Assessment, 2005

Box 1: Examples of Ecosystem Services in PES Transactions[7]

- Purification of air and water
- Generation of renewal of soil & soil fertility
- Pollination of crops
- Carbon Sequestration
- Wind breaks
- Control of agricultural pests Dispersal of seeds & translation of nutrients
- Aesthetic beautify and landscape enrichment
- Maintenance of biodiversity

Worldwide, both voluntary and mandated markets are being developed to pay (or exchange something valuable to) landowners for providing or maintaining specified ecosystem "services". Box 1 provides some illustrative examples of ecosystem services in which PES markets have been developed or could be developed for. The chief component of any PES program however is not the exchange of money between the proprietors of the ecosystem service and those willing to pay for it, but rather that;

- The payment *causes* the benefit of the service to occur where it would not have otherwise. (Critically, these paid for services need to be 'additional' (discussed later) to business as usual. That, without the payment, these services would not have occurred otherwise. (See Box 2))

Moreover, in order to ensure environmental integrity, transactions may require regular and independent verification that the paid-for ecological service is being maintained or enhanced.

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[7] *Payments for Ecosystem Services; Getting Started* 2008, (Forest Trends, The Katoomba Group, UNEP, 2008). Taken from Ibid. Gretchen Daily, 1997.

Box 2: PES can be defined as:
1. a **voluntary** transaction in which
2. a **well-defined environmental service** (ES) or form of land use likely to secure that service
3. is bought by at least one ES **buyer**
4. from a minimum of one ES **provider**
5. if and only if the provider **continues** to supply that service.[8]

Payments for ecosystem services have take form in three different types of markets;

(1) **public payment** schemes for private land owners to maintain or enhance ecosystem services;

(2) **formal markets** with open trading between buyers and sellers which is either voluntarily driven or derived from regulation or;

(3) **self organized, private deals** with little or no connection to regulation or transparency to market participants (also known as over-the-counter trading or bilateral agreements):

Box 3: Potential Markets for Ecosystem Services[9]		**examples:**
Public Payments:	Forest and farm landowners have a strong connection to this type of market due to longstanding exposure to and participation within a variety of public payment programs. While specifics vary from program to country, these programs commonly involve direct payments from government agencies or other public institutions to landowners or managers.	Conservation Reserve Programs (CRP); Environmental Quality Incentives Program (EQIP); Wildlife Habitat Incentive Program (WHIP).
Formal Markets: *(1)* under a regulatory cap or;	Regulatory imposed ecosystem service markets, usually established through legislation, creates a demand for a	Established through the Kyoto Protocol, countries around the world have

[8] Ibid. *Payments for Ecosystem Services; Getting Started* 2008.
[9] Ibid. *Payments for Ecosystem Services; Getting Started* 2008.

(2) voluntary	particular ecosystem services by setting a 'cap' on environmental damage (pollution, conversation of environmentally valuable habitat, etc.). Parties responsible for the damage can either comply with the regulation, trade with others who are able to meet the regulation at a lower cost or, when possible, finance programs which offset the damage in another area. *Please see Carbon Market, for more information. Also see Appendix 1 for diagram depicting How an Ecosystem Service Market Works.*	created open trading markets for carbon dioxide emission reduction.
Self organized, private deals:	Where no *formal markets* or government involvement exists, self organized private deals have been formed by buyers of ecosystem services (usually companies or conservationists) who pay landowners to change management practices in order to improve environmental quality to which the buyer wishes to maintain or is dependant upon.	Perrier Vittel (now owned by Nestle) found it more cost effective to conserve farmland surrounding their aquifers than to build a filtration plant to address water quality issues. As such, bilateral agreements for long-term conservation contracts where formed with local farmers.[10]
Please see Appendix 2, for an illustrative view of what farms could look like in the future with the incorporation of PES schemes.		

Carbon in Your Trees and Why it is Worth Something:

Forest ecosystem management has long been a critical factor in the development and sustainability of livelihoods for people and society at large. Forests have long served as a source of food, shelter, construction material, clean water and fuel. Throughout the world, forests continue to serve these basic human needs.[11]

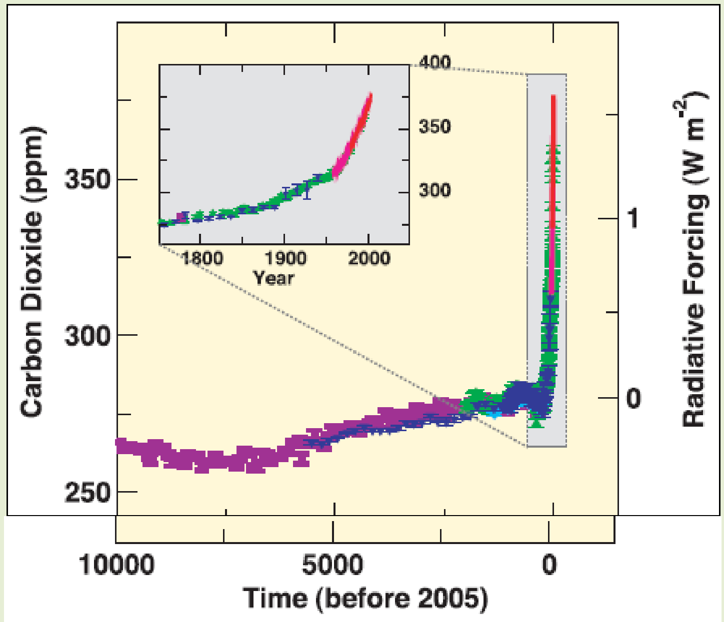
[10] Danièle Perrot-Maître, "*The Vittel payments for ecosystem services: a 'perfect' PES case?*" 2006: http://www.katoombagroup.org/documents/tools/TheVittelpaymentsforecosystemservices2.pdf Accessed January 8, 2010.
[11] Michael Apps and David Price, Forest Ecosystems, Forest Management and the Global Carbon Cycle (New York: Springer, 1994).

While the Industrial Revolution greatly expanded our technological reach and urbanized our lifestyles, the world today is dealing with the consequences of massive, entrenched, interconnected industrialized economies. Environmental managers are gaining more comprehensive understandings of the importance of forest ecosystem services for the health of human communities, and new values are being attributed to forest ecosystems that are properly managed and integrated within our rural communities

Climate change, the name given to the phenomenon of a general warming of our planet, is principally caused by the accumulation of greenhouse gases (largely carbon dioxide or CO_2) in our atmosphere. Since the beginning of widespread use of fossil fuels in 1850 – the birth of our industrialized world – energy and manufacture related CO_2 emission (also known as 'fossil CO_2') have risen 145 fold from 100 million tons to 29 billion tons a year. This increase has caused the global atmospheric concentration of CO_2 to increase from a pre-industrial level of about 280 ppm (parts per million) to 379 ppm in 2005 [12] (see Figure 2). Left unregulated that number will surely increase as developing nations grow industrialized power centers of their own. Models project another rise of 54% by 2030.

[12] IPCC, Fourth Assessment Report, *Climate Change 2007: The Physical Science Basis*, Summary for Policymakers, 5 Feb. 2007, <http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> (accessed January 23, 2010).

Figure 2: **Global Carbon Dioxide Emissions Over Time**[13]



It has been widely acknowledged that unabated global anthropogenic (human-caused) emissions of greenhouse gases may seriously affect the global climate system.[14] Nearly all scientific evidence suggests that this accumulation of CO_2 and other greenhouse gases is caused by human activities primarily resulting from:

- Practices in our **transportation** sector;
- Practices used to create the **energy** for our business and homes;
- The processes in which we **manufacture** industrial commerce, and;
- **Agricultural** practices, **deforestation** & other types of unsustainable land-use change.

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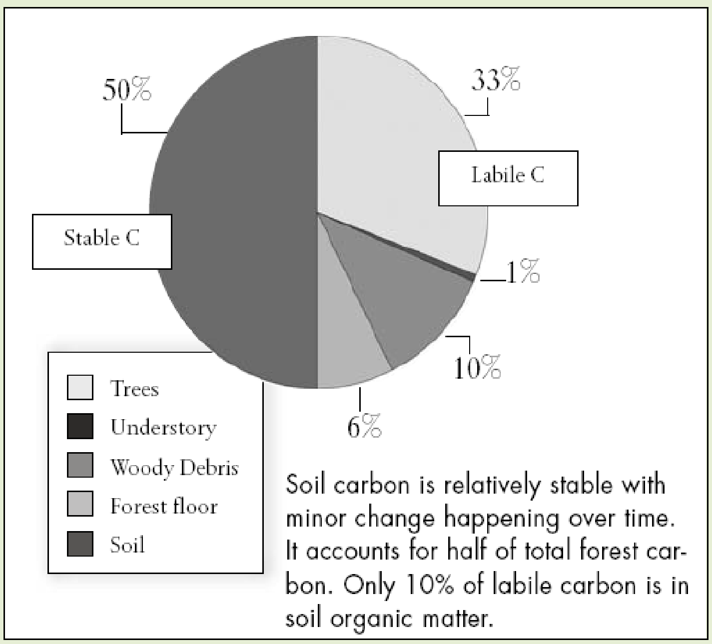
[13] Ibid. IPCC, Fourth Assessment, 2007. page 3

[14] James Hansen et al. "Global climate changes as forecast by Goddard Institute for Space Studies three-dimensional model." *J. Geophys. Res.*, 93, 9341-9364, doi:10.1029/88JD00231, 1988.

This increase of carbon in our atmosphere represents a human caused augmentation of the carbon cycle.

In the carbon cycle plants take carbon dioxide (CO_2) from the atmosphere and turn it into biomass (wood, leaves, fruits etc) through the process of photosynthesis (See Figure 3). Some of the carbon taken in by plants is returned to the atmosphere through respiration by the plant or by other living organisms, including people, which use plants for food or fuel. Simply stated, trees grow when the amount of carbon fixed through photosynthesis exceeds the amount of carbon lost through respiration.[16] This process renews the carbon cycle. As we extract and utilize fossil fuels (mostly oil, natural gas and

Figure 3: Global CO_2 Emissions By Sector[15]



[15] Laurie Wayburn, Jerry Franklin, John Gordon, Clark Binkley, David Mladenoff, Norm Christensen, Jr. *Forest Carbon in the United States: Opportunities & Options for Private Lands*, 2007, Pacific Forest Trust: pg 5, taken from Turner, D.P. et al. "A carbon Budget for Forests of the conterminous United States". *Ecological Application* 5(2), 1995, pg 421.
[16] Burton Barnes, et al., Forest Ecology 4th Edition (New York: John Wiley and Sons, Inc., 1998) pg 486-487.

coal) from the earth on massive scales, we overload the atmosphere with carbon, and change our climate in irreversible ways.[17]

In response to increasing levels of carbon dioxide in the atmosphere, programs have been proposed which place value on sectors and practices which can sequester CO_2. In the forestry sector, such opportunities represent the development of financial incentive programs with the potential to connect more carbon in trees with 1) supplemental economic income streams for landowners, 2) increased rural development, 3) more sustainable forests, and 4) restored natural ecosystems.[18]

While forests ecosystems cover only 21 percent of the Earth's land surface, they hold a disproportionately large share of terrestrial plant mass (75 percent) and their annual growth (37 percent). As the element carbon largely forms the foundational basis of plant structure (47 percent), the extent to which forests are altered by human activities – such as harvesting or conversion to other types of vegetation such as crops – has substantial influence on the amount of carbon which is cycled or stored globally.[19]

In the U.S., current activities which sequester carbon — over 90 percent of which occurs from our current forests sequestering carbon — negates

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[17] "Climate Change Facts; A Primer on Carbon Cycling" The Wilderness Society <http://wilderness.org/files/primer_carbon_cycling.pdf> (accessed February 8, 2010).
[18] Richard Birdsey, "Carbon Accounting Rules and Guidelines for the United States Forest Sector" (Madison, Wisconsin, *Journal of Environmental Quality*. 35, 2006) pg 1518–1524
[19] Ibid. Apps and Price, 1994.

approximately 12 percent of U.S. greenhouse gas emissions from all sectors of the economy.[20] Carbon is stored in much greater quantity in forests than in agricultural or developed land. Every year U.S. forested lands sequester 190 million tones of carbon in vegetation and soils, whereas developed land sequesters only 12 million.[21]

> Box 4: **Carbon Sequestration in Forests.**
> "The capacity of stands to sequester carbon is a function of the productivity of the site and the potential size of the various pools—soil, litter, down woody material, standing dead wood, live stems, branches, and foliage. Net rates of CO2 uptake by broad-leaf trees are commonly greater than those of conifers, but because hardwoods are generally deciduous while conifers are commonly evergreen, the overall capacity for carbon sequestration can be similar. Forests of all ages and types have remarkable capacity to sequester and store carbon, but mixed-species, mixed-age stands tend to have higher capacity for carbon uptake and storage because of their higher leaf area."[22]

Augmenting forests to sequester more CO_2 in the carbon cycle – a carbon sequestration activity which can be among the most cost efficient to perform – will be a key mechanism policy makers choose to utilize in any greenhouse gas program. Trees and soils can gain and lose carbon through different processes. Forests build up carbon pools by accumulating carbon within live trees, standing dead trees, woody debris, understory forest floor and soil layers pools. In forests, carbon can be sequestered over decades or even centuries, until mature

[20] *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2002* (Washington D.C, Environmental Protection Agency (EPA) 2005).
[21]*Inventory of U.S. greenhouse gas emissions and sinks: 1990–2005*. (Washington, D.C, EPA 430-R- 07-002., 2007)
[22] Robert Malmsheimer, et al., "Forest Management Solutions for Mitigating Climate Change in the United States", *Journal of Forestry*, April/May 2008, pg 120.

ecosystems reach a stage of carbon saturation.[23] The U.S. Department of Agriculture defines carbon pools as:

- "*Trees*: live and standing dead trees including coarse roots, stems, branches, and foliage (live trees only).
- *Understory vegetation*: roots, stems, branches, and foliage of seedlings (trees usually less than 2.5 cm diameter), shrubs, and bushes.
- *Forest floor*: fine woody debris up to 7.5 cm diameter, tree litter, and humus.
- *Down dead wood*: logging residue and other coarse dead wood on the ground and larger than 7.5 cm diameter, and stumps and coarse roots of stumps.
- *Soil*: including all organic material in soil excluding any carbon specified for above pools." [24]

Forest Sector Carbon Sequestration Project Types:

Programs which look to augment forests to sequester carbon for financial benefit include **forest management**, **aforestation** and **reforestation** practices.

Box 5: Examples of Forest Sector Carbon Sequestration Project Types	
Forest Management	Extend rotation lengths, or curtailing forest management to allow existing trees to grow longer and therefore larger within harvest cycles.
Aforestation	Tree planting, mainly the conversion of agricultural or barren lands to forest land which can lead to large increases in carbon stocks for the treated area.
Reforestation	Active regeneration of harvested forest land which can

[23] Zach Willey and Bill Chameides, Harnessing Farms and Forests in the Low Carbon Economy; How to Create, Measure, and Verify Greenhouse Gas Offsets, (Durham & London: Duke University Press, 2007)

[24] "Technical Bulletin No. 1907". Global Change Program Office, Office of the Chief Economist, U.S. Department of Agriculture, 2004, pg 163.

accelerate the natural regeneration process and allow for the establishment of fast growing species.

Recent research has shown that these forest sector practices, among others, conducted at wide enough scales can sequester carbon at levels to substantially offset carbon emissions from other sectors, decreasing what would have otherwise been the total amount of carbon in the global atmosphere[25] [26] [27].

This Guidebook:

This guideline aims to provide a comprehensive introduction to U.S. private forest landowners about the opportunities inherently available to them from a cap-and-trade or other federally administered program that seek to regulate domestic greenhouse gases.

As voluntary and mandatory greenhouse gas mitigation programs already exist at state and regional levels, this Guidebook may also be used to introduce forest sector carbon sequestration practices that may already be in use. However, the emphasis of the Guidebook is to introduce programs, opportunities and responsibilities of the private forest landowner derived from federally created legislation. It uses the regulatory framework of legislation introduced and debated in the 111th Congress, most prominently the offset and supplemental programs developed by the *Clean Energy Partnerships Act of 2009* (SR 2729).

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[25] Ibid. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2002*
[26] Ibid. Zach Willey and Bill Chameides, 2007
[27] S Pacala and R Socolow, "Stabilization wedges: solving the climate problem for the next 50 years with current technologies" (*Science* 305, 2004) pg 968–972.

Audience:

Fifty-six percent of the 751 million acres of forested land in the United States is privately owned. Of this, family forest owners hold 62 percent or 264 million acres throughout the U.S.[28] America's 10 million family forest owners are diverse, dynamic and numerous. They are pivotal actors in the protection and sustainable management of our forests and ecosystems across America's landscapes.[29] This Guidebook is designed to be used by these private forest owners, as well as private and state foresters, seeking a better understanding of how forest resources and private property can generate income and improve forest management in this rapidly approaching low-carbon economy.

Guidebook Organization:

This Guidebook provides a comprehensive overview of federally developed offset programs which forest land owners may utilize. Specifically, the Guidebook informs landowners;

i. Why carbon is considered a financial product in the view of Payments for Ecosystems Services schemes;
ii. The distinguishing characteristics and sequestration potential of a variety of relevant forest related activities to sequester carbon;

[28] Drue DeBerry, "Family Forests & Climate Change", (American Forest Foundation, 2009)
[29] "Who Owns America's Forests?" United States Department of Agriculture, Northern Research Station, 2008.

iii. An overview of the current bill which looks to form the basis for a federally administered carbon sequestration (offset) program;

iv. A description of the various problems and characteristics to which landowners participating in an offset program need to be aware of, and;

v. Recommendations to the U.S. Forest Service and the American Forest Foundation on what and how to disseminate this information to America's forest landowners.

The Carbon Market, an Ecosystem Service Market and How Your Forests Play a Role:

As we have seen, ecosystems play a vital role in sustaining the ecological services that humans and our larger society are critically dependant on. With the encroachment of discernable and dangerous climate change one such service which has received much attention is providing climate stability through the sequestration of carbon dioxide, a greenhouse gas, principally accomplished during photosynthesis. As previously noted, the growth and sustainability of our forests regulate our climate. In the face of international efforts to combat climate change, carbon sequestration represents one of the first ecosystem services for which a network of domestic and international markets is forming to place valuation on this service currently considered free.

As different programs and markets have been debated in Congress and Presidential administrations, this Guidebook introduces forest landowners to the opportunities inherent within a nationwide federally administered cap-and-trade system. At the time of this writing, a federal cap-and-trade system has received the most support in Congress as the framework to establish a program to reduce greenhouse gasses (known as *"mitigation"*).

Cap-and-trade programs enforce an annual federally established cap on the total amount of greenhouse gas emission allowed to be released in the country. A regulatory body then annually distributes permits for a "right to pollute" which can be used in that year, traded with others who hold permits or simply held onto (also known as "banked") as a form of private property. The number of greenhouse gas permits, called allowance permits or simply "allowances", decline each year, creating an industry demand for permits as well as a strong incentive to implement cleaner technology. One allowance permit represents one metric ton of carbon dioxide or an equivalent amount of heat-trapping ability of any of the other six greenhouse gas.

In contract to a strict "command and control" regulatory strategy, cap-and-trade allows polluters flexibility to choose from several different courses of action to comply with a decreasing number of available allowance permits. In a cap-and-trade scheme, essentially, regulated polluters can:

(1) Spend money to reduce emissions in parallel with the decreasing volume of allotted or available allowances.
(2) Continue to pollute over your allotted pollution allowance by purchasing allowances from other polluters. Other polluters will have excess allowances as; a. they have reduced their emissions below their allowed levels, or; b. they can more cheaply reduce their emissions from the revenue generated from the sale of their allowances than other polluters can from their cost of buy additional allowances.
(3) Purchase **allowance offsets** from third parties.

The flexibility in purchasing and selling (or trading) within all three actions, as well as other factors such as how the market is structured and regulated, effectively creates a market price for these allowances: a price for the right to pollute, or "a price on carbon".

With markets determining price, some parties will realize that at certain prices it is more profitable to reduce their own emissions and sell their permits to industries with higher emissions reduction costs. At other prices parties will seek different ways of compliance including purchasing offsets from forest landowners. This will be an especially important compliance strategy in the early years of the program when the costs of transitioning to new technology are high.

In an unadulterated cap-and-trade system winners and losers are chosen by market dynamics because the regulated actors choose the price they want to reduce their emissions and how – with what type of technology, energy source or offset – they want to make reductions in their emissions. Opportunities for profit are the main drivers for innovation and investment in today's global economy. To solve climate change, both are needed.[30]

Discussions centering on the constitution of an offset, their characteristics and requirements for inclusion in a cap-and-trade will largely serve as the focus of this Guidebook.

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[30] Slideshow of Holmes Hummel, "An Introduction to Cap-and-Trade Climate Policy" <http://www.slideshare.net/grist/capandtrade-thru-musical-chairs-full> (accessed February 21, 2010)

Box 6: **US Forestry Facts:**

- General forest cover in the United States has declined by one-third to one-half its extent since European settlement.
- Forests account for one-third of the US land mass (747 million acres), with almost two-thirds of that area (424 million acres) under private ownership.[31]
- The 424 million acres of forest under private ownership constitute the most productive forests in the U.S., producing the greatest amount of timber and representing the capacity to sequester the great amount of carbon in the country.[32] [33]
- While U.S. forests, especially in the Northeast and Southeast, have seen considerable re-growth since the early to mid-1900s, nevertheless the U.S. lost 11.5 million acres of existing forest between 1982 and 1997, losing twice as much acreage in the five years from 1992 to 1997 than in the 10 preceding years. USDA's Natural Resources Inventory (NRI) explains that the loss between 1982 and 1997 represents 5.7 percent of the private forested land base in the United States.[34]
- On average, the U.S. lost 1.275 million acres of forest each year during the last 15 years.[35]
- As a result, since 1990, the US has stored less forest carbon each year. In 1998, the National Research Council projected that the US will lose another 20 million forested acres by 2020. The Southeast and Northwest, the nation's most productive forestland areas, lead the country in forest loss.[36]
- Private forests are the most productive— and threatened—forests in the country. Their state of carbon accumulation or release has a major impact on the US carbon balance. When forests are disturbed through harvest or conversion to other land uses, they release carbon, adding to emissions overall.

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[31] Ibid. Wayburn, Franklin, Gordon, Binkley, Mladenoff and Christensen, 2007
[32] Constance Best and Laurie Wayburn. "*America's Private Forests: Status and Stewardship*" (Island Press, 2000)
[33] 1997 National Resources Inventory, (Department of Agriculture, National Resources Conservation Service, 2000).
[34] Ibid.
[35] U.S. Department of Agriculture, Natural Resources Conservation Service, 1999. National Resources Inventory 1997. <http://wwwnhq.nrcs.usda.gov/NRI> (assessed December 1, 2009)
[36] Ibid. 1997 National Resources Inventory, 2000

Offsets and the American Forest Landowner

Offsets are paper contracts of *additional, verified, registered* and *permanent* practices that lower greenhouse gas emissions. Polluters may pay for such practices from third parties, such as landowners, to offset their own pollution. Forest landowners will play a vital role in this aspect of the cap-and-trade scheme.

Figure 4 illustrates how offsets create mitigation of greenhouse gasses. "The mitigation or net greenhouse benefit from a project is the difference between the *baseline* and project emissions."[37] (See page 42 for a detailed discussion on baselines.) As both baselines and projects emissions change overtime, both sets of emissions must be tracked and compared.

Forestry and Offsets

Forestry activities can help reduce the atmospheric buildup of carbon dioxide in a number of ways. Principally forests can act as carbon sinks sequestering CO_2 in tree biomass and soils. Two of the main types of activities landowners may pursue for the financial benefit of carbon sequestration are efforts at *improved forest management* and *aforestation*.

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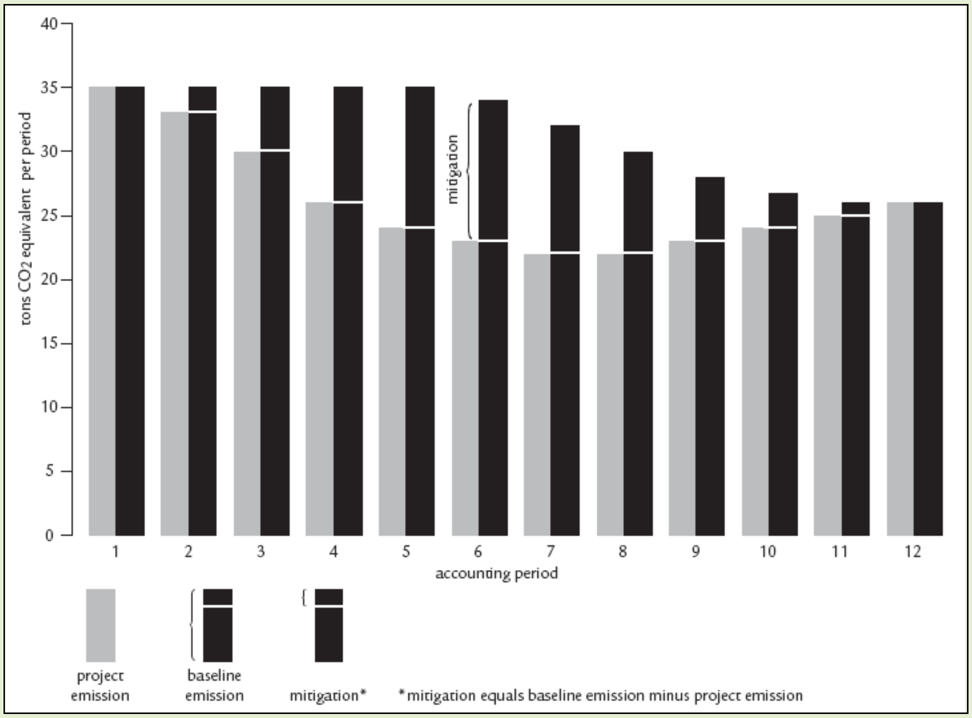
[37] Ibid. Zach Willey and Bill Chameides, 2007

Figure 4: Graphical Description of Offsets[38]



Improved Forest Management

Management of private and, in some cases, public forests has traditionally focused on maximizing the value of harvested commercial timber over time. However, under a cap-and-trade scheme forests managed to enhance carbon sequestration also provide financial benefits. Recent economic analyses suggest that such management practices may be attractive to landowners at a carbon price as low as $10 ($10 per milligram of carbon).[39] [40]

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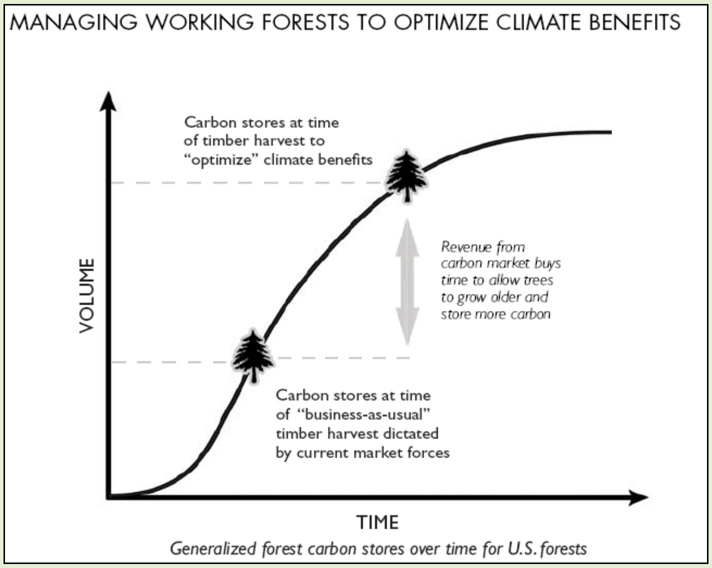
[38] Ibid.

[39] Ibid. Richard Birdsey, 2006

[40] J Lewandrowski, M. Sperow, M. Peters, M. Eve, C. Jones, K. Paustian, and R. House. "Economics of Sequestering Carbon in the U.S. Agricultural Sector." *Tech. Bull. 1909*. (Washington, DC, USDA Economic Res. Serv., 2004)

Figure 5: Managed Forests and Climate Benefits[41]



As foresters know, managed forests grow through multiple stand ages from stand establishment to harvest. When forests are managed for timber production the optimal time of harvest is when the price value of any additional growth is overtaken by the opportunity cost of the delay. In other words new optimal time to harvest is when the value of the stand reaches the market price of the timber.

However, if carbon sequestration is considered in forest output, the economic value of delaying the rotation may be higher because carbon continues to accumulate as the trees grow.[42] Thus, if carbon sequestration is valued, forest managers may receive payments for "improved management" by extending the harvest age of managed forests which can measurably sequester more carbon

[41] Ibid. Wayburn, Franklin, Gordon, Binkley, Mladenoff and Christensen, 2007 pg vii.
[42] G. C. van Kooten, C.S. Binkley and G. Delcourt, "Effect of Carbon Taxes and Subsidies on Optimal Forest Rotation Age and Supply of Carbon Services" (*American Journal of Agricultural Economics* 77, 1995).

(Figure 5). Over time, managed forests will reach new and higher carbon equilibriums.[43]

Forests however are not homogenous. They greatly differ in species and soil composition, nutrient type and levels, topography, sunlight exposure and a variety of other factors which affect tree growth and species distribution. Such diversity of tree species within North American forests will result in variant carbon sequestration rates from forest management practices implemented throughout the country.

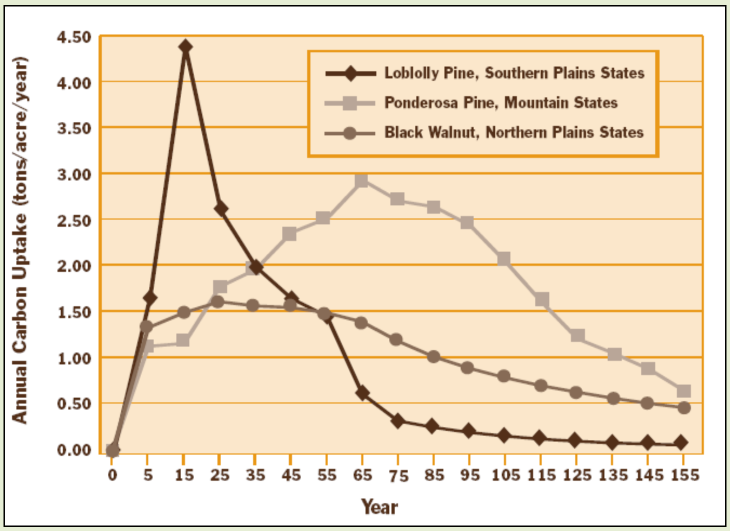
For example, in woodlands as trees are small in size and are more widely spaced their carbon stocks are generally not more than 20 to 40 metric tons of carbon per hectare (Mg C ha^{-1}). Forests managed for timber, on the other hand, hold carbon in trees typically not exceeding 50 - 100 Mg Cha^{-1}.[45] Finally, carbon

Box 7: Vegetation Types (Live Trees) Carbon Stocks: [44]	Vegetation Mg C ha^{-1}
Tundra and alpine	3
Desert scrub	5
Temperate Grassland	7
Temperate woodland	27
Tropical woodland	60
Old-growth Ponderosa pine, eastern Oregon, USA	113
Temperate broadleaf deciduous	143
Mature topical/subtropical	247
Old-growth Douglas-fir, Cascades, Oregon, USA	557
Old-growth spruce hemlock, coast, Oregon, USA	598

[43] Environmental Protection Agency, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture" (Washington D.C., National Service Center for Environmental Publications, Nov. 2005)
[44] Ibid. Zach Willey and Bill Chameides, 2007 pg 137.
[45] Richard Birdsey, "Carbon storage for major forest types and regions in the conterminous United States" *Forests and Global Change*, vol. 2, *Forest Management Opportunities for Mitigating Carbon Emissions*, ed. R.N. Sampson and D Hair. American Forests, Washington, D.C., 1996.

stocks in undisturbed mature temperate and tropical forests may double or triple carbon stocks in forests managed for timber.[46] Box 7 illustrates the variation in carbon stocks among differing ecosystems.

Figure 6: Carbon Sequestration Rates by Species [47]



Moreover, just as carbon sequestration rates vary among different ecosystem types, there is also considerable variation in sequestration rates among different tree species. As illustrated in Figure 6, the use of loblolly pine in the Southern Plains States produces rapid uptake of carbon, peaking at 4.5 tons per acre per year at 15-20 years of age and decreases rapidly thereafter. In contrast, Ponderosa Pine, planted in Western Mountain States, experiences gradual increases in sequestration rates over 20 years, peaking later in its lifetimes at 3 tons per acre per year.[48]

What becomes apparent is that, in general, young trees tend to have high rates of net carbon uptake that culminate earlier for rapidly growing shade-

[46] R.A. Houghton, "The Annual Net flux of Carbon to Atmosphere from changes in Land Use", 1850-1990, *Tellus* 51B, 1999.
[47] Robert Malmsheimer, et al., "Forest Management Solutions for Mitigating Climate Change in the United States", *Journal of Forestry*, April/May 2008, pg 149.
[48] Robert Stavins, Kenneth Richards, *The Cost of U.S. forest-based Carbon Sequestration* (Pew Center on Global Climate Change, Jan 2005)

intolerant pines (loblolly) than for slower growing, more shade-tolerant trees (ponderosa). Forest landowners must take note that while some trees are initially slower growing they may sequester more carbon overall with later growth. When determining carbon sequestration rates, a multitude of factors including species of tree, shade relationships between trees, regional locations, soil content, just to name a few, need to be considered alongside procedural issues, such as length of offset contracts.[49]

A 2005 study by the Environmental Protection Agency (EPA) suggests that using a high end estimate of dollars per MT CO_2e (metric ton of carbon dioxide equivalent) an estimated 2,100 million metric tons (MMT) of CO_2e could be sequester per year over the next 100 years from agriculture and forestry sector activities. By way of reference, 2,100 MMT is approximately 30 percent of the total current annual U.S. output of greenhouse gas emissions.[50] Out of the 2,100 MMT, EPA estimates forest management could account for 385 MMT, producing real opportunities for forest landowner investment and revenue.

Activity[51]	$ per MT CO_2e				
	$1	$5	$15	$30	$50
Forest Management (MMT CO_2e)	**25**	**105**	**219**	**314**	**385**

[49] Ibid. Robert Malmsheimer, et al., 2008.
[50] *Agriculture and Forestry in a Reduced Carbon Economy; Solutions from the Land: Executive Summary*. (25x'25 April 1, 2009).
[51] Ibid.

Afforestation
Broadly, afforestation is defined as the establishment of trees on lands that were without trees for some period of time. Different programs provide differing interpretations of the time period which lands must be without trees. For example the Intergovernmental Panel on Climate Change (IPCC) defines afforestation as the planting of new forests on lands that have not contained forests historically.[52] While the United Nations Framework Convention on Climate Change (UNFCCC) defines "afforestation" as 'the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources'.[53] For the purposes of this Guidebook, the cap-and-trade program debated in Congress most often refers afforestation as establishment of trees on acreage not forested as of January 1, 2009.[54]

Reforestation, or the reestablishment of a forest after a harvest in the United States, is also an activity for which landowners may be awarded credits. However, it too has been defined broadly and can sometimes be considered a subcategory of forest management.

Afforestation enhances carbon sequestration because, as discussed, forested lands have considerably more carbon storage potential then barren, urban or agricultural lands. Afforestation effectively transfers land away from uses

[52] Intergovernmental Panel on Climate Change (IPCC) (2000) Land Use, Land Use Change, and Forestry, Summary for Policymakers. Cambridge University Press, Cambridge, UK. page 377
[53] UNFCCC Definitions available at <wwwunfccc.int> (accessed February 9, 2010)
[54] *Clean Energy Partnerships Act of 2009*. Introduced 2009, 111th Congress

with relatively low carbon storage potential to types with higher carbon storage potential. Just as in forest management, rates of carbon sequestration for afforestation will vary depending on similar issues of tree species, climate, soil type, management, and other site-specific characteristics. Estimates suggest that afforestation can sequester 2.2 to 9.5 tones of CO_2 per acre per year depending on these factors.[55]

The U.S. has experience undertaking concerted afforestation efforts. Most recently from 1982 to 1997 as over 14 million acres of pastureland were converted to forest cover.[56]

In contrast with forest management, afforestation practices typically need a higher price of carbon to be financially viable. EPA models also suggest that when carbon prices are high, afforestation produces larger carbon offsets than could be achieved through forest management. EPA estimates that 832 MMT of carbon savings out of a total estimated 2,100 MMT from forestry and agricultural practices can potentially be attributed to afforestation activities.

Activity[57]	$ per MT CO_2e				
	$1	$5	$15	$30	$50
Afforestation (MMT CO_2e)	0	2	137	435	832

[55] Richard Birdsey, "Regional Estimates of Timber Volume and Forest Carbon for Fully Stocked Timberland, Average Management After Final Clearcut Harvest." *Forests and Global Change: Vol. 2, Forest Management Opportunities for Mitigating Carbon Emissions,* R.N. Sampson and D. Hair (eds.), pp. 309-334, American Forests, Washington, DC. (1996)
[56] Ibid. 1997 National Resources Inventory, 2000.
[57] Ibid. 25x'25, 2009.

General Concepts of Forest Management and Afforestation

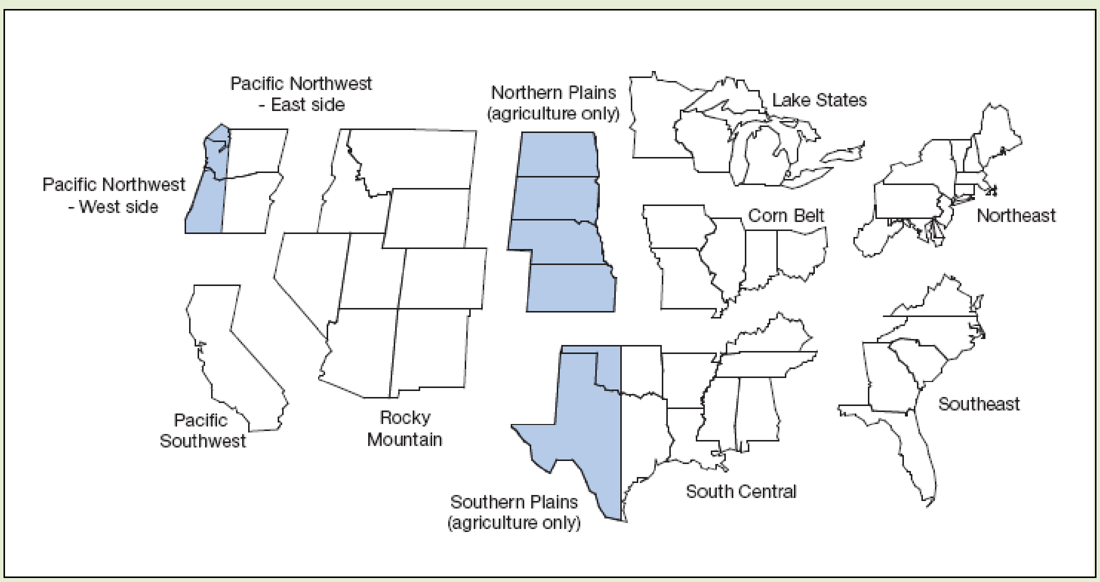
EPA's study of the domestic forestry and agriculture potential for carbon sequestering reveal some central concepts.

- **Programs to regulate greenhouse gases can generate substantial mitigation** from the U.S. forest and agriculture sectors especially in the first few decades. After 2025 the rate of annual mitigation declines over time, as the practices are reaching a saturated carbon point and initial practices which utilize improved management within forest timber are harvested.[58]
- **The optimal portfolio and timing of mitigation strategies are affected by the greenhouse gas price levels.** At relatively low greenhouse gas prices (≤$5/t CO_2e.) and in early years, modeling suggests that carbon sequestration in agricultural soils and forest management will be the dominant mitigation strategies. Afforestation becomes the leading strategy at middle to higher prices (≥$15/t CO_2e) from the early/middle years to 2050. However both afforestation and forest management substantially lose potential as sources of sequestration by 2055 due to carbon saturation, harvesting, and other reversals.[59]
- **Mitigation is likely to have a regional, uneven distribution.** From a heterogeneous U.S. landscape, the adoption and effectiveness of generate greenhouse gas mitigating activities will not be uniform across regions of the country. The South-Central, Corn Belt, and

[58] Ibid. EPA "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005
[59] Ibid.

Southeast regions may possess the largest competitive potential to generate greenhouse gas mitigation from agricultural and forestry sectors. The Rockies, Southwest, and Pacific Coast regions may possess the least competitive potential. In these areas climate and topography are expected to significantly limit the movement of land between major uses such as forestry and agriculture. In low carbon prices scenarios, forest management in the South-Central region generates the most greenhouse gas mitigation, followed by agricultural soil carbon sequestration in the Corn Belt, Lake States and Plains. While in estimated high price for carbon, afforestation in the South-Central and the Corn Belt are seen as likely winners [60] (see Figure 7-8 and Box 8).

Figure 7: Regions of the United States in Environmental Protection Agency, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture" [61]

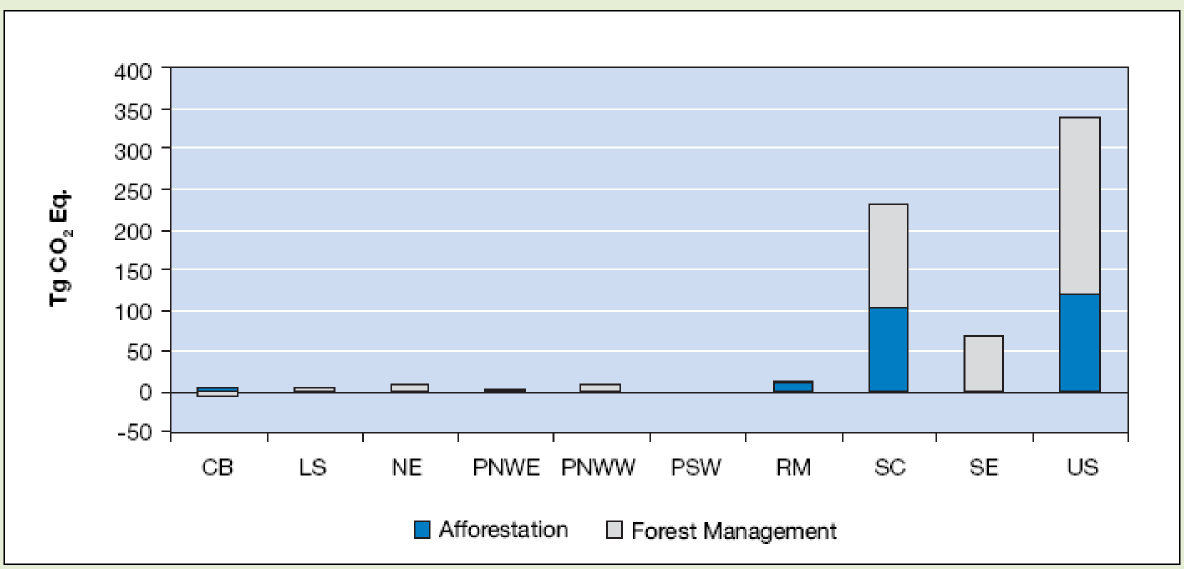


[60] Ibid.
[61] Ibid

Box 8: Top 10 Regional Forestry Mitigation Activities by Price Scenario.
Rankings also include agricultural practices which are not shown here.
Rankings are based on mitigation quantities analyzed over the period 2010-2110.[62]

Region	Activity	Greenhouse Gas Price Scenarios ($/ton CO_2e)				
		$1	$5	$15	$30	$50
South Central	Forest Management	1	1	1	3	3
South East	Forest Management		4	3	6	8
South Central	Afforestation			2	1	2
Rocky Mountain	Afforestation			9		
Corn Belt	Afforestation				2	1
Lake States	Afforestation					9

Figure 8: Greenhouse Gas Mitigation under Payments for Afforestation and Forest Management at $15/ton CO_2e by Region.
Quantities are per year net emissions reduction below baseline, annualized 2010-2110.[63]



[62] Ibid
[63] Ibid

Forestry within Compliance and Voluntary Carbon Markets

Though forestry shows great potential as a source of carbon sequestration, current active global voluntary and compliance carbon markets have not yet utilized offset programs which incorporate the full spectrum of forest carbon activities.

For example, the **Kyoto Protocol** (an international legally-binding treaty ratified by 184 countries to date, committing 37 industrialized countries including the European Union but not the U.S., to reduce greenhouse gas emissions by 5.4% below 1990 levels by 2012)[64] introduced the concept of trading greenhouse gas emission credits, but currently limits the role of forestry only to afforestation and reforestation.[65] [66]

The first phase (Phase I) of the **European Union Emissions Trading Scheme (ETS)** (the world's largest emissions trading scheme established to help 27 European nations meet their Kyoto obligations)[67] excludes all forestry activities[68] until 2020.[69]

Domestically, two main compliance-driven greenhouse gas programs have been developed to regulate a carbon emissions trading program. The **Regional**

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64 UNFCCC <http://unfccc.int/kyoto_protocol/items/2830.php> (accessed February 19, 2010)
65 Green Carbon Guidebook, World Wildlife Fund. (WWF International, 2008).
66 Ibid. Robert Malmsheimer, et al., 2008.
67 Ecosystem Marketplace. *Forests: Taking Root in the Voluntary Carbon Markets,* (Washington, DC, 2008) <www.ecosystemmarketplace.com> (access November 23, 2009)
68 Ibid. Robert Malmsheimer, et al., 2008.
69 Tuerk, A., Streck, C., Johns, T. and Pena, N. "Working Paper: The role of land-based offsets in Emissions Trading Systems: Key design aspects and considerations for linking" (Climate Strategies, 2008) <http://www.joanneum.at/climate/linking/Forestry_1.pdf> (accessed March 4, 2010)

Greenhouse Gas Initiative (RGGI), an effort by ten Northeastern and Mid-Atlantic States to reduce GHG emissions 10% by 2018 from the power sector,[70] limits eligibility to only afforestation.[71] [72]

The other, the **California Climate Action Reserve (CAR)**, has developed and is in the process of implementing the most advanced protocols for forestry practices. These protocols include activities that reforest (afforestation), improve forest management, and avoid conversions of forested land.[73]

Domestic voluntary markets play a key role as they have been the critical testing grounds for the development of offsets. Much of the work in voluntary markets has been funneled through the **Chicago Climate Exchange (CCX)** or **over-the-counter** transactions.

Launched in late 2003, the **Chicago Climate Exchange (CCX)** is "North America's only voluntary, legally binding rules-based greenhouse gas emission reduction and trading system."[74] Currently the CCX trading scheme allows afforestation and reforestation, reduced deforestation and degradation, improved forest management, and carbon retention in wood products.[75] While CCX allows for these forest activities, strict guidelines must

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[70] Regional Greenhouse Gas Initiative http://www.rggi.org/home, (accessed March 1, 2010)
[71] Ibid. Robert Malmsheimer, et al., 2008
[72] http://www.rggi.org/offsets, (accessed March 1, 2010)
[73] Forest Project Protocol, Version 3.1, Climate Action Reserve, October 22, 2009.
[74] Ibid. Ecosystem Marketplace. *Forests: Taking Root in the Voluntary Carbon Markets*, 2008
[75] Chicago Climate Exchange http://www.chicagoclimateexchange.com/content.jsf?id=242, (accessed February 8, 2010)

be met before inclusion. Forest activities must be approved by the CCX Forestry Committee as well as independently verified by CCX third-party auditors.[76] Project developers must agree to a minimum 15 year contract, and 20% of earned offsets must be retained in a reserve pool to mitigate risks associated with unintentional catastrophic losses, such as from fires, floods, hurricanes and other reversals.[77]

Over-the-Counter (OTC) trading, previously characterized as "self organized, private deals", currently represents the largest portion of the overall domestic voluntary carbon market. Unlike the CCX or other registries with voluntary participation, carbon credits known as Verified Emissions Reductions are traded between parties and not on regulated exchanges. While these practices are numerous, forestry activities traded Over-the-Counter are extremely difficult to characterize as their dealings are usually confidentially and not tracked by exchanges. Annually surveys however suggest that forestry land based projects comprised roughly 18% of the OTC market, tying it with energy efficiency projects for the second largest sector of trading with and behind renewable energy projects.[78]

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[76] Murali Kanakasabai. Workshop on Clean Development Mechanism: Chicago Climate Exchange Presentation, April 16, 2008. www.teamorissa.org/powerpointpresentationoncdm/CCX-Ctran_April2008, (accessed March 1, 2010)
[77] Ibid
[78] K, Hamilton, M, Sjardin, T Marcello and G Xu, "Forging a Frontier: State of the Voluntary Carbon Markets 2008." (Washington DC The Ecosystem Marketplace, 2008)

Senate Resolution 2729 – Clean Energy Partnerships Act of 2009

While international programs have been established and state and regional voluntary and compliance programs are operating and refining their protocols, Congress has long debated a federal nation-wide program to regulate greenhouse gases. While these federal programs have not yet been signed into law, their details and provisions written in legislation can serve as the basis for educating forest landowners about the opportunities inherent within a federally created low-carbon economy.

At the time of this writing two main pieces of legislation have been developed by the 111th Congress which detail the regulatory framework for offsets: HR 2454 – *American Clean Energy and Security Act* (also known as Waxman-Markey) which passed the House of Representatives in July, 2009 and SR 1733 – *Clean Energy Jobs & American Power Act* (also known as Kerry-Boxer), which was introduced in the Senate Committee on Environmental Public Works in late 2009.

These bills largely shadow each other in their offset market framework and in the rules which govern landowner responsibilities, with minor variations.

Another bill, which independently tackles the development of an offset market, has been drafted. Authored by Senator Stabenow (D-MI), SR 2729, the *Clean Energy Partnerships Act of 2009*, may be considered the offset framework with the most political buy-in and consensus in the Senate. As the Senate remains the only federal legislative body not to have passed a climate regulatory bill, using the *Clean Energy Partnerships Act of 2009* as the basis for educating landowners within this publication seems the most prudent.

Below is a detailed chart that delineates specifics that forest landowners need-to-know for the development of forestry offsets within any federal climate program authorized by the *Clean Energy Partnerships Act of 2009*. As this bill is not law at the date of this writing, details within this chart are subject to change.

Box 9: SR 2729 –*Clean Energy Partnerships Act of 2009*– ***Title 1: Offset Credit Program***		
Issue Area:	**Provision:**	**Definitions and Reference to Guidance Sections:**
Administrator of the Offset Program:	The Secretary of Agriculture (Secretary) is authorized authority over forestry and agricultural offset projects.	
Timeline of Rule and Methodology Development:	Within 1 year the Secretary and the Administrator of the Environmental Protection Agency (Administrator) will publish the initial list of allowable projects. Within 1 year after project publication, the Secretary and Administrator will establish rules and methodologies governing these projects.	
Initial List of Forestry Projects:	Recorded in legislation, the Secretary shall include at minimum the following projects: ▪ Afforestation and reforestation of acres not forested as of January 1, 2009. ▪ Forest management and land use changes resulting in increased forest carbon stores. ▪ Conservation and improved management	

<table>
<tr><td></td><td>of grasslands.
Reduced deforestation or avoided conversation of land.
Urban tree-planting and maintenance.
Agroforestry
Adaptation of plant, practices or technologies that increase sequestration rates.
Petitions may be filed at any time to add projects to the list.</td><td></td></tr>
<tr><td>Specific Requirements of Forestry Projects:</td><td>All forestry projects must:
Adhere to standardized methodologies.
Pass performance standards for determining additionality.
Develop activity baselines.
Monitor and account for leakage.</td><td>Additionality
(see page 42)
Baseline
(see page 42)
Leakage
(see page 45)</td></tr>
<tr><td>Timeline of Forest Crediting Periods:</td><td>The crediting of forestry offset projects can not exceed 30 years. Project developers may petition for new crediting periods after their established crediting period ends.</td><td></td></tr>
<tr><td>Offset Project Approval:</td><td>USDA must approve or deny petitions for offset projects within 30 days of submission prior to verification report.</td><td></td></tr>
<tr><td>Registry:</td><td>Administer, in consultation with the Secretary, must set up a registry within 1 year of the enactment of the program.</td><td></td></tr>
<tr><td>Offset Project Verification:</td><td>Projects are required to be verified by third-parties and may include parties with USDA, EPA or the American National Standards Institute accreditation.

At minimum the contents of the verification report must include:<ol type="A">
the name and contact information for the offset project representative for the offset project;
the quantity of greenhouse gas emission reductions;
the methodologies applicable to the project;
a certification that the project meets the applicable requirements;
a certification establishing that the conflict of interest requirements have been complied with; and
any other information that the Secretary considers to be necessary to</td><td>Transaction Cost
(see page 55)</td></tr>
</table>

	achieve the purposes of this title.	
Audits:	As part of the Forestry Offset program you may be audited.	
Early Actors:	The federal offset program will allow credits to be given to given to projects of Early Actors if established through a program approved by the Administrator in consolation with the Secretary. Such programs must: ▪ Have developed standards, methodologies and protocols through public or peer reviewed process ▪ Projects which are measurable, additional, verifiable and enforceable. ▪ Projects which are verified by state regulatory agencies or third-parties. ▪ Projects registered in publicly accessible registry with individual serial numbers assigned for each ton of carbon dioxide equivalent emission reductions. ▪ Projects with crediting periods less than 10 years.	"Early Actors" are project developers who have established a project after January 1, 2009 but before the establishment of a federal offset regulation program.
Stackability:	The bill states that nothing will "preclude an offset project from meeting the requirements of this section . . . only because the relevant activity . . . receives an additional payment from another source for an ecological service other than emission reductions." This allows a landowner to earn payments for additional ecosystem benefits for the same forestry practice through other conservation programs.	**Stackability** (see page 59)

In addition to developing the framework for landowner participation in the offset market, the *Clean Energy Partnerships Act of 2009* creates a separate program – Title II, the **Carbon Conservation Program** – which provides landowners and grazing contract holders another opportunity to receive payments for practices which sequester carbon.

Box 10: SR 2729 –*Clean Energy Partnerships Act of 2009*– ***Title II: Carbon Conservation Program***	
Issue Area:	**Provision:**
Administrator of the Offset Program:	The Secretary of Agriculture and the Secretary of the Interior shall jointly administer this program. The Department of the Interior shall coordinate funds for grazing contracts on public lands The Secretary of Agriculture shall designate the Chief of the Forest Service to carry out all forestry-related components of the program.
Connection with the Offset Program:	Projects undertaken with these funds are not eligible for offset credits. However, projects which have expired contracts with these funds are eligible for offset credits.
Purpose of the Program:	➢ Reward the continuation of practices by early adopters of conservation practices such as no-till farming that provides carbon benefits. ➢ Ensure that individuals and entities that took action prior to the implementation of the offset program and do not qualify for early offset credits or can not pursue offset due to economy of scale or other issues can receive payments for carbon sequestration practices; ➢ Support the development of new methodologies for landowners to participate in offset projects. ➢ Improve management of privately owned lands that result in an increase in carbon sequestration. ➢ Avoid conversion of land that would otherwise result in carbon emissions. ➢ Support actions to adapt to climate change. ➢ Improve management on federal lands to increase sequestration of carbon.
Initial List of Allowed Practices:	▪ Conservation easements; ▪ Sequestration contracts (such as timber harvest or grazing contracts) with the Department of Agriculture or the Department of the Interior, as appropriate.
Conservation Easements:	Priority conservation easements given to those that sequester carbon and protect forested land or working forest land, or protect native prairie or native grassland, within the boundary of a working farm or ranch. At least 30% of all funds for the Carbon Conservation Program must be used on conservation easements.
Sequestration Contracts:	Sequestration contracts are 10 year commitments from farmers, ranchers and forest owners to perform projects which reduce greenhouse gas emissions or sequester carbon. Non forestry contract holders may withdraw from contracts without penalty after 5 years. In the early years, priority given to contracts with early adopters of greenhouse gas emissions reduction projects and contract that sequester the most carbon on a per acre basis.

Coordination with Current Government Activities or Programs:	All contracts under this program shall be coordinated with the activities and goals of various programs including: ▪ Conservation Reserve Program *(USDA)* ▪ Wetlands Reserve Program *(USDA)* ▪ Farm and Ranch Lands Protection Program *(USDA)* ▪ Grassland Reserve Program *(USDA)* ▪ State & private forestry programs of the Forest Service *(USDA)* ▪ Health forests Reserve Program *(USDA)* ▪ Programs funded through the Land and Water Conservation Fund Act of 1965 *(Interior)* ▪ Any applicable climate change adaptation program *(Interior)*

Quantifying the Greenhouse Gas Emission Reduction of Forestry Projects and Expectations of Landowners:

Current effort in greenhouse gas reduction determines that quantification of true offsets can be more difficult for forestry and agriculture industries then other sectors. Land greenhouse gas quantification is particularly difficult as carbon flows can not simply be measured like pollution expelling from a stack. Key measurements need to be accurate to ensure offset integrity and environmental measurements can be difficult to quantify. In particular, forest offset accounting must capture:

- ✓ the baseline greenhouse gas sequestration that would have occurred without the development of the project (what is happening in business-as-usual scenarios);
- ✓ the measurement, monitoring and verification (MMV) of the emission reductions produced by the project.
- ✓ any reversal or re-release of any carbon sequestered over time through harvesting, discontinuation of practices, or natural disturbance, and;

- ✓ any <u>leakage</u> of greenhouse gas emissions that may have occurred outside the boundaries of the project as a result of the project.[79]

Additionality and Baselines:
The test of "additionality" assess whether emission reductions resulting from an offset project would have happened otherwise under a 'business as usual' scenario. Because offset projects are used to compensate for the reductions in emissions that a regulated entity would otherwise had to make itself, "the reductions resulting from offset projects must be shown to be 'in addition to' reductions that would have occurred without the offset credits."[80]

In the *Clean Energy Partnerships Act of 2009*, additionality is determined by:

- Whether the reduction resulted from an activity that was not required by law or regulation (excluding contracts).
- Whether the reduction resulted from an activity not commenced prior to January 1, 2009, except for already implemented projects (known as 'early actors') commenced after January 1, 2001.
- Whether the reduction resulting from the activity which exceeds an activity baseline.

For forestry projects, additionality can be difficult to demonstrate. To determine additionality, a carbon baseline for the forest in question must be

[79] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005
[80] Ibid. 25x'25, 2009

established against the net change of carbon is measured. This allows the carbon emission reduction to be credited as it can be quantified, verified, and registered.[81]

Baselines:

The Stabenow bill refers to project baselines as being able to “reflect a conservative estimate of business-as-usual performance or practices for the relevant type of activity such that the baseline provides a science-based margin of safety to ensure the emission integrity of offsets calculated in reference to the baseline.”[82] Essentially, demonstrating additionality requires establishing a project baseline,[83] as the difference between the baseline and the actual emissions after the implementation of the offset project represents the amount of emission reduction which can be credited to the landowner.[84]

There is no general agreed methodology in domestic or international markets for the development of project baselines by activity and region, although numerous efforts are under way to design consistent protocols.[85] [86]

Stabenow’s offset program requires the Secretary to determine how best to establish these baselines as well as set a firm start date for baselines by

[81] Ibid. Robert Malmsheimer, et al., 2008.
[82] *Clean Energy Partnerships Act of 2009*. Introduced 2009, 111th Congress
[83] Ibid. EPA, “Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture”, 2005
[84] Ibid. 25x’25, 2009.
[85] Ibid. EPA, “Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture”, 2005
[86] Climate, Community & Biodiversity Alliance (CCBA) “Climate, Community & Biodiversity Project Design Standards (Draft 1.0).” (Washington DC, 2004) www.climate-standards.org (accessed March 5, 2010)

project type "for use in determining the extent to which greenhouse gas emission reductions achieved by an offset project of that type exceed a relevant activity baseline." [87] Baselines can be created at the project level (such as Stabenow's program) or sector level as seen in other programs.

As Stabenow's bill credits agency deference in developing the methodology for creating baselines to determine additionality, landowners may want to take a look at California's Climate Action Reserve for protocols as it represents the strictest requirements in forest offset protocols. Projects which comply under CAR will surely win approval under any federally established program.[88]

Leakage:

Leakage is defined as an increase in greenhouse gas emissions (usually) outside of the project's emissions boundary that occurs as a result of the projects implementation. For example, avoiding deforestation in one area may simply transfer deforestation to other areas, negating the value of the offset somewhat or entirely. Given this problem, planned rates of reduction might not materialize as they may be offset by increased emissions somewhere else. However, measuring leakage may be complicated as the effect is often outside boundary areas of the project and beyond the control of the landowner. Leakage may also be difficult to quantify or to connect to

[87] *Clean Energy Partnerships Act of 2009*. Introduced 2009, 111th Congress
[88] For CAR's new rules and protocols governing forestry offsets as well as a detailed look at landowner's responsibility for baseline determination please go to: http://www.climateactionreserve.org/how/protocols/adopted/forest/current/

particular impacts of individual offset projects.[89] Figure 9 provides estimates of how leakage will likely accompany efforts in afforestation and forest management.

Figure: 9 Leakage and MMV estimates from studies conducted by the Environmental Protection Agency[90]

Activity	Leakage Potential (and Estimates)	MMV Difficulty
Afforestation	Moderate U.S. average: 28% Regions: 18-42%[a]	Relatively easy to measure, monitor, and verify forest establishment. Measuring carbon is relatively straightforward for above-ground carbon, less so for below-ground carbon. Models can be used instead of direct measurement if program allows.
Forest management	Likely some leakage through reduced afforestation No separate estimates available	Moderate to difficult to measure, monitor, and verify specific management actions attributable to a project. Measuring carbon in established stands is not exceedingly difficult, but tying the change in carbon to specific practices may be.

Several types of leakage are possible:

- <u>Internal leakage</u> occurs when the project causes activities to shift within a forest operation. "For example, the carbon sequestration created in one portion of the ownership prompts the owner to carry out carbon emitting activities elsewhere." [91] To negate this, some programs require landowners to develop reporting on forestry and carbon sequestration activities for all pieces of their land, not just those areas involved in offset projects. Furthermore some programs require that

[89] Ibid. 25x'25, 2009
[90] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005, results from Murray, B.C., B.A. McCarl, and H. Lee (2004) "Estimating Leakage from Forest Carbon Sequestration Programs." Land Economics 80(1): 109-124.
[91] Ibid. Robert Malmsheimer, 2008

the project be certified as meeting the requirements of an internationally recognized sustainable forest management standard. [92]

- External leakage occurs when the offset project causes other owners to change their behavior decreasing carbon sequestration. For example, "a forest project that halts land clearing for agriculture in one place causes farmers needing land to move and clear another forest. Or project rules require a large forest owner not to harvest, reducing supplies of lumber and prompting producers elsewhere to respond by harvesting more timber." [93] To negate this some programs establish leakage (discount) rates that require a leakage factor to be.[94] [95]

Recent reports from the Environmental Protection Agency[96] have determined certain principles about the potential for leakage under a cap-and-trade program that utilizes an industry-wide offset program (offsets which include forestry, agriculture, renewable energy generation, biofuels, among others):

1. **Activities in afforestation, forest preservation, and avoided deforestation, could have significant to very large leakage problems.** Principally, forest economies involve multiple feedbacks between

[92] Ibid
[93] Ibid
[94] B Murray, B Mccarl and H Lee, "Estimating leakage for forest carbon sequestration programs" *Land Economics,* 2004 80(1): 109–124.
[95] Ibid. Robert Malmsheimer, et al., 2008
[96] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005

markets for land and resources, including timber. As such, if greenhouse gas incentives are directed at just one component of the forest production system— such as in land use or harvest timing— models predict it is more than likely that other parts of the system will be affected, often in ways that diminish the proposed net greenhouse mitigation.[97]

2. **Leakage from projects other than the forest sector appears to be minimal.** Results from studies suggest biofuels and agricultural activities may constitute 0-5 percent of all leakage. As a result, owners of forest carbon projects should expect most regulations which account for leakage to fall on their sector and activities. [98]

3. **Leakage varies by region for a given mitigation activity, reflecting differing levels of market response to forest sector products across regions.** [99]

Many forest carbon accounting principles and protocols were developed before forest carbon offsets were recognized as a financial tool. As such, antiquated forest carbon accounting often does not adequately address all aspects of using forests to reduce greenhouse gasses, including leakage. Emerging standards are being developed to replace the now patchwork of regulatory

[97] Ibid
[98] Ibid
[99] Ibid

protocols for leakage accounting.[100] Identifying this, carbon legislation, including the *Clean Energy Partnerships Act of 2009*, directs the Department of Agriculture to address this problem.

Permanence:
A forest project must also demonstrate permanence. Ensuring permanence can be difficult since some sequestered carbon might be released through natural events, such as wildfires and hurricanes.[101] Permanence, or the retention of sequestered carbon over time, is often addressed (such as in the Department of Energy's 1605(b) program) by requiring continuous reporting once an entity enters the reporting system. The assumption is that, as in any market scenario, losses as well as gains must be accounted for.[102]

A number of logistical factors may make such a complete accounting of greenhouse gas inventory over time difficult for individual forestry and agriculture projects. Solutions to permanence can either come from the registry, contractual restrictions or through the development of required insurance plans to cover any potential loss of project permanence.

For example, "Some registries require that any released carbon be included in the net change calculations so that credits previously issued can be paid back; no additional credits can then be issued until the net change in carbon

[100] Ibid. Robert Malmsheimer, et al., 2008
[101] Ibid.
[102] Ibid. Richard Birdsey, 2006

stocks is again positive."[103] While this type of requirement seems logical in reporting systems it is problematic as it only addresses carbon releases after they have already occurred. Another mechanism to deal with permanence is to require deed restrictions on land use or mandate the use of long-term permanent conservation easements for land in carbon activities. This may provide protection against human induced land use change although natural disturbances may still plague long term contracts for carbon sequestration.[104]

Measurement, Monitoring, and Verification (MMV)

To ensure that emission reductions have occurred, the amount of greenhouse gases mitigated by a project must be (1) measured; (2) monitored over time, and; (3) verified by external hired third-parties or governments. No set MMV system exists for all forestry carbon sequestration projects. Usually this process can involve a range of methods, including:

- Repeated measurement of **sample plots** using refined scientific procedures;
- Collection and analysis of **aerial photographic** and satellite image data;
- The use of **ecosystem process models** to simulate likely outcomes, especially when observation is difficult[105], and;
- The use of **look-up tables** as default estimates that represent average forest conditions by region, ownership class, forest type, and productivity class[106].

An example of the difficulty in measuring forest carbon is detecting changes in carbon sequestration within soil. The amount of carbon stored in soils is

[103] Ibid.
[104] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005
[105] Ibid
[106] Ibid. Richard Birdsey, 2006

very problematic to quantify due to its high degree of spatial variability and the fact that any change (increase in sequestration) may be incremental relative to the size of the existing soil carbon stock, making MMV difficult.

Fortunately, publications are being developed to help guide landowners through MMV challenges. For a detailed account of forest carbon MMV see Harnessing Farms and Forests in the Low-Carbon Economy; How to Create, Measure, and Verify Greenhouse Gas Offsets[107] as well as *A Critical Comparison and Virtual "Field Test" of Forest Management Carbon Offset Protocols*[108] from the Climate Change Policy Partnership at Duke University.

As described in **Transaction Costs** (page 55), the requirements of MMV should be taken into consideration before embarking on a project as they can substantially affect the cost of the project and its rate of return.[109]

Forest Service Forest Carbon Accounting

In 2002, the Departments of Energy and Agriculture were directed by the President to revise the system that reports and registers domestic greenhouse gas emissions reductions. The program later became known as

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[107] Excerpts from the book can be found at: http://nicholas.duke.edu/institute/ghgoffsetsguide/ghgexerpts.pdf

[108] The report, *A Critical Comparison and Virtual "Field Test" of Forest Management Carbon Offset Protocols* can be found at: http://nicholas.duke.edu/institute/ccppoffsets.pdf

[109] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005

the 1605(b) program, named after the section of the Energy Policy Act of 1992 which authorized its development.[110]

The Forest Service has developed a paper which provides a general introduction and guidelines for how the forestry sector should be accounted for in the 1605(b) program. (The paper can be found at: http://www.treesearch.fs.fed.us/pubs/15855.) As the Forest Service states:

> "Forestry activities with potential for achieving substantial reductions include, but are not limited to: afforestation, mine land reclamation, forest restoration, agroforestry, forest management, short-rotation biomass energy plantations, forest protection, wood production, and urban forestry. To be eligible for registration, the reported reductions must use methods and meet standards contained in the guidelines. Forestry presents some unique challenges and opportunities because of the diversity of activities, the variety of practices that can affect greenhouse gases, year-to-year variability in emissions and sequestration, the effects of activities on different forest carbon pools, and accounting for the effects of natural disturbance."[111]

The Forest Service describes two ways to calculate forest carbon storage:

(i) Summing the annual changes in carbon stocks, or;

(ii) Calculating the cumulative changes in carbon stocks from the base year to the reporting year.

[110] Ibid. Richard Birdsey, 2006
[111] Ibid

No matter which approach landowners use to determine changes in carbon stocks, both approaches require an annual estimate of the inventory of carbon stored within the boundaries of the project. Calculating this quantity of carbon requires two pieces of information:

(i) The area of forest land included in the project, and;

(ii) The amount of carbon per unit area.

To get an estimate of total carbon inventory, these quantities are multiplied.[112]

When determining the amount of carbon per unit area, forest owners must use certain estimation or measurement tools that meet a minimum threshold standard of accuracy and precision for reporting purposes. The Forest Service outlines three methods, along with their ratings, which can be used to satisfy 1605(b) requirements. An abridged description of these methods from Birdsey (2006)[113] is below.

(i) Look-up tables are 'default' estimates that represent average forest conditions by region, ownership class, forest type, and productivity class. Use of default tables

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[112] Ibid

[113] Ibid. Richard Birdsey, 2006

will generally be assigned a 'C' rating, although additional steps may be taken to elevate this method to a 'B.'[114]

(ii) Models—A variety of models are available for many different forest ecosystems and project activities. These may be considered more accurate than look-up tables. If the modeling guidelines are followed, this method will be assigned a 'B' rating, although additional steps may be taken to elevate this method to an 'A' rating.[115]

(iii) Measurement—The most accurate way to determine changes in carbon stocks is to directly measure stands with specific sampling procedures. Costs of measurement will be higher than using look-up tables or models, but this method will be assigned an 'A' rating if the technical guidelines are followed.[116]

It should be noted that some landowners have found it useful in some circumstances to effectively partition the land base to facilitate more efficient estimation. Landowners who partition are allowed the use of more than one estimation method as heterogeneous landscapes and multiple types of projects may facilitate the need for different ways measure carbon. This gives

[114] Ibid
[115] Ibid
[116] Ibid

landowners (or more likely hired forestry consultants) some flexibility which can reduce overall cost.[117]

Transaction Costs:

Transaction costs refer to the time, effort, and resources required to locate, initiate, negotiate and complete a deal.[118] Transaction costs (i.e. the costs of doing business) increase the costs of the project which in turn reduces the gains from any program implementation as well as the size of the market.[119] [120]

Estimating the quantity of carbon sequestered by a forest can be a complex and potentially expensive task, representing a significant part of the cost of reporting.[121] Recent studies suggest that transaction costs are a key challenge for private forest landowners in participating in carbon markets.[122]

Below is part of a list adopted from Milne (1999) which outlines the categories of cost landowners are likely to face:

- Design costs include the establishment of the project area, development of monitoring techniques, methods for baseline and project scenario measurements.

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117 Ibid

118 R Lile, Powell and M Toman, 'Implementing the Clean Development Mechanism: lessons form the U.S. private sector participation in Activities Implemented Jointly', Discussion Paper (Washington D.C. Resources for the Future, 1998).

119 D. J. Dudek and JB Wiener, 'Joint Implementation, Transaction costs, and climate change', (Paris, Organization for Economic Cooperation and Development, (96), 1996) pg.173.

120 Milne, M, Transaction Costs of Forest Carbon Projects Center for International Forestry Research (CIFOR, 1999).

121 Ibid. Richard Birdsey, 2006

122 Christopher Galik, Justin Baker and Joseph Grinnell, "Transaction Costs and Forest Management Carbon Offset Potential", Working Paper (Climate Change Policy Partnership, Duke University, 2009).

- Implementation costs incorporate hiring staff and consultants, site selection, development of required technical and management plans, legalizing leases/registration of land, distribution of planting material and other inputs.
- Verification and certification costs are required to verify to investors and regulatory bodies that the estimated levels of carbon have been sequestered and can be traded.

Depending on the framework of the offset program, the liability for these transaction costs may fall on the buyer of offsets (potentially aggregators or registries, see Appendix 1), the seller (landowners) of offset, or both parties.

If the seller is liable, an increase in their costs increases the amount they need to be compensated to voluntarily engage in the transaction. On the other hand, if the buyer is liable, "this lowers the amount they are willing to pay for a unit of mitigation, because the full cost of the unit includes the transaction cost." [123]

An important concept is that many of these transaction costs operate under the principle of 'economies of scale'. Experience in current offset markets illustrates that (1) many of these transaction costs are largely fixed and as

[123] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005

such therefore (2) the cost per transaction declines with the number of transactions covered.[124] [125]

For example, costs associated with measurement, monitoring, and verification will not be 10 times greater for projects generating 100,000 tons of CO_2e per year of mitigation than ones generating 10,000 tons of CO_2e per year. Moreover many current programs require a minimum amount of CO_2e per year mitigation to be traded on exchanges. This requires landowners to bundle (or *aggregate*, see page 38) their activities with others. The Chicago Climate Exchange, for example, requires a minimum trading block of 12,500 tons of CO_2e. If agricultural tillage practices generate 0.5 tons of CO_2e per acre per year, this will require bundling across 25,000 acres. "Therefore," as a principle, "large operations will be able to bundle more cost-effectively than small ones".[126]

The issue of fixed transaction costs is a critical component to the feasibility of these projects to forest landowners as a full 94% of America's family forests landowners hold less than 100 acres. It should be noted however, that the remaining 6% of family forests holders actually own roughly 47% of all forested land classified as family forests, leaving the potential as presented in

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[124] Ibid
[125] Mooney, S., J.M. Antle, S.M. Capalbo, and K. Paustian. 2004b. "Influence of Project Scale on the Costs of Measuring Soil C Sequestration." Environmental Management 33(supplement 1): S252-S263.
[126] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005

this document for substantial forest sector project development.[127] Nevertheless, efforts to efficiently aggregate sequestration activities or bring down transaction costs will be key considerations both the government and private operators as the program progresses.

Evidence of how these transaction costs affect implementation rates of forest and agricultural sequestration practices is quite limited. One study estimates costs of measuring forest carbon less than $0.25/ton carbon equivalent or $0.07/ton CO_2e.[128] However, costs will vary widely and may be dependant on such factors as the degree of precision required in the regulatory framework, heterogeneity of the landscape, frequency in which sampling is needed to fulfill measurement requirements as well as the size of the project.[129] [130] [131] Additionally, transactions costs, along with many other characteristics of the forest carbon process, will change widely if the practice is conducted for an offset or supplemental program.

Aggregators:

As stated previously, certain programs require projects to sequester a minimum amount of carbon before being allowed to trade on exchanges.

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[127] "Who Owns America's Forests?" United States Department of Agriculture, Northern Research Station, 2008.

[128] John Kadyszewski, Testimony before the Senate Agricultural Committee, March 29, 2001.

[129] Ibid. Mooney, Antle, Capalbo, and Paustian, 2004.

[130] Brown, S., O. Masera, and J. Sathaye (2000) "Project-Based Activities." In: Land Use, *Land Use Change, and Forestry*, R.T. Watson, I.R. Noble, B. Bolin, N.H. Ravindranath, D.J. Verardo, and D.J. Dokken (eds.), Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK. page 377.

[131] Ibid. EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture", 2005

Aggregators are used extensively in domestic voluntary markets. Because entities who buy or sell offset credits incur transaction costs, “they prefer to buy credits in large amounts. As a result, the [Chicago Climate Exchange][132] requires landowners to work through an aggregator if the project sequesters less than 12,500 mT per year. The aggregator pools credits from multiple landowners into a marketable package and trades the credits on behalf of the landowner, allowing exchange members to purchase large quantities of credits with low transaction costs.”[133]

“When a landowner enters into a contract with an aggregator, the landowner has given the aggregator the rights to the carbon sequestrated in exchange for payment. The aggregator chooses when to sell the credits to the market established by the CCX, and within 24 hours of the sale will receive payment from the CCX into the aggregator’s account. Then, at varying times throughout the year, depending on the aggregator, sales are totaled and payments are made to program enrollees (landowners). The payment allocation and disbursement system varies from aggregator to aggregator.”[134] “The Chicago Climate Exchange also takes an enrollment and trading fee of $0.20 per ton.”[135]

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[132] A list of CCX Aggregators can be found here: http://www.chicagoclimatex.com/content.jsf?id=64
[133] “A Landowners Guide to Carbon Sequestration Credits” Center for Integrated Natural Resources and Agricultural Management, University of Minnesota Department of Forest Resources.
[134] Ibid
[135] Ibid

Stacking and Bundling:
A longstanding issue with programs developed to provide financial incentives for carbon sequestration practices is the question of stackability, and the related question of bundling. These questions are even more prominent when considering payments for ecosystem services at larger. As many widely utilized government sponsored payment programs already exist to promote conservation and environmental health, can activities to promote carbon sequestration be combined with other programs?

For example, landowners may be receiving Conservation Reserve Program (CRP) payments to conserve land. Can those same landowners receive carbon offset credits for conserving the soil carbon in that same plot of land? If so the benefits are stackable. Stacking allows credits to be generated from a single acre using multiple market-based strategies. In stacking credits are sold separately into each market. For each credit type, the applicable market rules will apply.[136]

Bundling, on the other hand, allows a landowner to combine multiple values from a piece of property to be sold under a single credit type. For example, if a landowner restores an acre of riparian forest, it may result in improvements to more than one ecosystem service, including reduced stream temperature, improved wildlife habitat, sequestered carbon and mitigation of

[136] Nathaniel, C., Fox, J., Bayon, Ricardo. 2009 Conservation and biodiversity banking: a guide to setting up and running biodiversity credit trading systems.

potential flooding.[137] Can a landowner bundle all these services to be sold in available market from one plot of land improved by one project?

Essentially, the issues of stackability and bundling pose how holistically can markets move towards capturing the full suite of benefits produced from healthy, functioning landscapes, in contrast to current regulatory frameworks that approach such valuation in a piecemeal fashion.

Critically, the *Clean Energy Partnerships Act of 2009* states that nothing will "preclude an offset project from meeting the requirements of this section . . . only because the relevant activity . . . receives an additional payment from another source for an ecological service other than emission reductions." Essentially, this allows a landowner to earn payments for additional ecosystem benefits for the same forestry practice through other conservation programs, permitting stackability and potentially, if the markets exist, bundling.

One of the reason policymakers support stackable incentives is that it offers landowners opportunities to (1) reduce start up costs for entering into carbon sequestration projects (Box 11) as well as (2) increase the economic viability of these projects for small landowners by allowing them to "stack" their lands profitability with other programs (Box 12).

[137] Ibid

Box 11: Programs which, if "Stacked" with Carbon Sequestration Projects, May Provide Opportunities in Cost Reduction [138]

Cost Reducing Opportunities	Percent of Costs Covered	Landowner Involvement	Practices Covered	Other
Environmental Quality Incentives Program (EQIP) – Critical Area Planting	50% of up to: Earthwork: $1000/acre Fertilizer: $35/acre Veg Cover: $260/acre Weed Control: $10/acre	» Installment of Practices » Perform upland treatment actions, and adequately address potential adverse impacts to conservation	» Permanent Vegetative Cover - Mixed Native Grasses	» One time payment of $40/acre » Up to 10 acres may be enrolled » Must be on lands that would have been planted as row crops
EQIP - Residue Management	100% of up to $30/acre	» Installment of Practices » Perform upland treatment actions, and adequately address potential adverse impacts to conservation	» Low till farming » No till farming	» Annual payment of $30/acre/yr for up to three years » Up to 250 acres can be enrolled
EQIP – Forest Site Preparation	50% of costs up to $130/acre	» Installment of Practices » Perform upland treatment actions, and adequately address potential adverse impacts to conservation practices	» Clearing of previous vegetations to allow for the installation of new forests	» Regeneration will be accomplished according to a detailed forest management plan. » Regeneration practices shall be done in accordance with procedures and guidelines contained in Forest Site Preparation » Forest Site Preparation should be used in conjunction with Tree and Shrub Establishment for seedlings and planting.
EQIP – Tree/Shrub Establishment	50% of up to: Tree Planting, Conifers: $270/acre Hardwoods: $310/acre Veg Cover: $350/acre Site Prep: $110/acre	» Installment of Practices » Perform upland treatment actions, and adequately address potential adverse impacts to conservation	» Tree Plantings: Conifers and Hardwoods » Site Preparation, seed, stock, planting and necessary tending	» Covers between 400-800 trees per/acre » Weed Control where required will be accomplished within 24 months from planting. » At this time, the only authorized repellants are Deer Away Big Game Repellent Powder and Plantskydd Deer Repellent.
EQIP – Restoration and Management of Declining Habitats	50% of up to: Tree Planting, Conifers: $270/acre Hardwoods: $310/acre Veg Cover: $350/acre Site Prep: $110/acre	» Installment of Practices » Perform upland treatment actions, and adequately address potential adverse impacts to conservation	» Tree Plantings: Conifers and Hardwoods » Permanent vegetative cover, native ecosystem mix	» A detailed plan is required, in accordance with the specifications outlined in the NRCS practice standard.
Continuous CRP Cost-Share Assistance	Up to 50%	» Establishment of approved cover on eligible cropland	» Establishing perennial vegetations on previously cropped land	» Land must have been cropped four out of the previous six years
Erosion, Sediment Control & Water Quality Cost Share Program www.maswcd.org	Up to 75% for high priority practices Up to 50% for secondary	» Installment of permanent, non-production practices designed to protect and improve soil and water quality	» Critical area stabilization » Field Windbreaks » Strip Cropping » Terraces	» Contact your local Soil and Water Conservation District for further information

138 "A Landowners Guide to Carbon Sequestration Credits" Center for Integrated Natural Resources and Agricultural Management, University of Minnesota Department of Forest Resources.

Box 12:	Programs which, if "Stacked" with Carbon Sequestration Projects, May Provide Opportunities in Cost Reduction [139]			
Government Payments	**Payment Forms**	**Landowner Involvement**	**Practices Covered**	**Other**
Sustainable Forest Initiative Act (SFIA) » http://cfc.cfans.umn.edu/nryb/nrr/SFIA_NRR.pdf	» Annual payment based on Market vs. Current Use Values » Minimum payments of \$1.50/acre, often around \$5.00/acre	» Must have a forest management plan by an approved plan writer and record a 8 year covenant restricting the woodland from being developed.	» Dedication of land to sustainable forest management	» Annual incentive payments are treated as taxable income to the property owner, not a rebate on property taxes.
Conservation Reserve Program (CRP)	» Payments are based upon the productivity of the land in traditional farming methods	» Installment of practices » Must provide contracts when applying for Carbon Credits	» Conversion of specified, usually highly erodible, land into conservation practices such as perennial grasses or trees	» As part of his ethanol push, President Bush has proposed that no new General CRP contracts be awarded during 2007 & 2008. However, Continuous CRP and CREP are still being accepted and the practices allowed dovetail well with carbon sequestration programs
Forest Legacy Program (FLP) » Permanent Conservation Easement » www.dnr.state.mn.us/forestry/index.html	» One time payment equal to the difference in market value of property before and after easement restrictions are set in place.	» Prepare a multiple resource management plan as part of the conservation easement acquisition.	» Dedication to sustainable forest management	» Landowners surrender development rights to the property in exchange for a one time payment » The federal government may fund up to 75% of project costs, with at least 25% coming from private, State or local sources. » Land must be located within one of seven "legacy areas."

[139] Ibid

Conclusions and Recommendations:

This masters project highlights a portion of the large body of knowledge which landowners must develop in order for them to internalize all the costs and benefits associated with generating admissible carbon sequestration on their lands. While guidance provided by consultants, financers and aggregators will be of extreme importance in implementing projects, their services may come at a price or be in piecemeal fashion. It is the responsibility of the government to educate landowners about these new opportunities, and, in-point-of-fact, the *Clean Energy Partnerships Act of 2009* requires the Secretary of Agriculture to provide such technical assistance to landowners.[140]

This masters project serves to underscore the types of issues institutions which regularly interact with forest landowners (such as the U.S. Forest Service and the American Forest Foundation (AFF)) need to communicate to begin the education process. Informal interviews illustrate that the best way to begin the process of education is to target landowners already familiar with government programs and management plans.

Together the Forest Service's Forest Stewardship Management plan and AFF's Tree Farm Management plan account for the vast majority of basic forest management plans throughout the country. A primary purpose of these

[140] Section 103(c)(4) of the *Clean Energy Partnerships Act of 2009* requires Secretary of Agriculture to "the make available technical assistance to landowners undertaking activities in preparation for the sale of carbon credits derived from activities on the land of the landowners, including work and opportunities with aggregators and third-party verifiers pursuant to section 107;"

plans is to "development of comprehensive, multi-resource management plans that provide landowners with the information they need to manage their forests for a variety of products and services." Any landowner desiring involvement in current federal cost-sharing or other financial incentive plans (as exhibited in Boxes 11 and 12) need either a Forest Stewardship or Tree Farm plan. As the development of any carbon sequestration project on private land will also likely require a type of management plan, management plan seem an inherently logical place to being communication.

This masters project can be used to develop a 2-page summary of recommendations to landowners as they consider the type of management which best utilizes their resources and services their end goals. The summary should provide recommendations which abide to 6 core principles[141] of forest carbon sequestration as its inclusion within the boarder goals of private forest management.

Box 13: **Principles of Carbon Sequestration Management**
1. Good forest management increases carbon storage. Any summary should begin by providing a simple description that essentially carbon is wood, and that more wood within the project site over a period of time, properly accounted for, is the basis for financial rewards within a federal offset program.
2. A strong forest inventory can be your biggest asset.

[141] These principles and recommendations have been developed from an extensive literature review as well as informal interviews. However such recommendations do not necessarily reflect the opinions of the participants involved, including Bob Simpson, American Forest Foundation; Al Todd and Amanda Cundiff, Office of Ecosystem Service Markets, Forest Service, USDA; Karl Dalla Rosa, Cooperative Forest, Forest Service, USDA; Mike Burns, Empire State Forest Products Association; Neil Simpson, The Simpson Group; Mike Gaudern, MRG Consulting, and; Chris Gallek, Climate Change Policy Partnership, Duke University.

No matter the final framework for an offset program within a federal cap-and-trade scheme, the development of a strong forest baseline may be the most important step and biggest asset in implementing a carbon sequestration project. Fundamentally, offsets will need to verify that they are sequestering carbon above a business-as-usual baseline. To do this, landowners must provide a robust measurement of their current sequestration efforts.

3. Multi-use management is still important.

   Carbon sequestration projects should not be viewed as the silver bullet in stemming America's forest loss.[142] [143] The program however has benefits in providing a supplemental funding stream to American's forest landowners. Landowners should look at their forests holistically and plan their forest resources using a variety of environmental health incentive programs which can maximize their efforts.

4. Aggregation will be key.

   When planning for forest carbon sequestration projects within an established carbon trading scheme or OTC, American private landowners must recognize that aggregation of their carbon savings with other landowners may be necessary. Family forest owners are primarily small forest holders. Approximately 94% of forest landowners own holdings of 100 acres or smaller. As such aggregation must be a part of landowner's planning process in determining the profitability these practices.

5. Always look for ways to decrease transaction cost.

   As stated, transactions costs for forest carbon sequestration practices are typically fixed and subject to economies of scale. Landowners, state and consultant foresters, aggregators and the government must look for ways to decrease transaction cost to 1) allow for greater participation and 2) create a stronger market. For example, landowners in developing baselines should hire consulting foresters when timber prices are low and a foresters business is slow. Additionally, coordination between landowners within a region can pool a better price for consultants.

6. Practices and programs should always adhere to certain principles.

   No matter the type of practice you decide to implement or the type of program your offset will be considered in, landowners should produce offsets which adhere to certain general principles. Those principles include reductions in carbon that have been **measured** using determined techniques; are **additional** to a robust **baseline**; have been **verified** by a third party, and; has been utilized in a recognized, **established** trading platform. If these principles are met inclusion within a federal program is greatly improved.

[142] Ibid. 1997 National Resources Inventory, 2000.

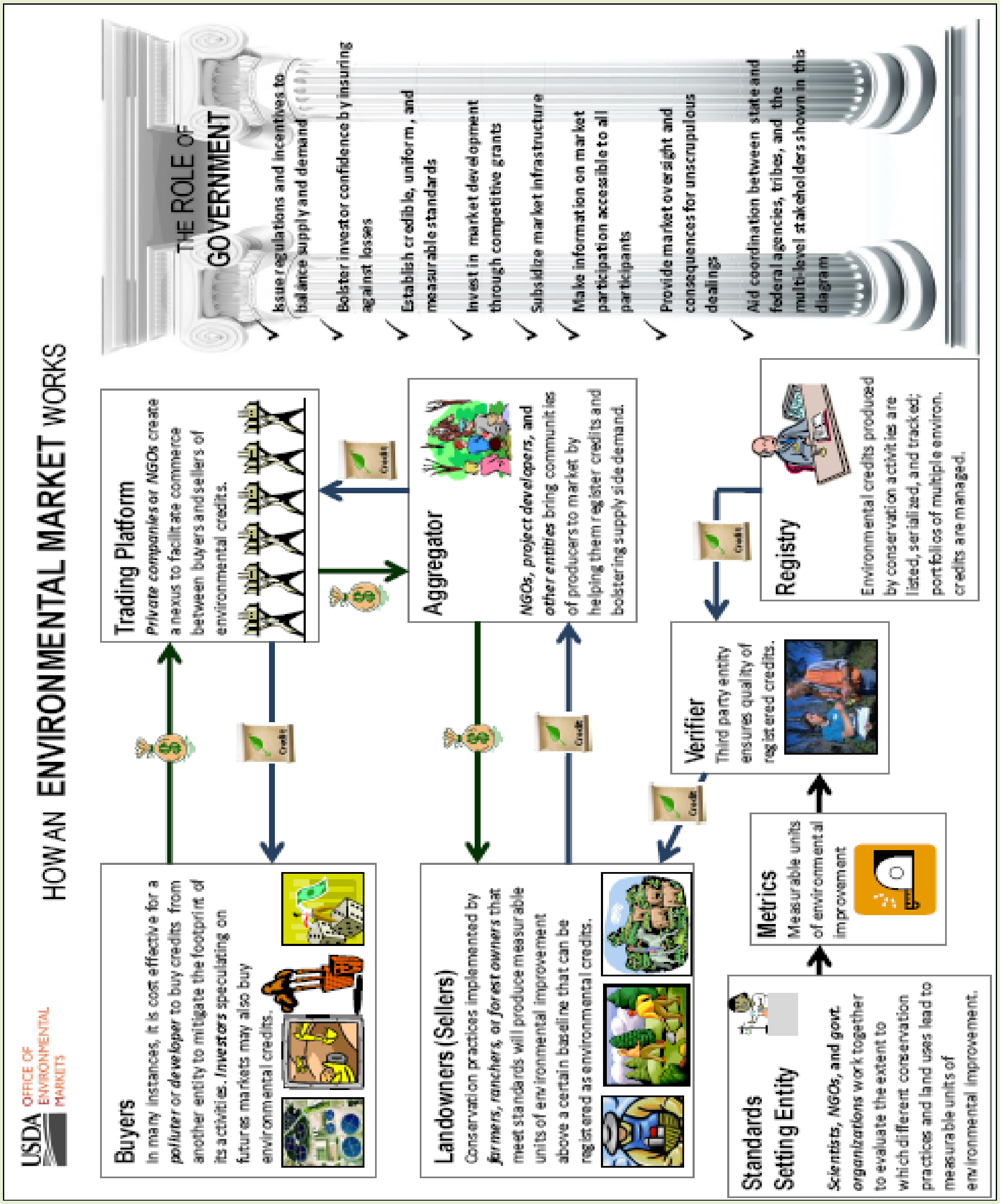
[143] The Pacific Forest Trust reports that one-third of U.S. forests have been lost since our nation's found. Today, 4,000 acres a day are bulldozed for new development.

Furthermore, there are a variety of vehicles which can disseminate this summary document interested parties. Box 14 outlines recommendations as best to reach landowners.

Box 14: **Techniques for Summary Dissemination**
1. Circulate on websites and newsletter. The American Forest Foundation and USDA can easily reach a large audience by simply uploading the summary document to their websites, making it searchable, as well as publishing it within their newsletters.
2. Mail or Email the Forest Stewardship and Farm Tree participants as well as consulting and state foresters. The Forest Service alone has produced more than 270,000 multi-resource management plans from 1991 to 2006.[144] If contact information for these landowners is available, the summary document could be sent to landowners over mail or email. Similarly, AFF could reach out to landowners directly about the opportunities of carbon sequestration projects.
3. Update publications. A variety of publications from USDA, State forestry agencies, AFF and other groups which discuss forest management plans and opportunities could be updated to consider the potential offset market. Two publications for consideration include; *A Stewardship Handbook for Family Forest Ownership* by the National Association of State Foresters, and *My Healthy Woods*, by the Aldo Leopold Foundation and the American Forest Foundation.
4. Update management plans. A key mechanism in educating landowners about how they might manage for carbon would be to incorporate carbon into any new management plan. Both AFF and the Forest Service could require landowners to read this two page summary of forestry and carbon, have them sign and date it as part of their contractual management plan. This would also be useful as it would target dissemination efforts towards landowners most likely to get involvement in a government land program.
5. Use in new national management plan templates. The Forest Service is currently working to develop a national template for forest management plans. Plans from AFF, the Forest Service and the Natural Resource Conservation Science (NRCS – another USDA department) are all different but can, in most cases, be used interchangeably. The Forest Service is undergoing efforts to make one plan applicable to all three organizations, programs and their landowners. This two page summary could be folded into this new uniform management plan.

[144] "Forest Stewardship Program" USDA Forest Service, <http://www.fs.fed.us/spf/coop/programs/loa/fsp.shtml> (accessed April 4, 2010)

Appendix 1: How an Ecosystem Service Market Works[145]



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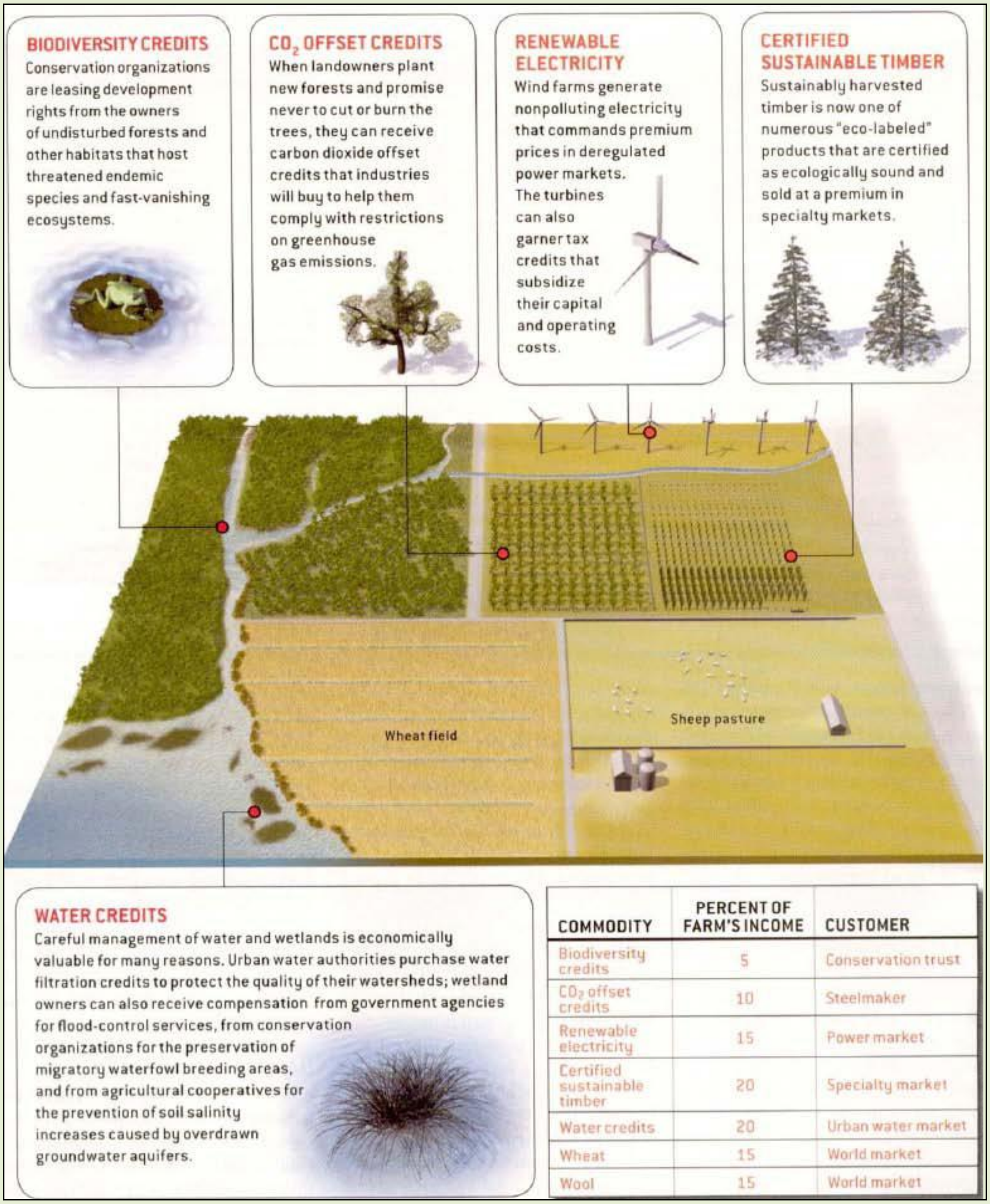
[145] Developed by Ryan Atwell, USDA Office of Environmental Markets, ryan.atwell@osec.usda.gov

Appendix 2: A Farm of the Future[146]: According to some reports, ecosystem services, previously accounted has free commodities, could generate perhaps half the income of a farm if diverse markets are developed. Below illustrates a portfolio of services which a single farm can offer customers.



COMMODITY	PERCENT OF FARM'S INCOME	CUSTOMER
Biodiversity credits	5	Conservation trust
CO_2 offset credits	10	Steelmaker
Renewable electricity	15	Power market
Certified sustainable timber	20	Specialty market
Water credits	20	Urban water market
Wheat	15	World market
Wool	15	World market

[146] As Illustrated by W Wyat Gibbs, "How Should We Set Priorities" Scientific America, September 2005. page 113.