ISSUE 8

forest WISDOM

newsletter number eight of the forest guild / december 2007

Climate Change and Forests

In this issue of Forest Wisdom we explore the challenges and opportunities climate change poses to forest managers and how it is reshaping society's expectations of forests.

in this issue:

PARADIGM SHIFT - AGAIN

Forest Stewardship in a Changing World

By Fred Clark

For many foresters practicing today an old paradigm may be dying. We have believed that, while the conditions of the forests we care for may be more or less altered by direct human activities ranging from careful stewardship to shameless exploitation, the response of species and the forests we manage are knowable, predictable, and somewhat constant. Many of us have believed that through the application of our best efforts we could restore forests to, if not exactly an equilibrium, at least to a managed, somewhat stable state that with reasonable inputs and maybe a few bumps along the road would provide a steady stream of benefits for its owners and society.

Today, however, most of the universe of people who care about forest ecosystems are in agreement that the only consistent and predictable attribute we should be expecting from our forests (and our environments overall) for the foreseeable future, like possibly the rest of our lives, will be change, and sometimes it will be profound and rapid change.

So while the newly developing and evolving world of carbon forestry has led to a great deal of interest in capturing new revenue streams from emerging carbon markets, many foresters are also soberly assessing the realities that, despite the unquestionably positive potential of the world's forests to mitigate climate change, our forests are already being profoundly affected by a whole suite of stresses and disturbances that are themselves being triggered or exacerbated by a changing climate.

Changing World, continued on page 3

forest **WISDOM**

forest guild / december 2007
newsletter number eight

forest **GUILD**
P.O. Box 519
Santa Fe, NM 87504
505-983-8992
505-986-0798 F
www.forestguild.org

forest **GUILD**

Dear Forest Guild Members and Friends,

The debate about the reality of climate change is over and an unprecedented critical mass is growing around finding strategies to combat it. Modification of our behavior to reduce greenhouse gas emissions is paramount as is adoption and implementation of strategies to reduce their rate of increase in the atmosphere. Society is recognizing and debating the role for forests as part of this mitigation effort.

The prospect for policies increasing forest carbon storage to help combat climate change presents challenges and opportunities. On one hand, policies could inadvertently focus on maximizing carbon sequestration and institutionalizing damaging forest management practices at the expense of other forest values. On the other hand, they can create incentives for excellent forestry and preventing forestland conversion. The outcome will be influenced by how advocates for excellent forestry engage in the dialogue and contribute our collective expertise.

Accordingly, this edition of Forest Wisdom explores the challenges and opportunities climate change poses to forest managers and how climate change is reshaping society's expectations of forests.

The cover story, "Forest Stewardship in a Changing World," describes strategies to increase carbon storage in forests, namely forest conservation to maintain stored carbon in place, and sequestering carbon through excellent forestry so other values are not sacrificed. This article also discusses the uncertainty of how a changing climate will affect forests and suggests strategies for foresters to consider in response.

To provide a regional breakdown of past and potential future gains and losses in U.S. forest carbon stores, we've reprinted "Recent Trends in U.S. Private Forest Carbon" (courtesy of the Pacific Forest Trust), which also explores how forest conservation, reforestation, and excellent forestry could be employed to assure future gains. We've also summarized through "Carbon Policy – A State of Flux" the state and regional carbon registries and cap and trade systems that have been created in the absence of federal leadership on this issue (a void that recently has begun to be filled).

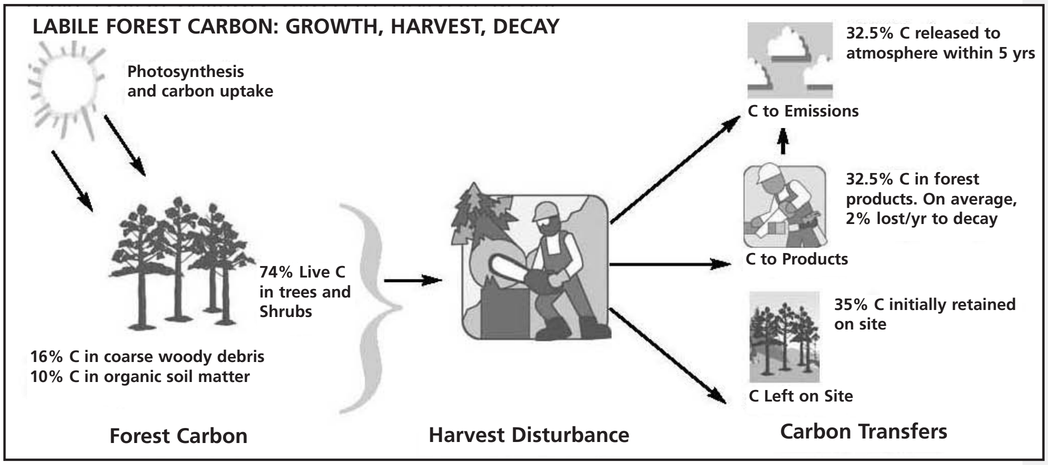
Foresters will become an essential link in making carbon markets work. In "Carbon Markets – A New World and New Responsibility for Foresters," we explore the niches foresters are beginning to fill in measuring and quantifying forest carbon stocks, monitoring and modeling changes in these stocks, and calculating and reporting net carbon sequestered and emitted for the various carbon trading registries.

Although climate change's predicted impacts are dire, they may also provide opportunities. "American Chestnut – The Return of an American Legacy" describes the efforts to restore this once dominant and widespread king of the eastern forests, and how these efforts may become even more significant in the face of climate change and the stresses to forests that are predicted to follow.

This issue's concluding article, "Guild Tackles Climate Change" summarizes how the Forest Guild is engaging in this issue, which is consistent with one of our strategic goals: to identify and promote policies and practices related to climate change that facilitate and support excellent forestry. As always, your participation and suggestions are encouraged as we align Forest Guild programs to help society determine the role of forests in mitigating climate change while also ensuring the best possible outcome for our forests.

Yours in Service,

Howard Gross
Executive Director



Sources: Harmon et. 1996 c; Turner et al. 1995 a and b.

When forests are disturbed by harvest, 32.5% of the carbon is released to the atmosphere within 5 years. This increases to 62.5% over time as the majority of the 35% of carbon initially retained on site (in stumps, roots, and coarse woody debris) is released through decay. 32.5% of carbon is transferred to the forest products pool, where 2% of this carbon is released per year through decay.
Reprinted by permission of the Pacific Forest Trust 2007.

Managing Forests to Mitigate Climate Change – a 10% Solution with Multiple Benefits

It is estimated that at least 20% of greenhouse gas (GHG) emissions accrue from land use change and the forest sector worldwide. In the developing world land conversion and deforestation comprise roughly 40% of total GHG sources. In the United States, more positively, forests are estimated to sequester over 200 million metric tons of carbon each year, offsetting about 10% of annual U.S. emissions from fossil fuels. From a regional perspective, the areas where the Forest Guild is most active not surprisingly tend to have the greatest current and potential impact on GHG reduction. In the densely populated but heavily forested Northeastern U.S., forests are estimated to offset as much as 20% of the region's annual carbon emissions.

While there are many reasons to remain cautious and discerning as we navigate the new paradigms developing around "carbon forestry," it seems clear that forests have a significant role to play in mitigating the effects of GHGs. An important role for the Forest Guild will be to help ensure that to the extent regulatory and market forces are used to influence forest management in offsetting GHG emissions, that such programs are credible, effective, and do not compromise other important values or public benefits from forests.

So as foresters, what strategies can we use to both increase carbon storage in forests and help prepare forests for climate change? And how does the Forest Guild as an organization, and how do we as Guild members, frame these new understandings in the context of our Mission and Principles?

Conservation of existing carbon stores in forests is one of the most effective and simplest ways to avoid carbon emissions and reduce atmospheric CO_2. Luckily (unlike much of the rest of the carbon issue) this principle can be simply explained to a stranger in an elevator – it is the time-honored notion of keeping forests in forests. Deforestation and conversion of forests to non-forest uses – whether for housing developments or palm oil plantations – releases large pulses of stored carbon into the atmosphere.

From a policy viewpoint, the principle of forest conservation yields strategies that are already well-known to foresters. Encouraging landowners to explore conservation easements and other land protection strategies, and facilitating their continued realization of personal and economic benefits to keep forest ownership an attractive investment alternative will be key practices. Likewise supporting the work of land trusts and community-based forest acquisition projects that protect working lands, natural areas, and even parklands will help maintain the fabric of forestland within a community.

Forest Guild Principle #1 states "The well-being of human society is dependent on responsible forest management that places the highest priority on the maintenance and enhancement

Changing World, continued on page 4

OBSERVING
LOCAL CHANGES

Minnesota -
Fall Colors Appearing Early

Autumn color has appeared weeks earlier than usual this year, as the continuing drought has stressed trees and other plants in area forests. Many trees, especially birch and red maple, have already marked the end of their growing season with the changing of their leaves.

excerpted from the
Timberjay News
Ely, MN.
September 7, 2007
By Marshall Helmberger

Changing World, continued from page 3

of the entire forest ecosystem." Foresters can be part of a growing social effort to maintain forestlands for a wide variety of uses with carbon offsets being just one benefit.

Sequestering additional carbon through sustainable forest management is a more complex strategy that will increasingly claim the attention and professional skills of the forester.

A simple example of this principle occurs through afforestation of open lands, and this practice has been the easiest to measure, understand, and adopt. Since most carbon registries value the rate of cumulative carbon sequestration – a function of growth rates – many current carbon programs face the pitfall of rewarding planting of fast-growing monocultures at the expense of other values that might be better met through more site-adapted and diversified restoration practices. A Guild policy goal is to promote standards for planting that reflect broader criteria and that will result in more diverse benefits, including carbon benefits, for a longer period.

Until recently, forest management practices that increase the rate of biomass accumulation (and carbon sequestration) in existing forests have been mostly neglected in market-based carbon trading programs because of the challenges of accounting for and documenting the benefits. The major carbon registries are beginning to address this issue.

One complication is that, despite their overall benefits, even well-managed forests become net carbon sources (net emitters) at various stages of their development. Following harvest the accumulation of stand biomass is temporarily reduced, and relatively large volumes of stored carbon are released in the form of decomposing logging slash and later by wood waste released throughout the wood manufacturing process. Add to this the fossil-based energy consumed during the harvest operation and wood transport (including all those marking and inspection trips to the woods by foresters in their Prius's), and it is easy to see that, even with a portion of the harvest volume sequestered in wood products of varying life cycles, harvest timing and frequency have a significant influence on the carbon balance of a managed forest.

Silviculture that increases growing stocks and total standing volumes, while minimizing disturbances to those needed to maintain natural processes, will provide the greatest benefits in sequestering carbon. Minimizing disturbances also means attempting to foresee and protect forests from catastrophic threats such as insect outbreaks or stand replacing fires that can rapidly release stored carbon – negating the gains made by good stewardship.

These principles are consistent with our Principle #2 – which encourages us to apply "responsible forest management (that) imitates nature's dynamic processes and minimizes impacts when harvesting trees and other products." One novel twist in our new paradigm however is that nature's "dynamic processes" are becoming more dynamic, and unpredictable, and in some cases they may threaten to exceed the ability of our forests to absorb them. The degree to which many of the processes affecting our forests are any longer considered natural may also become an increasingly rhetorical question.

Managing Forests in Response to Climate Change

While we've added a Manhattan Project-sized objective, sequestering carbon, to the already long list of deliverables expected of our forests, the job has become more complicated due to the uncertainty of how forests will actually respond to the many variables associated with a changing climate. Climate models and ecologists seem to agree however that a warming climate is likely to increase the occurrence and severity of forest disturbances, including wind, floods, droughts, insects, pathogens, and fires.

The end of the 21st century is predicted to see average temperatures increasing by between 3.6° and 11.9° F. Under these conditions it may no longer be sufficient or as useful for us to look to the past to deduce future patterns or processes in a changing landscape. In this version of the future we are not only likely to see direct impacts on species, but modeling suggests that the entire assemblages of species we call

Changing World, continued on page 13

Harvest operations *only partially capture and store forest carbon. By some working estimates, as much as 65% of forest biomass is lost during the logging and manufacturing process. The remainder that is finally captured in wood products is subject to a decay rate of 2%.*

Conversion of forests to non-forest uses is a significant source of net carbon emissions.

CARBON POLICY – *A State of Flux*

adapted from *Climate Change, Carbon, and the Forests of the Northeast* (in progress)
by Robert Perschel, Alexander M. Evans, Marcia J. Summers

The regulatory framework for carbon in the U.S. is in a state of flux. In the absence of a comprehensive national policy, a number of state and regional carbon or greenhouse gas (GHG) registries and cap and trade systems have been created. The registries facilitate reporting of projects that can sequester carbon or defer emissions, but do not in and of themselves create a market for the carbon offsets. Markets are created when limits (or caps) are placed on GHG emissions and emitters seek carbon sequestration or conservation projects to offset any emissions over the cap. Under a cap and trade system, trading exchanges facilitate the sale and purchase of emissions rights. The following is a brief summary of major carbon policy initiatives in the U.S. as of October 2007.

California Climate Action Registry

In 2001, the state of California created the California Climate Action Registry, a non-profit voluntary registry to establish GHG emissions baselines against which any future GHG emission reduction requirements may be applied. The Registry was mandated to thoroughly examine complex protocols and allow businesses and organizations that complied to bank sequestration for potential regulatory markets. California passed two landmark laws to reduce emissions of carbon dioxide and other pollutants and established the first carbon cap and trade system in the U.S. Through the California Global Warming Solutions Act (AB 32), California became the first state in the country to limit statewide global warming pollution. AB 32 requires the state to develop market mechanisms and regulations that will reduce California's GHG emissions by 25% by 2020. California law SB 812 required the California Climate Action Registry to develop protocols that would encourage carbon sequestration by creating an incentive for landowners to implement forest conservation, conservation-based management, and reforestation projects.

On October 25, 2007 the California Air Resources Board adopted forestry protocols for measuring the amount of carbon stored in a forest. These protocols will enable qualified forestry projects in California to be utilized to reduce GHG emissions. According to the board's staff report, criteria that are embedded within the protocols should maintain carbon benefits without losing ecosystem and other benefits. The California forestry protocols for projects and accounting procedures are groundbreaking and will likely serve as models for other states and regions.

A State of Flux, continued on page 12

GHG Fact

State actions can have a significant impact on emissions because many individual states have high GHG emission levels. For example, Texas emits more GHGs than France and California's emissions exceed those of Brazil.

Source: ***"Learning From State Actions on Climate Change"*** *March 2007 update. Pew Center on Global Climate Change*

Mature forests store large amounts of carbon while generally balancing sequestration and emission.

Technical Sources for Measuring and Modeling Forest-based Carbon

Carbon Trading: A Primer for Forest Landowners
http://www.carbon.sref.info/

US Forest Service - COLE: Carbon On Line Estimator
http://ncasi.uml.edu/COLE/

California Climate Action Registry - Forestry Protocols
http://www.climateregistry.org/PROTOCOLS/FP/

Technical Guidelines for Voluntary Reporting of Greenhouse Gas Program - Part I appendix: Forestry. U.S. Department of Energy
http://www.pi.energy.gov/enhancingGHGregistry/index.html

The USFS Model Forest Vegetation Simulator
http://www.fs.fed.us/fmsc/

USDA Forest Service - Northern Research Center Climate Change Tree Atlas
http://www.nrs.fs.fed.us/atlas/

CARBON MARKETS – *A New World and New Responsibility for Foresters*

It appears that carbon trading is here to stay, and foresters will become an essential link in the chain of professionals who make it work. One role for foresters is working on behalf of organizations involved in carbon trading as "verifiers" – usually independent third parties (often sub-contractors) who are hired to evaluate claims for carbon offsets made by carbon trading program participants. Forest professionals involved either in helping their existing clients participate in carbon offset programs, or serving organizations managing such programs, will need to educate themselves in a mix of basic science, economics, and the rules of the new game of carbon trading.

Specifically, foresters will need to understand the theory and practice of:

- Measuring and quantifying biological carbon stocks in forests.

- Monitoring and modeling changes in carbon stocks, both as a result of "business as usual," and as a result of anticipated management regimes or changes.

- Calculating and reporting net carbon sequestered and emitted within subject properties, using the rules and methodologies approved by various carbon trading registries.

Measuring and quantifying carbon begins with understanding the various "pools" within which carbon exists in a forest. Forest carbon pools include: living biomass – both above ground and below ground; dead biomass – including standing snags, downed wood, the forest litter and duff layers, soil-based carbon, and finally "off-site biomass" or the carbon captured and moved off-site in wood products. In practice, no current carbon programs require measurement of all of these pools, but most programs limit required measurements to aboveground biomass and where necessary rely on modeling or allometric equations to estimate the carbon stored below ground. Many registries rely on the use of look-up tables to estimate stored or sequestered carbon values based on variables as simple as forest type and age; however concerns over the potential inaccuracy and limitations of this approach are significant. Allometric models will be used for inferring total biomass from tree diameter and height measurements, and correlating those to carbon. Regardless of the measurement method used, carbon accounting involves estimation of forest biomass and its subsequent conversion to carbon stored.

Field practice for carbon measurements will largely be dictated by the requirements of the trading program in which the ownership is participating. The California Climate Action Registry, for example, requires what are probably the most rigorous inventory protocols. Participating entities need to develop dedicated inventory methods that well exceed the information collected in standard forest reconnaissance. By contrast, the still-developing Michigan Working Forest Carbon Offset Program will rely on program verifiers importing traditional forest cruise data into a carbon model specially adapted by the program partners.

Regardless of the offset program and its specific requirements, professionals involved at any level will need to understand the basic principles of carbon measurements. (See sidebar for additional technical resources on carbon measurements.)

Carbon Markets, continued on page 14

An exotic fungus, Cryphonectria parasitica swept through the Eastern U.S. killing an estimated 3.5 billion trees between 1904 and 1960.

AMERICAN CHESTNUT –

The Return of an American Legacy

by Leila Pinchot

Just eighty years ago, fall would have been a time of abundance for both wildlife and for humans. Chestnuts would litter the forest floor all along the Eastern United States. Had I lived in the rural Appalachians during that time, I would gather chestnuts with my family by the wagon-full. We would eat them fresh, boiled, roasted, partially dried, and even grind the chestnuts to make flour for baking. We would send out our hogs and turkeys into the forest to fatten on the nutritious nuts and we would sell the chestnuts to our local general store in exchange for cash or store credit. In fact, the money made from selling chestnuts might be the only source of income available to our family. This bucolic way of life, however, came to an end when an exotic fungus, *Cryphonectria parasitica*, swept through the Eastern U.S. killing an estimated 3.5 billion chestnut trees by 1960.

[1] Douglas F. Jacobs, 2007. Toward development of silvical strategies for forest restoration of American Chestnut (Castenea dentata) using blight-resistant hybrids. Biological Conservation 137:497-506.

Chestnut Ecology

The American chestnut, *Castanea dentata*, was known as" King of the forest" for its rapid growth, large stature, and vast abundance. From southern Maine down to northern Georgia, and from the Ohio Valley south to Mississippi, chestnut grew as a dominant or co-dominant tree in mixed forests on well-drained slopes and uplands composed of non-calcareous soils. Chestnut was principally regenerated by coppicing with light thinning, as the trees sprouted prolifically. Its rapid annual growth — up to 5 feet in height and two inches in diameter—in addition to its ability to sprout vigorously from the root collar enabled chestnut to out-compete most other trees. In fact, the only other hardwood in the East that rivaled chestnut in growth and height was tulip poplar (*Liriodendron tulipifera*). In some parts of its range chestnut comprised upwards of 25% to 50% of all hardwoods. Because it was such a common tree and produced copious numbers of sweet, nutritious nuts, wildlife such as squirrels, turkey, bear, and grouse were dependent on the annual mast and suffered greatly when the tree fell to blight.

Chestnut Blight

In 1904 the chestnut blight fungus, *Cryphonectria parasitica*, was isolated on American chestnut specimens in the Bronx Zoological Park. The fungus, whose spores are disseminated by wind, birds, and insects, spread up to 50 miles per year. By the 1950s chestnut was virtually eliminated as a dominant forest tree throughout most of its range. The loss of chestnut created wide-ranging ecological, economic, and social after-effects. Because chestnut was such a dominant species, huge areas of formerly closed canopy forests suddenly were filled with gaps, allowing other species, principally oak, to replace chestnut, changing the Eastern forest landscape dramatically.

American Legacy, continued on page 11

"...perhaps one of the most tragic ecological events in the post-glacial history of Eastern North American forests was the demise of the ill-fated monarch American chestnut...[1]*"*

Leila Pinchot
Leila is a Forest Guild member, New England Regional Science Coordinator for the American Chestnut Foundation, and a master's candidate at the Yale School of Forestry.

By Laurie A. Wayburn,
Jerry F. Franklin,
John C. Gordon,
Clark S. Binkley,
David J. Miadenoff,
Norman L. Christensen, Jr.
This excerpt is reprinted with permission of the Pacific Forest Trust from *Forest Carbon in the United States: Opportunities and Options for Private Lands.* Updated August 2007. The complete document including references can be viewed at www.pacificforest.org/publications/index.html

FOREST PRODUCTIVITY

Recent Trends in U.S. Private Forest Carbon

Of the nine forest service regions identified by the US Forest Service (USFS), four are most important in terms of potential gains and losses in US forest carbon stores: the Northeast, Southeast, Midwest /Lake states and Pacific Northwest regions. (Figure 8) The forests in these regions contain the majority of private forestlands, are the most productive, most intensively managed, and most threatened by conversion (Best and Wayburn 2000). Thus, their carbon fate is a major determinant in national forest carbon flux. Of these four regions, the Southeast and Pacific Northwest have the greatest forest productivity and ability to increase carbon stores. These two regions are particularly important in tracking overall carbon flux.

Three factors are significant in tracking forest carbon:

- The amount of area in forest (forestland extent)
- Average forest age
- The balance of harvest to growth

"The longer a forest is allowed to grow prior to harvest or the greater the average age of a standing forest, the greater the carbon stores..."

Forestland Extent and Forest Carbon Reservoirs

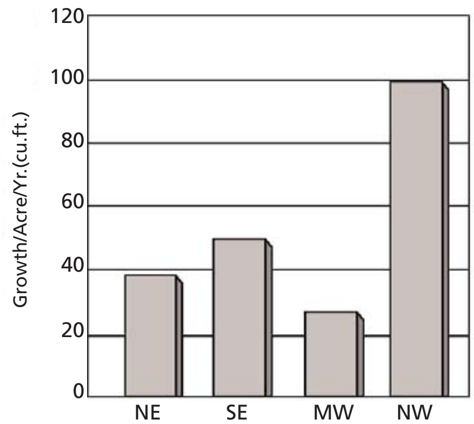
Forests are the most significant, expandable long-term future carbon reservoirs or sinks in the U.S. While the Northeast and Midwest/Lake states regions have gained some 1.5 million acres of forestland, the Pacific Northwest and Southeast combined have lost 3.2 million acres, mainly to development. The USFS projects development pressure will increase, affecting the afforestation of croplands as well and leading to an accelerated decline in forest extent (Align 2000). *Decreasing forestland losses would substantially decrease US forest-based carbon emissions and increase net stores.*

At an average carbon stock of 35 tons per acre, the 1982-1997 loss of 1.7 million acres of existing forests in Oregon, Washington, Georgia, Florida, Virginia, and the Carolinas alone meant the release of at least 60 million metric tons of carbon, as well as the loss of additional potential stores from the forests' diminished capacity to store carbon.

The USFS is projecting the loss of another 20 million acres of timberland by 2050. Conserving these lands would prevent release of 700 million tons of carbon and 19 billion tons of carbon dioxide, not to mention the loss of future stores. Increasing forest age could result in a doubling of carbon stocks in the major forest areas over the next 25 to 50 years. There has been a significant focus on reforesting, but in many states this has not been successful. Oregon, a highly productive forest state, estimates that some 775,000 acres of former forest remain in unforested condition (Cathcart 2000).

Figure 8

REGIONAL COMPARISON OF FOREST PRODUCTIVITY



Northeast=Maine, New Hampshire, New York, and Vermont
Southeast=Florida, Georgia, N.Carolina, S.Carolina, and Virginia
Midwest=Michigan, Minnesota, and Wisconsin
Northwest=Oregon and Washington

The two most productive forest regions of the United States are in the Northwest and Southeast. These have the greatest capacity to increase forest carbon stores in the short term and maintain them. These two regions are experiencing a net loss of forest land (Figure 9). Maintaining stocks in the Northeast and Midwest where forests have regrown over the past decades is equally important.

Source: Powell et al. 1992

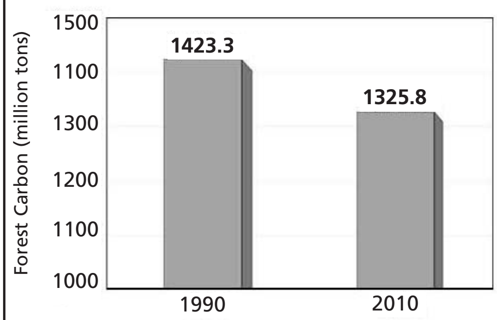
Reforestation and afforestation have substantial long-term potential, especially in the Southeast and in Midwest agricultural areas. The Conservation Reserve Program has demonstrated the appeal and effectiveness of tree planting in Midwest areas for net carbon and other ecological gains. *Combining these efforts of conservation, stewardship, and reforestation could increase net long-term US carbon stocks by hundreds of millions of tons by 2050.*

Forest Age and Carbon Stores

The longer a forest is allowed to grow prior to harvest or the greater the average age of a standing forest, the greater the carbon stores since older forests accumulate and store more carbon than younger forests. There is a declining average age of forests on private lands, continuing a long-term trend since settlement, when virgin forests began to be harvested. This is especially the case on private lands, exacerbated by the need to generate economic returns on shorter and shorter cycles. For example, in the Pacific Northwest, the average age of harvest of commercial species has declined from 80 to 40 years during just 20 years (Haynes 1995). As illustrated in Figure 10, this trend is projected to lead to a decrease of more than 100 million metric tons of carbon stores between 1990 and 2010 based on the loss of older age classes and gain in younger age classes of forest.

Figure 10

TRENDS IN FOREST CARBON STORES: THE NORTHWEST WEST REGION

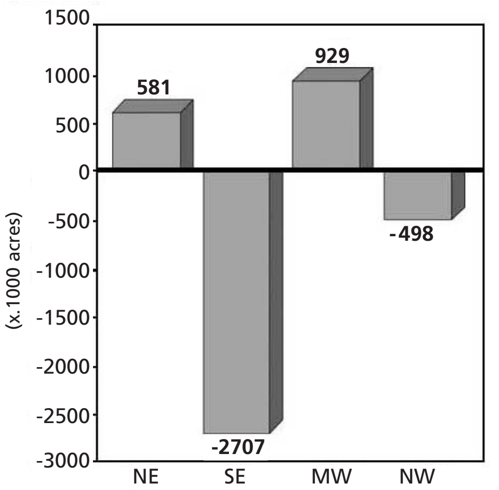


From 1990 to 2010, the Northwest West Region (Western Oregon and Washington) is expected to lose more than 97.4 million tons of carbon under business-as-usual management.

Source: Powell et al. 1992

Figure 9

TRENDS IN PRIVATE FORESTLAND GAIN AND LOSS (1982-1997)



Northeast=Maine, New Hampshire, New York and Vermont

Southeast=Florida, Georgia, N.Carolina, S.Carolina, and Virginia

Midwest=Michigan, Minnesota, and Wisconsin

Northwest=Oregon and Washington

Between 1982 and 1997, the Southeast and Northwest experienced losses of forestland while the Northeast and Midwest experienced slight gains. The net loss of forestland between 1982 and 1997 is 1,695,000 acres.

Source: Powell et al. 1992

There is a significant opportunity to reverse this trend in carbon stocks by extending rotations, retaining trees through one or more harvests, and rebuilding older age classes of forest on the landscape.

The estimates of forest age recorded in traditional growth-and-yield tables for commercial forests can be a useful surrogate for estimating carbon volume. The Forestry Inventory Analysis, or FIA, also gathers data on the growing stock volume. This, in turn, is translatable to standing carbon. Table 1 illustrates changes in standing volume of carbon in the main forest regions; it highlights overall declines in carbon in the Southeast, Northwest, and Lake States and increases in the Northeast.

Sustainability of Management, Harvest and Growth

When more biomass is accumulated through the growth of forests than removed in harvest, a net gain of carbon occurs. When more harvest

Forest Trends, continued on page 10

OBSERVING

LOCAL CHANGES

Northern Sierras –
Changes at the Edges

"In the past 20 years I have observed two vegetation changes that I would attribute to climate. First, antelope bitterbrush has been out-competing ponderosa pine on the fringe areas of the forest zone where annual precipitation barely supports pine trees. The second trend has been the decline of white fir at lower elevations. It invaded during a wetter period, but is now more susceptible to drought and competition than pines."

Phil Nemir
Forest Guild
Professional Member
Susanville, CA

Recent Trends, continued from page 9

Clearcutting is common silviculture in many forest regions. Typically, harvested sites are then burned to remove slash and competing brush. Often the soils are then cultivated prior to planting, releasing more carbon. With increasingly short rotations, this silviculture results in substantially reduced carbon stocks which do not recover by the next harvest.

occurs than growth, a net decrease occurs. Overall, private forests in the US are experiencing an increase of harvest compared to growth, despite continuing reforestation of the Northeast since the early 1900s and an increase in growth in the Southeast, especially in hardwoods. This trend is expected to continue as illustrated in Table 1. Hardwood harvest is projected to accelerate while harvest of softwoods declines as softwood inventories are depleted (Haynes 1995). In the four major forest regions considered here, there is a net excess of harvest over growth in three regions, with greater growth than harvest only in the Northeast. *The US has an opportunity to alter these business-as-usual trends, decrease harvest over the next decades, and rebuild carbon and timber inventories.*

Table 1, illustrating growth versus harvest by region in 1996, shows that removal of forest carbon exceeds growth of forest carbon by a net 7.5 million tons, not including loss of carbon from decay or transfer to the products pool. As indicated, roughly 60% of labile forest carbon is released over time due to increased decay. With these factors included, more than 50 million tons of carbon were released to the atmosphere in that year alone. *By allowing growth to exceed harvest, this trend could be substantially altered.*

For more indepth information on national harvesting trends, please refer to Table 2, page 19 in *Forest Carbon in the United States: Opportunities and Options For Private Lands.*

Table 1

GROWTH VERSUS HARVEST BY REGION (TONS C) 1996

Northeast	Growth	Harvest	Tons Gained
Softwood	3,661,251	4,525,926	
Hardwood	17,588,434	14,428,906	
Total	21,249,685	18,954,832	2,294,853
Southeast	Growth	Harvest	Tons Lost
Softwood	21,707,230	26,102,454	
Hardwood	16,976,851	18,597,599	
Total	38,684,081	44,700,053	-6,015,972
Midwest	Growth	Harvest	Tons Lost
Softwood	1,872,349	1,563,066	
Hardwood	13,430,444	14,750,751	
Total	15,302,793	16,313,817	-1,011,024
Northwest	Growth	Harvest	Tons Lost
Softwood	6,416,371	9,650,127	
Hardwood	1,080,244	647,054	
Total	7,496,615	10,297,181	-2,800,566

Northeast=Maine, New Hampshire, New York, and Vermont
Southeast=Florida, Georgia, N.Carolina, S.Carolina, and Virginia
Midwest=Michigan, Minnesota, and Wisconsin
Northwest=Oregon and Washington

In 1996, more carbon was released into the atmosphere through harvest than was accumulated.

Harvest data sources: FIA Website data (http://srsfia.usfs.msstate.edu/rpa/tpo/) and 1997 RPA data Growth data sources: Powell et al, 1992 (GTR-RM-234) and Draft 1997 RPA.

MANAGING FORESTS FOR GREATER CARBON

Forest NOT Managed for Carbon Result In:
- Decreased Biodiversity
- Decreased Ecosystem Health, Diversity, and Resilience
- Decreased Carbon Stability
- Increased Carbon Emissions

Forest that ARE Managed for Carbon Result In:
- Increased Biodiversity
- Increased Ecosystem Health, Diversity, and Resilience
- Increased Carbon Stability
- Decreased Carbon Emissions

American Chestnut, continued from page 7

Restoration Efforts

Several institutions, each using a different method, are dedicated to restoring American chestnut to its previous glory, including The American Chestnut Cooperator's Foundation, The American Chestnut Research and Restoration Project at the SUNY College of Environmental Science and Forestry, The Connecticut Agricultural Experiment Station and The American Chestnut Foundation (TACF).

TACF's breeding program, initiated in 1983, relies on resistance conferred by naturally resistant Chinese chestnuts to produce a tree that is about 94% American, 6% Chinese, and highly blight resistant. Breeding involves crossing a Chinese tree with an American, backcrossing the successive progeny with different American individuals over three generations, and then crossing the hybrids together over two more generations to increase resistance. Though this is a long process, taking about 5 – 10 years per generation, TACF hopes to end up with a tree that looks and acts American, while carrying blight resistance. TACF harvested the first batch of nuts from what is hoped to be the final cross in 2005. We will be testing the trees for resistance over the next several years.

Reintroduction

As the wide-scale production of highly resistant American hybrid chestnuts approaches, the looming question —not easy to answer—is how to best reintroduce the species. Forest ecosystems were just being studied and understood as chestnut faded from the Eastern forests, thus we do not fully understand the role chestnut played in forest dynamics. Studies are currently underway to determine how to best replant chestnut into the forest. Chestnut, as an intolerant species, grows best in clear cuts, and can also be successfully grown in mixed species plantings in forested areas. Landowners ultimately will have to decide what works with their management strategy. Possibly the largest challenge will be learning how to grow chestnuts among a hugely overpopulated deer herd. As foresters know, where there are too many deer, there is often too little forest regeneration. Fortunately, chestnut's rapid growth may provide a key advantage in helping overcome the recruitment bottleneck often caused by deer browse.

Chestnut and Climate Change

With a range that stretches about 1500 miles north-south, chestnut has a huge advantage over less extensive species in the context of a warming climate. As Marshal Case, TACF President and Chief Executive Officer puts it: "The challenges of climate change may actually be of benefit to the American chestnut reforestation initiative. As other hardwood species recede to the north, it is very likely that American chestnut will expand and extend its current range, filling gaps left by the demise of other hardwood species."

Although the development of resistant chestnut is encouraging, the reintroduction of chestnut remains a very long-term project. The enormous effort to put this tree back into the forest must be shared between private institutions, such as the American Chestnut Foundation, state and federal government and, perhaps most importantly, private landowners. It will take years, decades, and perhaps even centuries, for the species to spread naturally and regain anything approaching its former dominance. By then we will surely face other ecological problems, such as new exotic pests and the loss of other important forest species. But I have hope that chestnut will one day again become an important part of the Eastern landscape, ecology, and culture.

> *"The challenges of climate change may actually be of benefit to the American Chestnut restoration initiative."*

Historical Perspective

"Over the past 150 years, deforestation has contributed an estimated 30 percent of the atmospheric build-up of CO_2. It is also a significant driving force behind the loss of genes, species, and critical ecosystem services. However, in the international policy arena, biodiversity loss and climate change have often moved in wholly unconnected domains."

- ***Climate, Biodiversity, and Forests***, *World Resources Institute*, 1998.

A State of Flux, continued from page 5

In June, Chicago Climate Exchange announced that trading volume during the first half of 2007, almost 11.9 million metric tons of CO_2, surpassed the total 2006 volume of 10.3 million metric tons.

Western Climate Initiative

The Western Climate Initiative established in February 2007 involves six Western states and two Canadian provinces (as of October 2007) in a joint effort to set regional cap and trade systems for GHG emissions. The group agreed to an aggregate emissions reduction of 15 percent below 2005 levels by 2020 which, according to Union of Concerned Scientists economist Christopher Busch, would cap pollution at about 2% above 1990 levels. The members will design the regional market-based cap and trade system by August 2008. As part of their effort each of the partners has joined the Climate Registry.

Forest sequestration credits comprised 13 percent of the total trading volume on the Chicago Climate Exchange in 2006.

The Climate Registry

The Climate Registry is a national collaborative effort to develop and manage a common voluntary GHG emissions reporting system. As of August 2007, thirty-nine U.S. states, two Canadian provinces, one Mexican state, and three North American indigenous nations have signed on. The Registry's stated goals are to develop and manage a common GHG emissions reporting system with high integrity capable of supporting multiple GHG emissions reporting and emissions reduction policies; and provide an accurate, complete, consistent, transparent, and verified set of GHG emissions data from reporting entities. Third party verified information is intended to be consistent across borders and emissions reduction programs. The Registry is expected to be operational on January 1, 2008.

The Regional Greenhouse Gas Initiative (RGGI)

Ten states in the Northeast are working together through RGGI to develop a cap and trade system to reduce emissions from the electric power sector through caps, one mechanism of which is through the pricing and trading of allowances. In the Memorandum of Understanding signed on December 20, 2005 the signers agreed to "stabilize carbon dioxide emissions at current levels from 2009 to the start of 2015 followed by a 10% reduction in emissions by 2019."

RGGI will be operational in 2009 when the first allowances will be traded. On August 15, 2006, the participating states issued a model rule for the RGGI program. The only forestry standard set was for afforestation, the practice of creating a forest on land that had not had forest for at least 50 years. However, the participating states are charged in the Post Model Rule Action Plan to "evaluate new offset categories and types, prioritize those types, and develop new offset standards that are real, additional, verifiable, permanent and enforceable."

Chicago Climate Exchange

The Chicago Climate Exchange (CCX) is the world's first and North America's only rules-based GHG emissions trading system. It is a voluntary, legally binding integrated trading system that uses offset projects worldwide to reduce emissions. CCX emitting members make a voluntary, but legally binding commitment to meet annual GHG emission reduction targets. In June, CCX announced that trading volume during the first half of 2007, almost 11.9 million metric tons of CO_2, surpassed the total 2006 volume of 10.3 million metric tons. Thirteen percent of the 2006 total was forest sequestration credits.

Other state and regional climate change initiatives include renewable portfolio standards, renewable energy tax credits, and energy efficiency goals. Although state and regional GHG emissions reduction programs may not be as effective as a coordinated national effort, they are providing a solid foundation from which a comprehensive national policy can be built and expanded.

Changing World, continued from page 4

communities may begin to dissolve and re-coalesce into new associations – changes we cannot fully predict but can only imagine today.

As foresters move into this uncharted ground, the precautionary principle applies more strongly than ever. We will not know all the future threats we face, but we probably know the most immediate ones. Forest pests capable of causing extinction (or at least commercial elimination) exist in the U.S. today for a surprisingly large number of our key forest species, so business as usual will certainly not protect our forests from even the threats we do know about. Rather than managing for any desired mix of species for the next 100 years, it may become necessary to step back to a more basic objective of simply maintaining forest health and resiliency – in other words doing what is needed to protect the forest's primary functions, including its survival as a forest.

While markets may partly dictate our management decisions, one principle of managing for resiliency is keeping all of the pieces. Retaining as many species as possible, even the ugly ones, will help maintain options in the face of potential losses due to species shifts, major disturbances, or forest pest outbreaks. Mixed-species forests are usually more productive over the long term and can thus sequester more carbon at a higher rate and store it more predictably over a long term than single-species forests.

As is the case with pests and pathogens, increased fire severity and frequency in fire-prone regions is now a working assumption for forest planners. The carbon sequestered in conifer forests growing at unnaturally high densities can be substantially lost in stand-replacing fires – even with post-fire salvage – wiping out much of the mitigation benefit those forests provided. So, although prescribed ground fires in fire-dependent forests may be adding CO_2 to the atmosphere, they may be a necessary tool to avoiding much larger impacts. Likewise, responsible biomass removal that minimizes fire risk and supplies products that offset fossil fuel use provides a double bonus in this context. A few strategies to consider in preparing forests for climate change:

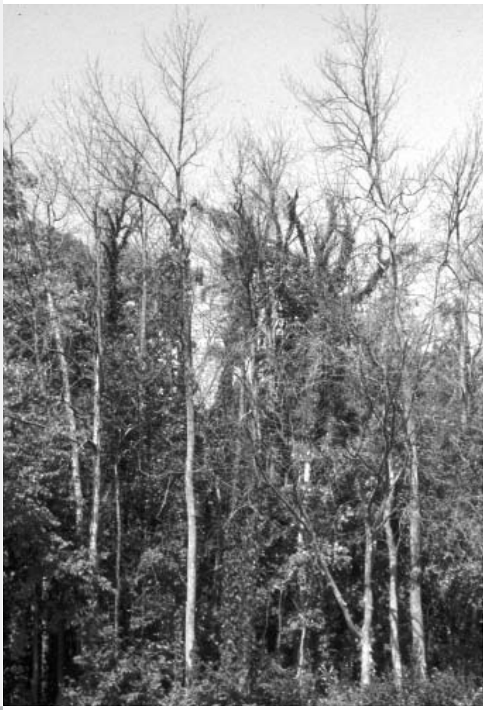
Managing for forests with a variety of species, ages, patch sizes, and structural complexity is one key strategy for maintaining resiliency in the face of climate change.

- When selecting species to manage for or introduce, consider their potential growth and viability in a warmer, drier climate. The USDA Forest Service – Northern Research Center Climate Change Tree Atlas is one good source for predictions on suitable habitat for trees in the Eastern U.S.
- Manage for stocking levels and for species mixes that will reduce the risk of catastrophic disturbances. Although high-density softwood monocultures may quickly sequester large amounts of carbon, those gains are often short-lived.
- Plan for stand and landscape-level patterns that promote continuity and heterogeneity – contiguous habitats, mixed-species stands, a variety of patch sizes, and a reserved area network that will provide additional habitat or refugia for species under climate stress. Luckily this type of management, one aspect of what we have come to call excellent forestry, is standard practice for many Guild members.

Forest practitioners will be on the frontlines in the effort to protect our forests and our environment from the effects triggered by changing climate. Guild members already possess many of the tools and skills that will be most needed. Our forest-based principles as a professional organization are well-suited for meeting both the new realities and the expectations that society is rapidly placing on forests.

This may not be an easy time, but there has possibly never been a more important challenge for the forestry profession. The Forest Guild and its members can provide a unique and needed perspective on this issue.

Carbon Markets, continued from page 6



Emerald Ash Borer (EAB) mortality in an Ohio forest. EAB is expected to eliminate ash (Fraxinus americana, F. Pennsylvanica, F. nigra) as commercial species in the Northeastern United States.

OBSERVING
LOCAL CHANGES

New England –
Shrinking Winters

New England does not seem to be getting the long periods of cold weather and consistently frozen ground conditions that used to characterize winter here. The warmer winters of late are wreaking havoc with forest operations planning and the ability to adhere to textbook BMPs.

Christopher Riely,
Forest Guild
Professional Member

For owners participating in carbon trading programs, inventory and calculation of carbon pools establishes a "baseline" condition against which future changes to carbon stocks are evaluated.

Monitoring and modeling build on the baseline condition to measure and predict changes to carbon stocks over time. All of the U.S. carbon trading systems at this time limit allowable carbon sequestration to the amount sequestered in excess of a baseline. At its simplest this could be growth of tree seedlings in a field devoid of aboveground biomass at the time of enrollment.

In the case of existing forests the rules between various carbon registries are not as uniform. The simplest protocols value the net carbon change as a result of both carbon emissions and carbon sequestered. However others, in an attempt to be credible in showing carbon is being sequestered above what would have happened without the sale of offsets, require projects to show "additionality" – the net carbon sequestered in excess of the rate that would have occurred without the incentive. In this case the rules of the game, and the methods of calculating offsets, grow more complex.

Just as when your utility estimates your electric usage during the billing periods when they don't get out to actually read your meter, carbon sequestration estimates derived from model outputs are used to calculate the net offset that occurs between an initial inventory and subsequent field-based re-sampling. Modeling changes to carbon stocks may involve a combination of additional field sampling at periodic intervals, supplemented by modeled or estimated results in intervening years to estimate offsets. Growth simulation models may be used to project growth rates and subsequent biomass accumulation given a natural condition, or given projected management interventions. The USFS Model Forest Vegetation Simulator is one example of a stand-level modeling tool suitable for use in estimating biomass accumulation.

Calculating and reporting the mass of carbon in the various carbon pools involves estimating at the plot level and scaling this up to the sampling unit level, and finally to the property or entity level just as with a timber inventory. Net carbon decreases (through harvest or other disturbances) in some areas may offset the carbon gained in other areas over the reporting period. An entity's allowable greenhouse gas (GHG) offset is usually the net calculated GHG benefit (net carbon sequestered, which is converted to tons of CO_2), discounted by a factor that accounts for statistical and biological uncertainties, including the likely permanence of the benefit. In an additional move toward conservatism, the Chicago Climate Exchange places 20% of reported offsets into a reserve pool that is held available in the event of subsequent reversals or losses of stored carbon on enrolled properties.

Of all the possible biotic offset projects which contribute to GHG reduction, forest projects have potential to provide some of the greatest benefits – including the many co-benefits that excellent forestry and forest conservation inherently provide. The GHG benefits of forestry can be complex to account for and difficult to measure precisely. As U.S. carbon markets mature and we move toward what many believe will be a single carbon trading market based on national cap and trade

Carbon Markets, continued on page 15

Carbon Markets continued from page 14

legislation, it is likely that those participating in forest offset enrollments will benefit from more standardized accounting methods, including expert systems designed to simplify measuring and estimating. Meanwhile, forest stewards involved in GHG reduction programs will need to ensure that our work to quantify the carbon benefits from forests is thorough, un-biased, and scientifically sound. Our standing as professionals will rise or fall with our ability to meet these new challenges.

*forest*GUILD

PROGRAM UPDATE

Guild Tackles Climate Change

By Alexander Evans
Forest Guild Research Director

Everyday Forest Guild members are working in the woods and in offices across the U.S. to deal with climate change by improving forest health and helping to sustain ecosystems. In addition to the Guild's ongoing national and regional program efforts that will continue to be relevant, the Guild has been expanding its programmatic efforts during the past year to specifically address climate change issues.

The Guild's Fall 2007 Northeast, Pacific Northwest, and Southeast regional meetings all included discussion of climate change or carbon credits. The Guild's new biomass case study research project will help understand how we can take advantage of renewable energy from forests in a responsible way.(http://www.forestguild.org/biomass.html) The Guild's climate change efforts also include a climate change working group, research and policy development in the Northeast, the development of a Forest Guild policy statement on climate change, and expansion of the Ecological Forestry Initiative's climate change response resources.

As mentioned in the July/August edition of *Across the Landscape*, the Guild has formed a climate change working group which will communicate and offer expertise directly to our Membership and Policy Council (MPC). One of the first tasks of the committee is to review the Guild's comprehensive draft report *Climate Change, Carbon, and the Forests of the Northeast*. The working group will also help draft a policy statement and pass its recommendations to the MPC for review, discussion, and approval. Creating a formal policy statement will augment the Guild's ongoing advocacy for excellent forestry from the local to the national level.

The Guild's Ecological Forestry Initiative is highlighting forestry and carbon sequestration ideas and resources as part of an online resource center,(http://www.forestguild.org/ecological_forestry.html). It will offer natural resource professionals access to information that increases their understanding of the latest climate change predictions relating to forests and tools for fostering forest resistance, resilience, and adaptation to new temperature and precipitation patterns.

MISSION

The Forest Guild promotes ecologically, economically, and socially responsible forestry as a means of sustaining the integrity of forest ecosystems and the welfare of human communities dependent upon them. The Guild provides training, policy analysis, and research to foster excellence in stewardship, to support practicing foresters and allied professionals, and to engage a broader community in the challenges of forest conservation and management.

Nonprofit Org.
US Postage Paid
Santa Fe, NM
Permit No. 276

forest **GUILD**
P.O. Box 519
Santa Fe, NM
87504

forest WISDOM

Forest Guild State and Region Coordinators:

Northeast

Andy Shultz - ME
63 Quimby Street
Augusta, ME 04330
207-623-3194
cell: 207-242-8845
andy@aforestry.com

Jeff Luoma - NY
132 S. Danby Road
Willseville, NY 13864
607-351-1088
jwluoma@hotmail.com

Ehrhard Frost - VT, NH
Full Circle Forestry
6078 Route 113
Thetford Center, VT 05075
wk: 802-785-4749
hm: 802-785-4308

Tim Abbot - CT, RI
Greensleeves Environmental Services
59 Prospect Street
Canaan, CT 06018
860-672-6678
greensleevesenviro@sbcglobal.net

Bruce Spencer - MA
P.O. Box 71
New Salem, MA 01355
978-544-5144
jnbennett@gis.net

Southeast

Nate & Jessica Wilson
197 8th Street
Monteagle, TN 37356
931-924-4539
jessandnatew@yahoo.com

Northwest

Jean Shaffer
Nisqually TreeArt Forestry Consulting
8400 Rocky Lane SE
Olympia, WA 98513
360-459-0946
jeanforest@cco.net

"It's great! You just tell him how much pollution your company is responsible for and he tells you how many trees you have to plant to atone for it."