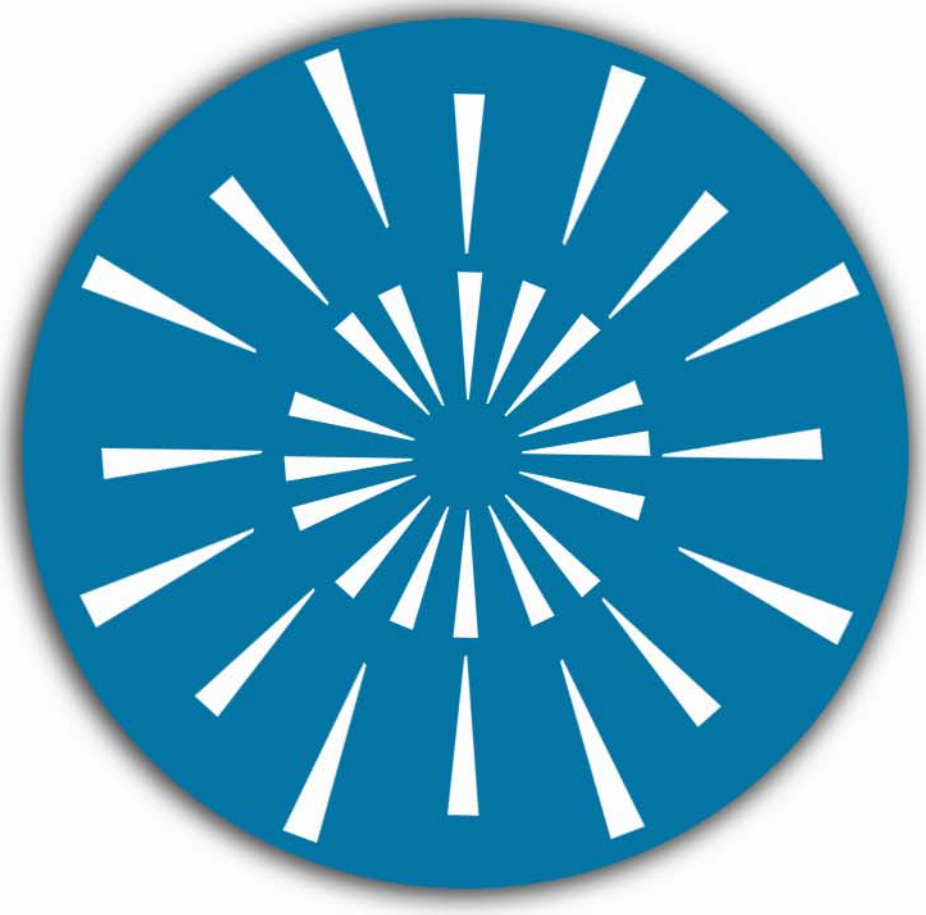
Land of Opportunity

The American Response to Climate Change

Forestry and Land Use
WORKING MEMORANDUM



THE WILD CENTER, TUPPER LAKE, NY
June 25 & 26, 2008

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Forestry and Land Use

THE AMERICAN RESPONSE TO CLIMATE CHANGE CONFERENCE

THE WILD CENTER, TUPPER LAKE, NY

June 25 and 26, 2008

As of 6/12/2008

The American Response to Climate Change: Forestry and Land-Use

A memorandum intended to prompt discussion at *The American Response to Climate Change* Conference[1]

The purpose of the Forestry & Land-Use Working Group is to examine the range of possible strategies to sequester carbon within the U.S. through protecting and expanding forest cover and improving land-use practices.[2]

This memorandum examines the opportunity to sequester carbon within the United States through forestry management and land-use policies and programs. It is organized into five sections:

- Need for action
- Goals for U.S. forestry and land-use policies
- Inhibitors to forest growth as a method of carbon sequestration
- Possible policy initiatives
- Suggested issues for discussion

[1] Prepared by Carter Bales and Tiffany Clay in consultation with the Forestry/Land Use Sector Advisory Team, which includes Peter Stein (chair), Carter Bales, Sandra Brown, Tiffany Clay, Brad Gentry, Bill Ginn, Jeff Horowitz, Michael Jenkins, David Liebetreu, Al Lucier, Jason Scott, Bill Stanley, Mike Virga, and Laurie Wayburn.

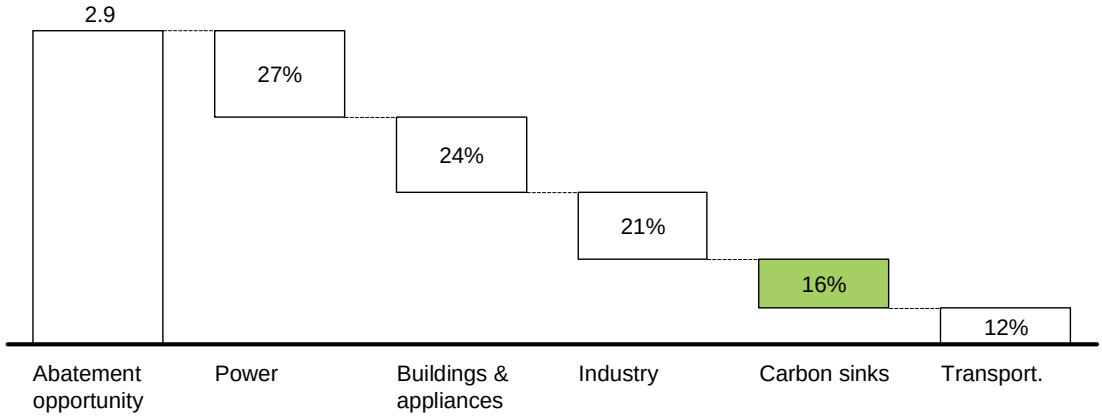
[2] Agricultural practices as a source of carbon sequestration are excluded from this Working Group.

NEED FOR ACTION

With roughly a tenth of the world's total land area and 10% of its forests, the U.S. carbon sink potential is significant.[3] Indeed, the annual carbon sink from U.S. pastureland and cropland (which, combined, cover half of the U.S.) and forests (another third of the U.S.) is just over one gigaton (Gt) of CO_2 per year, an offset of 14% of total U.S. annual greenhouse gas (GHG) emissions.

Due to the preponderance of land, incremental abatement from conservation-oriented policies is huge: upwards of 400 megatons (Mt) of additional carbon per year according to a recent McKinsey study. These 400 Mt constitute 16% of the total U.S. abatement potential by 2030 (an opportunity 25% greater than transportation abatement opportunities) and a sizeable 6% of the nearly 7 Gt of *global* abatement that could come from forestry and land-use-related measures.[4]

Table I: Clusters of U.S. abatement potential – 2030
Gt CO_2 per annum for options < $50/ton CO2; Percent of total abatement opportunity



** Excludes agricultural sink potential, which could create an additional 100 million tons of annual abatement*
Source: McKinsey Greenhouse Gas Abatement Mapping Initiative, 2007

While attention is often paid to the role that the developing world can play in preventing deforestation as part of a solution to the climate crisis, scant attention has been paid to the sizable role that conservation efforts and sustainable forest management can play *within* the U.S. The vast untapped

[3] Carbon "sink"—sometimes referred to as carbon "flux"—refers to carbon that is pulled out of the atmosphere and stored terrestrially as solid carbon. The net annual sink is therefore the amount of carbon transferred annually from CO_2 form to solid carbon, less the solid carbon that decays and becomes CO_2. This *offset* is the opposite of emissions *abatement*, which refers to the prevention of carbon going into the atmosphere in the first place. Carbon sinks are often referred to as "offsets" since they indirectly reduce net GHG emissions. For additional clarification on terminology, please refer to Table V in the appendix; figures from USDA Forest Service.

[4] McKinsey & Co., *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?*, December, 2007; Vattenfall; figures exclude additional sink potential from agricultural land-use shifts (e.g., implementation of conservation tillage and cultivation of winter cover crops).

sequestration potential of U.S. land necessitates policies to unlock these opportunities.

Such action to grow the U.S. carbon sink is all the more imperative in light of trends forecasting the impending decline of America's carbon-sink potential. Despite growing by 25% since 1990 as a result of widespread reforestation over the past century (mainly in the South), the EPA projects that the annual sink will decline by 7% between 2010 and 2030, due primarily to an expected slowdown in afforestation efforts and carbon uptake rates (see Table II).[5] Conversion of forest land to residential and commercial development will also drive the projected decline—a trend that has escalated over the past decade, particularly in the Northeast where there is rapid development (see Table VII, appendix).[6] According to the U.S. Forest Service, 20 million hectares of forest land across the country are expected to be developed for urban and community uses by 2050.[7]

In the absence of near-term economic incentives, ongoing "sink destruction" will materially decrease the extent to which the nation's rapidly growing emissions are offset. In addition, serious ecological effects will result, including the loss of natural habitats and biological diversity, destruction of open space, contamination of natural water supplies, land erosion, and the loss of recreational lands, among others. Many of these effects are irreversible.

Consequently, the U.S. must reverse these trends through policies and programs aimed at increasing forest cover in the U.S., either directly through government grants to fund forest and land-use conservation projects, or indirectly by providing incentives to private players and lower levels of government to finance these projects. These actions will not only increase the size of the U.S. carbon sink but will also help protect dwindling open space and the nation's biodiversity while increasing supplies of renewable materials and energy that help reduce demand for non-renewable alternatives with higher life-cycle emissions of greenhouse gases. This "convergence of purposes" makes action imperative.

Note that, although the focus of this memorandum is on policies to increase sequestration within the U.S., the important role the U.S. will have to play in reducing forestry and land-use-related emissions abroad must not be forgotten.

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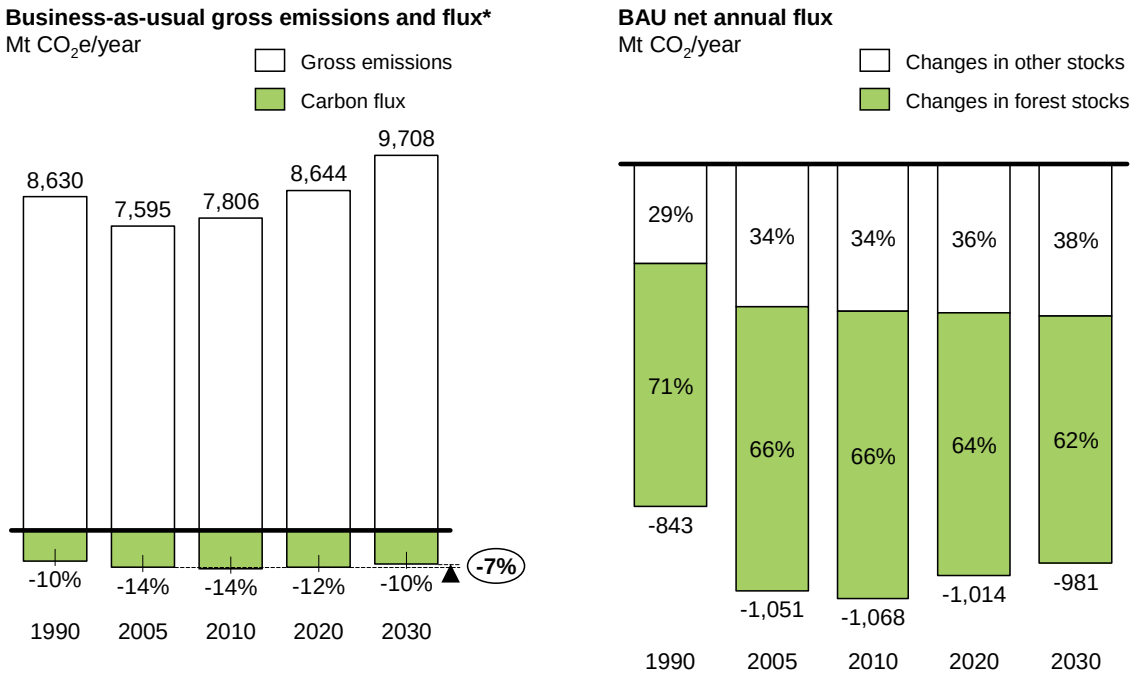
[5] Figures include changes in grassland, agricultural, and forest carbon stocks, as well as changes in harvested stocks (landfills, wood products, etc.); afforestation refers to forest growth on land not previously forested, in contrast to deforestation, which involves forest destruction, often due to land development.

[6] Note that the drivers of U.S. deforestation differ markedly from the drivers of tropical deforestation. Whereas U.S. deforestation is primarily caused by suburban sprawl, deforestation in developing countries is driven by forest conversion to cropland and pastureland, along with unsustainable harvesting practices. While there is timber harvesting in the U.S., much of it is done in an environmentally-sustainable way.

[7] USDA Forest Service. *Interim Update of the 2000 Renewable Resources Planning Act Assessment*, 2007.

Indeed, as the prime consumer of the harvested products driving the more than 10 million hectares of deforestation occurring each year (and 15–25% of global carbon emissions), the increase in global land-use and forestry emissions cannot be solved without U.S. policy initiatives.[8] Although such initiatives are not the focus of this memorandum, many of the policies that are proposed here regarding the expansion of the U.S. carbon sink—from measures that will create more sound carbon markets, to carbon finance proposals that will improve forestry-related project returns, to development planning incentives to reward conservation—could undoubtedly be applicable abroad and do much to expand global carbon sinks.

Table II: Historical and projected trends in the U.S. carbon sink



** Business-as usual (or "BAU") refers to the expected trend-line for emissions, assuming no significant changes to the status-quo*
Source: EPA, USDA

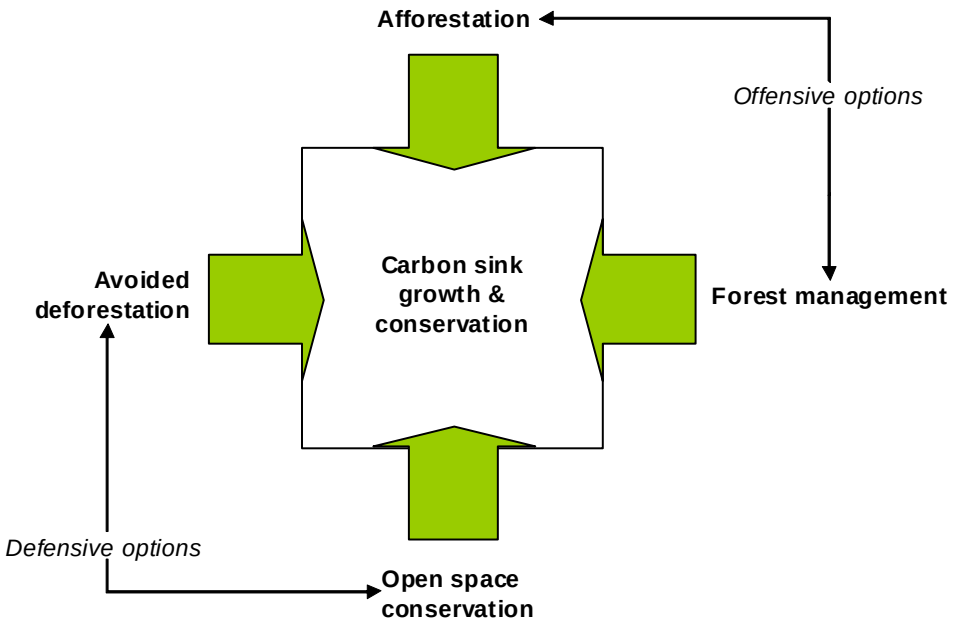
GOALS FOR U.S. FORESTRY AND LAND-USE POLICIES

Due to the magnitude of opportunities that could be captured at relatively low cost, forestry and land-use management within the U.S. must be a part of the solution to growing U.S. GHG emissions. The McKinsey U.S. Greenhouse Gas

[8] FAO, 2005.

Abatement Mapping Initiative found that some 320 to 452 megatons (Mt) of additional CO_2 could be stored annually through shifts in land-use, including forestry (see Table III).[9]

Range of options for growing the carbon sink and ensuring conservation



A majority of the opportunities highlighted in the McKinsey report (279–411 Mt) involves afforestation and reforestation of some 40 million hectares of marginal land (at an average cost of $20–$30 per ton of carbon abated).[10] An additional 41 Mt could be sequestered annually from shifts in forest management practices in 18 million hectares of degraded forests, which are severely understocked, resulting in low forest cover and, consequently, low carbon sequestration (forest management would cost an average of $20 per ton of carbon abated).[11] Achieving this level of abatement from forest and land management outlined in the McKinsey report would

[9] McKinsey & Co., *Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?*, December, 2007.

[10] Reforestation refers to restocking understocked forest land. Afforestation would involve planting trees on land that is currently being used as pastureland or cropland. Note that this could have leakage effects, which are not accounted for in the McKinsey offset estimates. These leakage effects are likely to be minimal, however, particularly for pastureland where the loss of pastureland could easily be compensated for by shifting a greater proportion of beef production to feedlots—a far more efficient form of livestock management than range stocking (note that roughly 88% of beef production in the U.S. occurs on feedlots, which constitute only 0.1% of land allocated to beef production—a fact that suggests that far greater efficiencies could be achieved in U.S. livestock production before the leakage of beef production offshore becomes a serious concern).

[11] Estimates of degraded land acreage from Moulton & Richards, U.S. Forest Service, 1990.

increase the net annual carbon sink by 30% to 40%, which would allow it to more than keep pace with the forecasted growth in gross GHG emissions (projected to increase 20% from 7.8 Gt in 2010 to 9.7 Gt by 2030). Consequently, this is a significant opportunity that must be prioritized in addressing the climate crisis (see Table IV).

It is important to note that McKinsey's estimate is likely conservative, as other reports suggest that this potential may be even higher. A recent study on the cost of extending harvest rotations, for instance, found that some 210 Mt of additional CO_2 could be sequestered at \$55/ton CO_2 in the southern and western regions alone, significantly more than was identified by the McKinsey report.[12] Additionally, the McKinsey estimate only analyzed the possibility of afforesting and improving forest management on already-degraded private lands; significant opportunities exist outside of these lands, however (in public lands such as national forests, city parks, and highway medians), further suggesting the McKinsey estimate is conservative. Finally, ample opportunities exist to prevent deforestation and open-space destruction, particularly in regions like the Northeast. Taken together, these options— afforestation of both public and private lands, sustainable forest management, prevented deforestation, and open-space conservation—could provide huge opportunities to increase the U.S. forest sink going well beyond the estimate in the McKinsey report.

Ideally, the full range of these opportunities to promote widespread conservation and greening would be captured. Governments can ensure the cost-effectiveness of the efforts, however, by prioritizing the highest-impact and lowest-cost options. The cost-effectiveness of forestry and land-use opportunities varies significantly by type and by region due to the variance in land costs and climate. Soil moisture and clay content, annual rainfall, and temperature all affect the type of forest growth and, hence, the carbon-uptake rates in a given region. Along with land opportunity costs, these factors drive differences in the costs and potential of either establishing or maintaining a forest and conserving open land (see Tables III, VI; appendix).

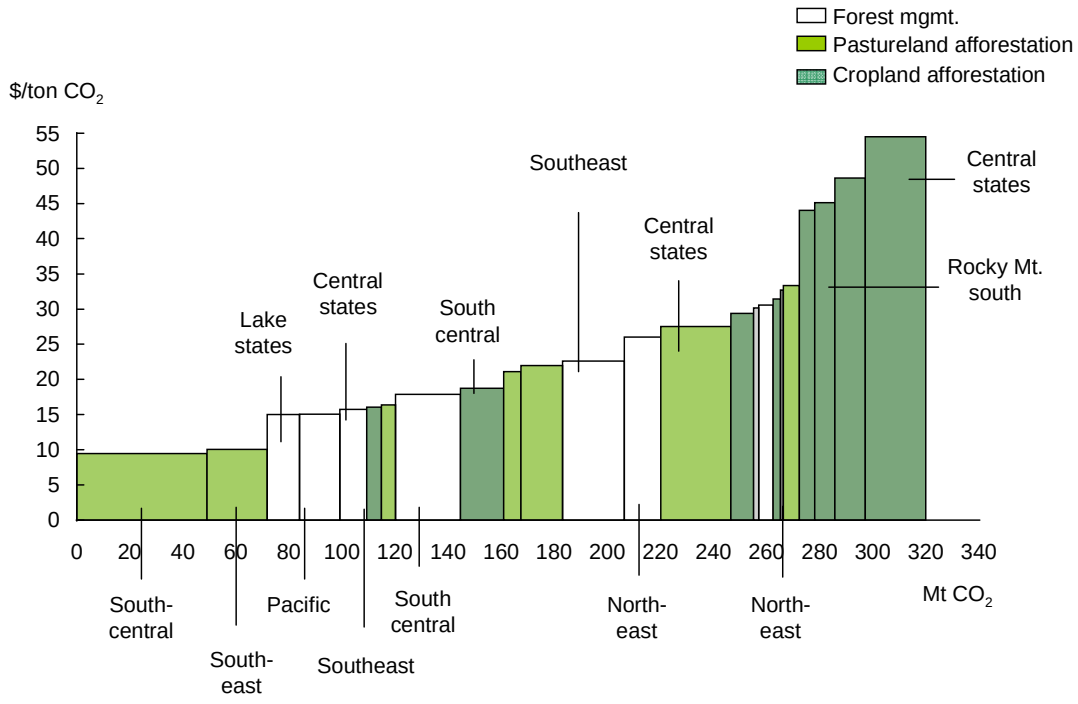
In the Northeast, for instance, forest-management activities (which could constitute some 8–18 Mt of carbon sequestration per year in the region by 2030) are far more cost-effective than afforestation of cropland due to the high opportunity cost of land. Consequently, these types of projects should be pursued first before other more expensive options are pursued. Of these activities, active forest management practices such as restocking understocked stands and extending harvest rotations

[12] Sohngen, B. and S. Brown, "The Cost and Quantity of Carbon Sequestration by Extending the Forest Rotation Age," 2006.

have the lowest marginal costs, far less than the cost of afforestation. A recent study, for instance, found that forest-management activities were close to breakeven in the Northeast, whereas afforestation costs were upwards of $60 per ton of sequestered carbon.[13] These regional variances in the cost-effectiveness of different conservation efforts makes it imperative for governments and private conservation groups to prioritize specific sites to be preserved.

Conservation and greening efforts should also promote near-term options. The timeline of conservation benefits achieved through land management differs markedly among project types. Forest management and avoided deforestation projects, for instance, begin accumulating significant amounts of carbon immediately, whereas afforestation projects take time (as a forest takes time to grow after it has been planted). Recent research has estimated that it would take an afforestation project in the U.S. at least 75 years to catch up to the benefits achieved by an avoided deforestation project, as a newly planted forest sequesters a smaller volume of carbon, even though at a faster rate, than older forests.[14]

Table III: Abatement cost curve for forest management and afforestation, 2030, medium case*

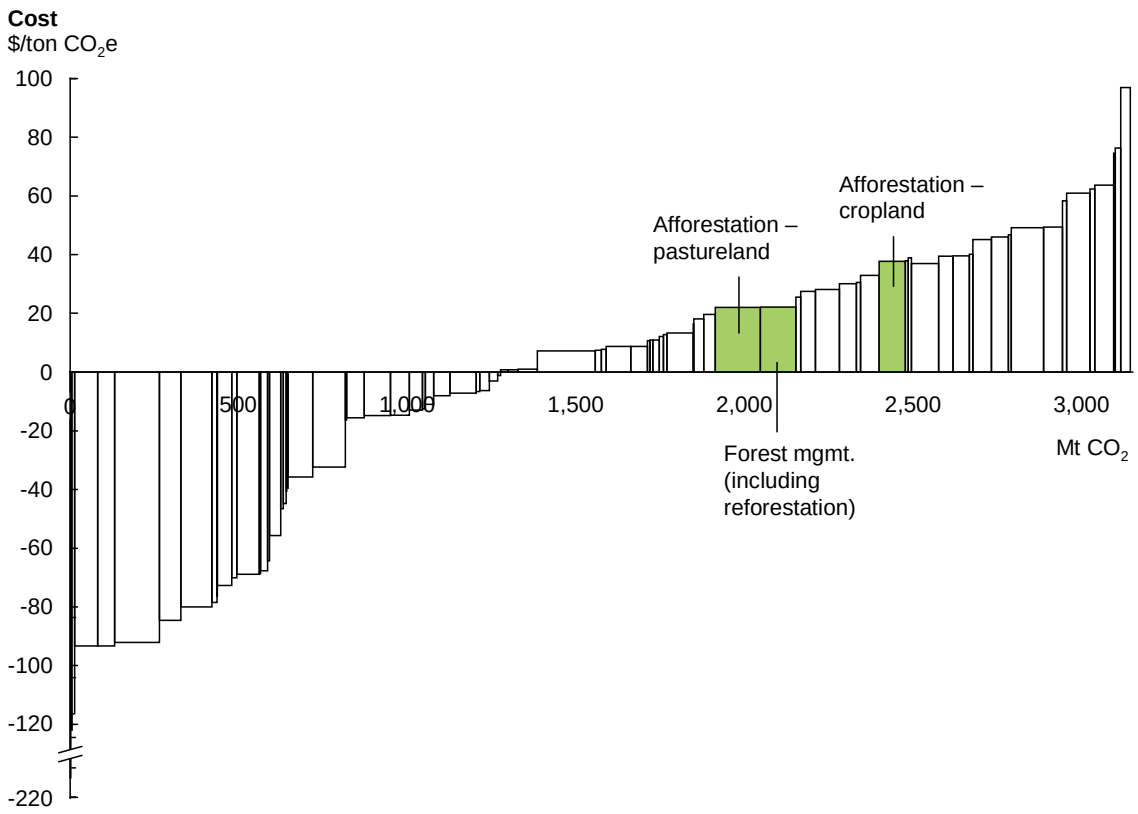


* *Cost estimates exclude potential revenue from timber harvesting*
Source: McKinsey Greenhouse Gas Abatement Mapping Initiative, 2007

[13] Walker, S.M., S. Grimland, N. Sampson, et al., "Terrestrial Carbon Sequestration in the Northeast: Quantities and Costs," Winrock International, 2007.

[14] Griffen, Alec, "A Policy Framework for Including Avoided Deforestation and Active Forest Management Practices as Forest Offset Types in the RGGI Model Rule," 2007.

Table IV: Forestry opportunity as portion of total U.S. estimated abatement opportunity, 2030*



** Note: Abatement benefits from avoided deforestation and open land conservation not included*
Source: McKinsey Greenhouse Gas Abatement Mapping Initiative, 2007

These efforts should be put in place now to ensure that benefits can be captured most cost-effectively. As land prices continue to rise, the near term offers the most attractive time to initiate greening projects, whose largest cost is often the opportunity cost of the land on which the projects are implemented. Moreover, the currently low cost of many land-use and forestry sink options may provide society a cost-effective way to offset and abate emissions in the short term, as more cost-effective methods are developed to abate emissions from other sectors over the longer term. Indeed, as players in other sectors seek more efficient methods to reduce emissions, the offset and abatement opportunities from forest management and land-use will likely be an attractive alternative in the near term.

Forestry measures, for instance, have the potential to reduce year-2030 compliance costs by roughly $15 billion.[15]

This offset mechanism will be most significant in those regions that have set aggressive targets for near-term emissions reductions. With the widespread adoption of low-cost power abatement technologies unlikely within that short timeframe (current cost estimates for carbon capture and storage [CCS] technologies are around $50 per ton of avoided CO_2e emissions), the use of offsets could be critically important. Allowing capped sectors to source a portion of their emissions reductions from outside the sector provides for flexibility and can reduce compliance costs, which would decrease the economic burden of abatement or allow more aggressive targets to be set. Such a system would have to address a myriad of accounting difficulties, however, which we discuss in more detail in the next section.

INHIBITORS TO CARBON SEQUESTRATION

Significant challenges stand in the way of attaining these goals, namely, the rising competition for land, growing demand for forest products, and lack of standardized accounting methodologies.

Rising competition for land. With suburban growth, the boom in agriculture, and in light of the emerging world food crisis, land costs are escalating. Cropland values have risen at an average annual growth rate of 12% since 2002 and pastureland at 10%. These rates have jumped in the past year (15% and 22%, respectively) in response to increased crop prices and demand for meat (see Table VIII in appendix) and will likely continue to rise rapidly in response to growing demand for ethanol.[16]

This rising competition for land will force policymakers to make trade-offs between competing land uses, whose carbon benefits are not always clear—such as whether fallow land should be used for biomass production or afforestation. As the recent corn ethanol debate has demonstrated, policymakers should be made aware of the lifecycle benefits of land-use, including the leakage effect that land-use policies within the U.S. have produced abroad.[17]

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[15] Assuming $50/ton marginal abatement cost from retrofit CCS to compensate for the failure to take advantage of forest offset opportunities.

[16] Agricultural Statistics Board, USDA, 2006.

[17] For additional information on the corn ethanol/ land-use tradeoff, refer to T. Searchinger, R. Heimlich, R.A. Houghton, et al., "Use of U.S. Croplands for Biofuels Increases Greenhouse Gases through Emissions from Land-Use Change." *Science*, February 2008.

The rising competition for land will also mean that increased financing will be required to incentivize forestry and land-use conservation and greening efforts. Of the opportunities outlined in the McKinsey report, almost all require significant financing support due to the high initial costs and ongoing expenditures necessary to maintain the projects, financing support that is driven primarily by the opportunity cost of land as well as the cost of planting and maintaining trees.

Foresting 40 million hectares in line with the objectives delineated above, for instance, would require an investment of some $6 billion per year, and due to the projected rise in land value, comparable projects are likely to require even more financing in the near future.[18] Such an investment is not unreasonable compared to the estimated $3.9 billion per year allocated in the U.S. to preserve open spaces, forests, and working land since 2001, but it is still a sizeable figure.[19] Consequently, without either the inclusion of offsets in a cap-and-trade system or government mandates and subsidies to protect land, the sector will not receive the financing needed to incentivize shifts in land management.

Growing demand for forest products. Relationships between demand for timber and forest conservation are complex and vary substantially among regions. Growing demand for forest products and bioenergy will undoubtedly encourage unsustainable harvesting practices and lead to deforestation and forest degradation. At the same time, revenues from timber harvest provide landowners with economic means and incentives to invest in sustainable forestry practices.

Good progress has been made in recent decades in the US and other countries in developing forest certification programs and other mechanisms to encourage greater use of sustainable forestry practices including measures to conserve biodiversity in managed forests and to avoid or minimize harvest in areas with high conservation value. Carbon offset programs should be designed to complement certification and other mechanisms for promoting forest conservation and sustainable forest management.

Lack of cost-effective, standardized carbon accounting methodologies. In the case of the creation of offset mechanisms as part of a potential cap-and-trade system, policymakers must agree on consistent offset accounting methodologies in order to establish baselines, prevent (or discount for) leakage, ensure offset permanence, and account for other environmental effects. Unlike emissions abatement, which can usually be easily measured, the value of carbon sinks is more difficult to assess.

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[18] Assumes $50/acre rental and establishment levelized cost (in line with the current value of marginal land in the U.S. Conservation Reserve Program) and $13/acre annual maintenance costs.

[19] Trust for Public Land and Land Trust Alliance, *Land Vote 2002: Americans Invest in Parks and Open Space*, Boston: Trust for Public Land, 2003.

Additionality, particularly financial additionality, is difficult to prove, as it is not always clear whether the sink would have occurred without outside intervention; plus, the possibility of leakage (if conserved land leads to deforestation elsewhere) must be taken into account.[20] So, too, is there the potential for impermanence (e.g., if a newly planted tree is prematurely cut down or is otherwise lost), along with the consequences of other environmental effects such as protection of biodiversity.

The need for aligning on consistent accounting methodologies is particularly true for forest management and forest conservation due to the difficulty of establishing baselines for these types of efforts compared to afforestation and reforestation projects. Neither the Kyoto Protocol nor major regional agreements like the Northeast's Regional Greenhouse Gas Initiative (RGGI) have provisions to support projects that reduce emissions from deforestation or forest degradation because of the difficulty of developing an agreed-upon accounting methodology. Efforts are underway to address this deficiency within RGGI.[21]

Despite the lack of precedent, methods for measuring, monitoring, and accounting for terrestrial carbon stocks are emerging. Indeed, the U.S. Forest Service's Forest Inventory and Analysis Team keeps detailed data that track annual carbon storage per hectare of all major tree species by region (data that is currently being updated based on ongoing analysis). In addition, methodologies been developed to account for offset measurement uncertainties: tonnage can be discounted, for instance, to account for the probability of leakage and impermanence, as was done for Bolivia's Noel Kempff Mercado Climate Action Project (the world's largest forest conservation project). The measuring and monitoring methodologies of the Climate Action Reserve, which registers and tracks offset projects as part of the California Climate Action Registry, already has significant regulatory credibility, having been adopted by the California Air Resources Board in 2007. The methodologies of the Chicago Climate Exchange also have broad support. Other regions looking to develop more robust offset mechanisms could draw upon these methodologies (see appendix Table IX for additional information on the Reserve).[22]

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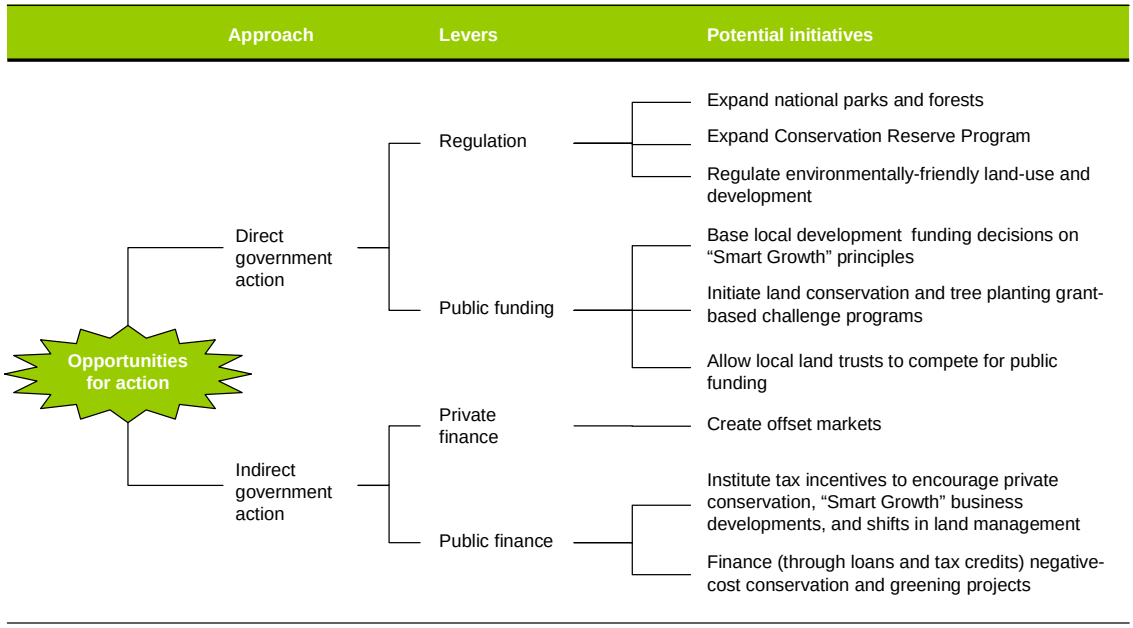
[20] Financial additionality—demonstrating that the project would not have occurred without carbon market funding—is far more difficult to prove than regulatory additionality (demonstrating actions not required by law) or measuring carbon additions from a base year (as for afforestation).

[21] Environment Northeast (ENE), Maine Forest Service (MFS) and Manomet Center for Conservation Sciences (Manomet) Draft-September 13, 2007. Prepared by Alec Giffen and John Hagan.

[22] Details regarding the Climate Action Reserve accounting guidelines, widely recognized as one of the most developed methodologies, can be found at http://www.climateregistry.org/ tools/protocols/project-protocols/forests.html.

POSSIBLE POLICY INITIATIVES

Policy initiatives can be divided into direct programs that take action to address the challenge of promoting forest growth (either through direct land protection regulations or grant funding) and indirect programs that motivate others to take action at the state, local, private citizen, or organization level (either through private financing, as is the case with offset mechanisms, or public financing in the form of tax incentives and loans).



Direct government action policy initiatives

Expand national parks and forests. Covering 34 million hectares, national parks currently constitute only 4% of total U.S. land. National forests constitute an additional 59 million hectares (23% of the total forest land in the U.S. and 7% of total land).[23] This is a large amount of protected land, but an estimated 65 million hectares of additional forests are severely degraded (e.g., are severely understocked,

[23] National Forest acreage based on U.S. Forest Service's Forest Inventory and Analysis; total forest acreage based on USDA's National Resource Inventory.

resulting in low forest cover and consequently low carbon sequestration) and could benefit from conservation.[24]

Expand the Conservation Reserve Program. As with forests, increasing amounts of cropland and pastureland could benefit from conservation, particularly as opportunity costs skyrocket and threaten to pull marginal land, already well below the tolerance level, back into intensive production. Since its inception in 1996, the federally administered Conservation Reserve Program has been extremely effective at reducing land erosion (which increases the carbon sink and prevents other detrimental environmental effects) by taking 12 million hectares of marginal land out of production.

The recent rise in crop prices, however, has encouraged many farmers to "de-enroll" from this voluntary program (participation year-over-year dropped 19% between 2006 and 2007). The emerging opportunities for farmers to receive financing for more environmentally friendly cultivation practices such as conservation tillage (this is one of the approved offset projects under the voluntary Chicago Climate Exchange) may mitigate some of the harm from the re-cultivation of these marginal lands, but these approaches will not do enough. Incentives in the form of increased payments (above the current rate of only $45 per acre) to match rising crop prices should be provided to counteract this trend for those lands identified to be most in danger of degradation from production.

Regulate land-use and development. Land cleared for residential development removes an estimated 50% to 67% of above-ground biomass and releases 22% to 25% of soil carbon.[25] Localities have a number of regulatory mechanisms at their disposal to mitigate these effects, which include:

- **The development of comprehensive Land Use Plans, which create a legally-binding blueprint for future development and conservation.** These plans should identify key lands and resources to be preserved and the proposed location and intensity of future developments. Localities can enforce the provisions of Land Use Plans through permitting and zoning approval decisions, which should explicitly include plans to mitigate the effects of development on carbon conservation. All states, plus six U.S. trust territories, have already developed State Wildlife Action Plans (also known as Comprehensive Wildlife Conservation Strategies) to set priorities for public agency actions to conserve habitat. Many of these states and territories are implementing the plans through multi-pronged partnerships

[24] Moulton & Richards, U.S. Forest Service, 1990.

[25] Environment Northeast, *Climate Change Roadmap for New England and Eastern Canada*, 2006.

involving public agencies at various levels of government and non-government organizations. Localities should use these "action plans" as a reference when developing local land-use plans.

- **Natural resource protection laws**. These regulations give local planning boards power to restrict development that will have adverse environmental effects, such as land filling, grading, mining, excavation, soil removal, building on floodplains, and disturbance of natural infiltration and percolation of precipitation to the groundwater table.

- **Zoning ordinances**. Zoning ordinances—which regulate the use of land, the density of land-use, and the siting of development—are a key mechanism by which localities can control development. These ordinances should include rules governing the environmental friendliness of developments—e.g., prohibit steep-slope building, or ban construction a certain distance from the high tide mark, or mandates to require developers to set aside a certain portion of developed land as open space. Ordinances can also mandate that emissions from land development be mitigated if they are to be eligible for public funding. Effective zoning techniques have included:

  - **Cluster zoning,** which bases development planning on tracts of land in their entirety rather than on a lot-by-lot basis. Cluster development can do much to preserve open space. In New York, the state legislature has provided local governments with the authority to use cluster development as part of their subdivision review process.

  - **Open-space zoning,** which uses clustering of building lots to permanently retain open space. Many localities in the Northeast have incorporated open-space zoning. One example of open-space zoning is conservation subdivision planning, which allows a community to designate a district where new subdivision development is not permitted to consume more than a certain percentage (often 50%) of any parcel. The remaining land is permanently restricted and further subdivision is not allowed.

  - **Overlay zoning** is a zoning technique for resource protection that can be used to direct development away from environmentally sensitive land. Overlay districts are imposed over existing zoning regulations and contain added provisions to provide further protection of specific resources (particularly useful for the

protection of floodplains, groundwater, scenic areas, steep slopes, woodlands, and wetlands).

Base local development funding decisions on "Smart Growth" principles. There is already large support for the adoption of Smart Growth principles, as evidenced by the 2005 U.S. Mayors' Climate Protection Agreement signed by 319 mayors, which, among other things, adopted Smart Growth principles. Limited programs exist to incentivize adoption of these principles, however, particularly at the state and federal level (as Smart Growth is largely being pursued only by localities at present). By virtue of controlling large amounts of the funds localities use for development, federal and state governments are in a unique position to encourage such localities to implement the Smart Growth principles they have endorsed. Prioritizing state development funding according to Smart Growth principles incentivizes localities to protect open spaces. Both Wisconsin and Maryland recently inaugurated "priority funding" initiatives governing municipal development budgeting.[26]

Sponsor challenge programs through matching grants to motivate state and local governments to preserve open space. Challenge initiatives can do much to incentivize widespread conservation spearheaded by localities—a decentralized approach to furthering conservation, which may be as cost-effective, if not more so, than massive, centralized conservation efforts. Most of the cost of conservation involves land opportunity costs, which do not allow for economies of scale, and labor, which many small-scale projects have "free" access to because of the potential to involve local volunteers. Such a "National Heritage Lands Program," which could be run at either the federal or state level (or both), would ideally be set up in the near term to induce land protection in the face of rapidly rising land values. The program could be funded though a combination of challenge grants from federal and state governments, as well as through local taxes on new home sales under a fund used for open-space protection—e.g., Maryland's "Program Open Space."[27] Revenue anticipation notes (RANs) have been used to bring forward projected collections so that funds for open-space protection can be applied at the fund's inception rather than waiting for the fund to build up over time.

In particular, federal and state governments could sponsor challenge grants for local governments that develop Smart Growth development planning funds. These funds can do much to preserve open spaces in the face of development.

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[26] Cynthia Nickerson, "Smart Growth: Implications for Agriculture in Urban Fringe Areas," *Agricultural Outlook*, April 2001 (Washington, D.C.: USDA, Economic Research Service, 2001), 27; www.op.state.md.us/smartgrowth/smartpfa.htm.

[27] 2,800 local projects have been funded through this initiative, which places one-half percent of the purchase price of a new home or land into a special fund; www.dnr.state.md.us/pos.html.

Massachusetts recently initiated this type of policy through its Community Preservation Act, which provides local governments matching funds for projects that preserve open spaces.

Federal and state governments could also initiate challenge programs to motivate state and local tree-planting programs (on both public and private lands), creating a "National Forestry Endeavor" where all citizens feel empowered to engage in afforestation. Particularly good areas that might be targeted are highway medians, street sidewalks, and public facility properties. Matching grants or free trees, fertilizers, and tools might be provided to spur local participation. Albuquerque, New Mexico recently initiated such a "Tree Initiative" where city and local nonprofits partnered to raise funds from corporate and private donations to plant trees in parks and other public places and encourage community "park ownership" initiatives.[28] As with open-space conservation, tree planting may be an initiative best accomplished at the local level due to the potential for eliminating many of the costs associated with large-scale afforestation, including labor (through the use of local volunteers) and land (by using "free" land such as medians, backyards, and open urban spaces). The recently enacted Federal Farm Bill laid out such a competitive grant program to support forest projects.[29]

Allow private conservation groups to compete for federal funds. Nonprofit land trusts are often far more effective and efficient at making land deals than government agencies due to greater flexibility, closeness to the community, and reduced transaction times. As a result, they have grown in popularity in the past decade: between 2000 and 2005, the pace of private land conservation by the roughly 1,200 local land trusts in the U.S. tripled, with total land acreage held by private land trusts increasing from 2.5 to 5 million hectares during the time period (note that this is twice the size of the state of New Hampshire).[30]

Despite their conservation success in recent years, however, local land trusts are not eligible to receive conservation funding in many jurisdictions—a reality that must be changed to introduce more competition into conservation budgeting processes. South Carolina's new Conservation Bank allows this, while also holding funding recipients accountable for results according to predetermined conservation targets—a competitive system that ensures government funds get used most efficiently.[31]

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[28] Tree New Mexico, http://www.treenm.com/6PROGRAM.htm#ati.

[29] U.S. Farm Bill, 2007.

[30] Land Trust Alliance

[31] Dominic Parker, *Cost Effective Strategies for Conserving Private Land*, Bozeman: PERC, 2002.

Note that it is essential that governments not provide grants haphazardly. Instead, these grants should be distributed to ensure the preservation of identified prioritized areas, namely, marginal land (e.g., land being used for productive purposes such as ranching or farming in a way that it is not sustainable) and important ecological habitats. Local, state, and federal governments planning to give significant grants for conservation should strive to make these plans even more specific. Maryland, for instance, recently engaged in a successful prioritization exercise involving biologists and natural resource managers to ensure that public funds were being expended on land of high ecological value at high risk of loss to development—a model that other states and localities should follow.[32] And, the recently enacted U.S. Farm Bill laid out provisions to provide State Foresters financial and technical assistance to develop and implement statewide forest resource assessments and plans to protect areas most in need of conservation.[33]

Indirect government action policy initiatives

Create offset markets as part of a possible carbon cap-and-trade system. Such a system would provide ample private sector financing to spur investment in greening and conservation projects, either in the U.S. or abroad. The EU Emissions Trading Scheme, along with regional U.S. agreements such as RGGI and the proposed Lieberman-Warner Climate Security Act (introduced in October 2007), allow for regulated carbon trading.[34] These allowances let businesses achieve cost reductions at lower compliance costs than they would otherwise be able to achieve with current technology.

Any U.S. offset mechanism should contain the following key provisions:

- **The system should recognize sustainable forest management, forest conservation, and land management as offset project types.** Forest management, including both active practices (e.g., changing species mix, thinning, extending rotation length, and propping up young trees with timber stands), as well as passive practices (e.g., limiting grazing) can significantly increase forest carbon, along with improving biodiversity. Currently,

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[32] Theodore Weber and John Wolf, "Maryland's Green Infrastructure—Using Landscape Assessment Tools to Identify a Regional Conservation Strategy," *Environmental Monitoring and Assessment* 63 (2000): 265-77.

[33] U.S. Farm Bill, 2007.

[34] The Lieberman-Warner Climate Security Act, introduced October 2007, provides for the creation of agricultural, forestry, and other land-use offset mechanisms, including offsets from conservation tillage, winter cover cropping, conversion of cropland to grassland, fertilizer use reduction, rice paddy flooding reduction, afforestation, forest management, and manure management (section 2403); note that this bill also contains provisions to dedicate 20% of expected revenues from the sale of emissions allowances towards conservation—an estimated $3 billion per year in the early years of the program, and increasing over time.

afforestation and reforestation (restoring forests to land that was once forested) are the only eligible forestry offset projects under most offset mechanisms, however. These types are admittedly easier to implement due to the facility with which a baseline can be established, but forest management is often far more cost-effective, particularly in regions where the opportunity cost of land is high (e.g., the Northeast and Pacific Northwest).

- **The mechanism must address the accounting challenges already delineated—namely, accounting for additionality, leakage, and permanence.** Additionality can be established by determining whether projects would have occurred without offset financing (such as by excluding projects required under existing regulations). To account for leakage, discount factors are often applied based on the probability of leakage, and entity-wide reporting is often required to account for and prevent the shifting of harvesting activity within a forest area. Permanence can be achieved by requiring long-term project plans (with at least 100-year timelines, following the minimal cycling of carbon dioxide in the atmosphere), annual reporting, periodic verification, and plans for replacing any credits that are lost during the project timelines (such as through a buffer or reserve pool of unsold reductions). The California Climate Registry Protocol and current RGGI rules also mandate that any forest offset effort is accompanied by perpetual conservation easement. Success at proving the reliability of a methodology for these projects in the U.S. would be directly transferable abroad to international protocols such as those of the Clean Development Mechanism (CDM), which still does not provide offset financing for most forestry-related projects.

- **In addition to resolving the accounting issues, enforcement obstacles must be overcome.** Offset providers should be certified according to international accreditation standards (such as the Voluntary Carbon Standard or the Climate and Biodiversity Alliance's CCB Standard) and monitored to ensure that the credits they are offering adhere to robust verification and accounting principles—something that is not assured in the current voluntary carbon trading market, where there is a preponderance of credit double-counting, the sale of non-existent credits, and the use of inconsistent measuring methodologies.

- **Carbon finance should build upon existing momentum in environmental banking**. Offset credits for projects that have positive environmental effects on the air, water, land, and biodiversity have long been used to offset environmentally degrading developments.

Environmental bankers, who create and certify offsets, have usually sold these credits to developers who are sometimes required by law to cap the amount of habitat destruction that takes place or offset destruction by paying for the protection of land with similar ecological characteristics. Any new carbon finance scheme should build upon the standards already achieved (such as verification protocols) and credit infrastructure developed in environmental banking.[35]

- **Finally, any offset mechanism that aims to be part of a sustainable climate solution must ensure private enterprise investment in offsets does not come at the expense of investments in technologies to abate emissions more cost-effectively** (e.g., CCS technology). Existing schemes have addressed this issue by limiting the use of offsets as a portion of the overall emissions cap, typically from 3% to 15%—efforts designed to keep the focus on reducing emissions, rather than merely offsetting them.[36]

Institute tax incentives to encourage conservation through private land donations, Smart Growth business development, and shifts in land management. The following are key initiatives that could be pursued:

- **Make qualified private land donations and conservation easements tax-deductible at the state and local levels.** Currently, qualified land donations and conservation easements are automatically tax deductible at the federal and state level, but the real property tax reduction is accepted only on an ad hoc basis at the local level (based on the rulings of the local tax assessor). An automatic property tax relief mechanism financed by the state or federal government and/or the creation of a tax credit against the state income tax would do much to further incentivize private land conservation. New York State currently has an income tax credit provision, but it is limited to $5,000 per year. Both Virginia and Colorado have much more robust incentives for state income tax benefits for land and conservation easement donations, including resale of the tax credits.

- **Promote existing conservation tax benefits.** Some tax incentives already exist but should be promoted to encourage both individuals and businesses to donate land. Making permanent the "enhanced" federal deductions that were available in 2006 and 2007 and have just been renewed for two more

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[35] Despite being at a small scale (there is only 30,000 hectares of wetland banking in the U.S. and 16,000 hectares of conservation banking), existing environmental credit markets have a long history that new carbon credit markets could build upon.

[36] Both the EU Emissions Trading Scheme (ETS) and RGGI have instituted offset "caps."

years would be an important additional incentive. Governments should make large landowners aware of these opportunities.

- **Institute business tax incentives to develop brownfield and greyfield sites (e.g., land previously used for industrial activities that has since been abandoned), rather than greenfield sites (undeveloped land).** By one recent estimate, every acre of redeveloped brownfield saves 4.5 acres of open space.[37] Already-developed but abandoned sites are ideal locations for environmental facilities, particularly those with hazardous materials that should be located away from housing developments, but this should not be done at the expense of open-land development if it can be avoided (due to the potentially negative ecological impacts). New power plants, transmission facilities, and industrial plants are also good candidates for siting on abandoned land.

- **Encourage tax-benefit reciprocity between localities**. Reciprocal policies regarding the tax benefits of easements would do much to incentivize conservation. As with the Smart-Growth-based funding decisions advocated above, federal and state governments are in a unique position to induce states to adopt these beneficial policies by making the existence of reciprocal agreements a prerequisite for funding approval.

- **Support tax-exempt revenue bonds issued for the acquisition of forest land by buyers who commit to sustainable forestry.** These low-cost revenue bonds, backed by the revenue streams generated by sustainable forestry on the land (e.g., limited timber harvesting), would allow land buyers committed to sustainable land management to borrow money for land acquisitions at lower costs. Legislation supporting the creation of these bonds is currently pending in Congress (S. 1952).

- **Expand and extend current tax deductions** beyond merely "qualified ranchers or farmers" to all landowners whose subject property is at least 50% forested, as defined by the U.S. Forest Service (lands with 10% or more canopy cover). This would provide greater incentives for private conservation efforts.

Finance (through loans and tax credits) negative-cost conservation and greening projects. Some forest- and land-management activities have positive economic benefits that can fully offset the cost of project implementation. Thinning, for instance, can reduce the risk of fire, increase growth rates, and provide wood

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[37] Office of the Press Secretary, White House. "President Signs Brownfields Bill," http://www.whitehouse.gov/news/releases/2002/01/20020111-3.html.

products for energy and construction use (in some countries like Brazil, the cost of thinning managed timberland is more than offset by the sale of biomass to local cogeneration facilities). Lengthening harvesting cycles at tree plantations can be comparably economic. Indeed, a recent study found that lengthening the harvested age could actually maintain harvest levels over the plantation lifetime while increasing total carbon sequestration.[38] Similarly, afforestation/reforestation projects in the U.S. that support sustainable timber harvesting (through longer harvesting cycles and reduced collateral damage to tree stands from harvesting) provide average returns of 6% to 9% (for additional data on U.S. timberland returns, refer to appendix Table X).

The availability of public financing, however, is often a critical part of making the risk/return profiles of these projects attractive to potential investors. This dependency on public finance obviously varies by region. Some regions like the southeast, where forestry projects can be undertaken cost-effectively due to high growth rates, are reliant on public finance to generate attractive returns to only a limited degree. In contrast, upwards of 75% of returns from conservation projects in western states are driven by favorable public finance terms.[39]

By providing financing, the government could incentivize greening while collecting revenues, which could then be allocated to other, more costly conservation efforts. If the government does not wish to provide the actual financing, it could still incentivize these projects indirectly by providing a portion of interest payments to the private debt holder, as Norway and the World Bank currently do, which increases the availability of financing.[40] The New Market Tax Credit Program, which was authorized by Congress to attract $15 billion of private-sector capital investment into financing community development projects (through a direct federal income tax credit of 39%), is already proving to be a powerful tool for local environmental preservation projects. State and local governments can support this program by promoting tax benefits to investors and providing additional state income tax credits.

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[38] Nabuurs, G.J., O. Masera, et al., "Forestry." In *Climate Change 2007: Mitigation*, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2007.

[39] U.S. Forest Capital.

[40] Norway promises to provide a portion of interest payment to the private debt-holder and the World Bank provides cash reserves to be used to cover interest payments during cash shortfalls.

SUGGESTED TOPICS FOR DISCUSSION

¶ **Issues**

- Why should expanding the U.S. carbon sink be a part of the climate solution?
- What elements of expanding the U.S. carbon sink can be applied to solving the international forestry and land-use crisis?

¶ **Policies**

- What are the most effective conservation and greening initiatives that could be implemented? What are their relative costs and effectiveness (in terms of both carbon sink and conservation potential)? What are their relative "time to results" and barriers to implementation? What evidence or case studies support the viability of these initiatives?
- How can state and federal governments best facilitate local action?
- If offset mechanisms are allowed under a future U.S. cap-and-trade system, what provisions should such a mechanism include to address the issues of additionality, leakage, and impermanence? What provisions should be included to ensure that investment in emission reduction in other sectors is not inhibited?

¶ **Action**

- How can carbon conservationists work with existing environment-related conservation groups to build support for their policies? What messaging can be used to build such a coalition of environmental stewards?
- What proof-of-concept projects might be proposed to implement the above initiatives? To implement other promising initiatives?
- Next steps?

* * *

With such significant carbon sink potential, forestry and land-use in the U.S. present a huge opportunity for action given the current climate crisis. This call for action is strengthened by the growing need to protect our open spaces and biodiversity—an end in-and-off-itself that is becoming more imperative in the face of rapid urban development.

The question remains, however: which pathway should be pursued to attain these ends? Other regions have prioritized indirect methods of boosting carbon stocks by incentivizing the creation of carbon offset markets, yet the lack of alignment on verifiable forest project types and accounting issues of permanence, leakage, and additionality associated with carbon-offset financing will have to be overcome before U.S. policymakers are likely to justify replicating such a system in the U.S. Moreover, the proliferation of low-cost offsets may allow private players to delay investing in developing low-energy infrastructure, a necessary step before the climate crisis is truly solved.

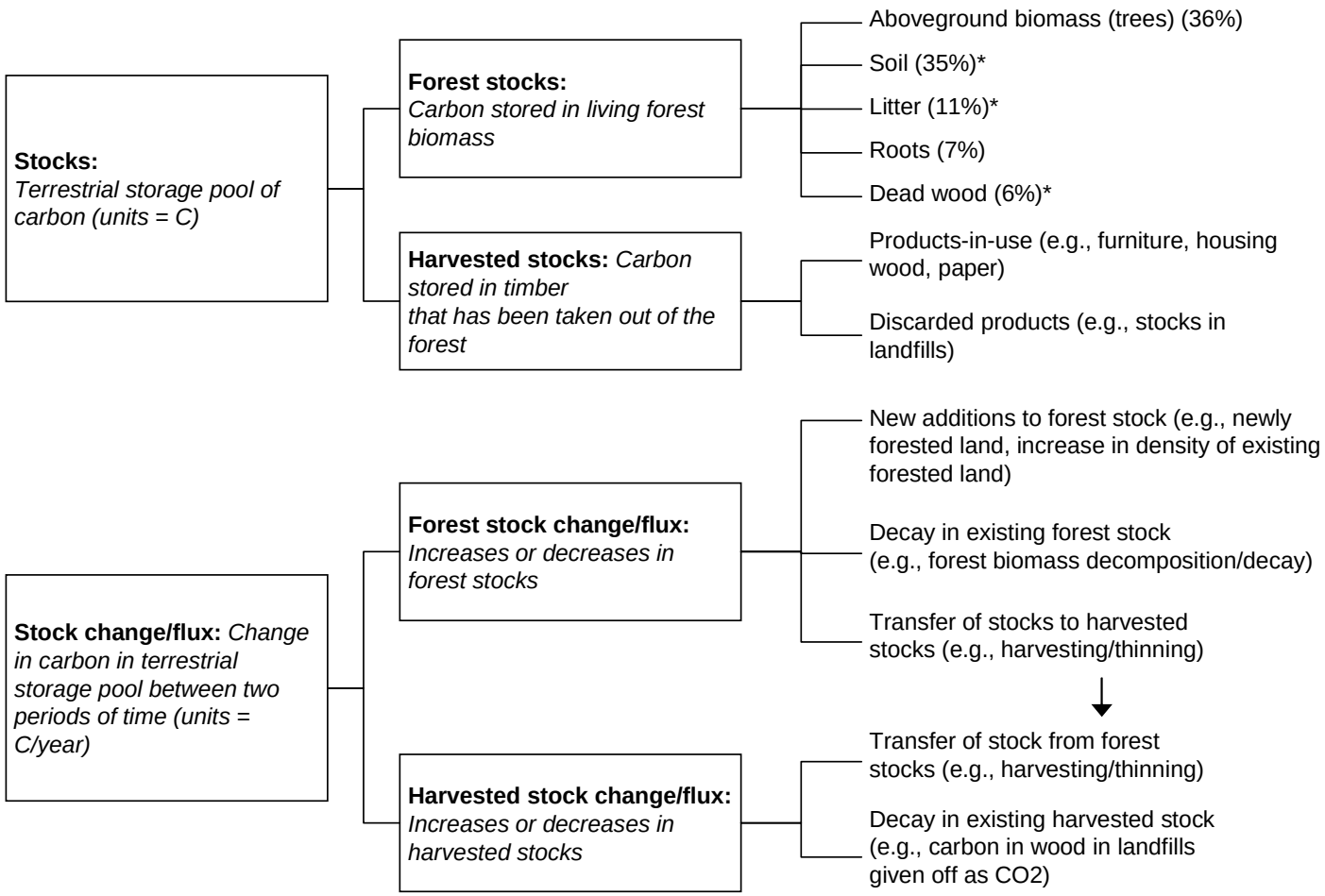
Fortunately, there are a number of other programs that policymakers could pursue in the meantime to promote land and forest conservation and greening. Among these are protecting land, incentivizing Smart Growth, and promoting land conservation through tax incentives, public financing, and challenge grants. Federal and state governments are in a position to take the lead in initiating many of these initiatives: as overarching governing authorities, they can not only incentivize local action through budgets and legislation, but they often have far more elastic revenue sources at their disposal than revenue-strapped local governments do, with which they can fund promising, long-term projects.

Whichever approach is chosen, policymakers should be conscious of two things. First is the need to build upon existing momentum in conservation-related markets such as air, water, and wildlife protection. Indeed, forest-carbon supporters, acting in collaboration with this coalition of environmental stewards, will be far more effective than if they pushed their agenda alone. So, too, is there much to be learned—from the protocols of environmental finance to the identification of areas most in need of protection—from these other groups, as they have been pursuing conservation-related policies for decades.

Second is the imperative to apply the lessons learned in expanding the U.S. carbon sink toward reversing the very ominous trends in forestry and land-use that are occurring abroad. The estimated opportunity to abate 500+ million tons of carbon emissions from growing the U.S. carbon sink is large but the opportunity to build on

the learnings achieved through U.S. policies to curb deforestation and foster afforestation/reforestation efforts abroad is even larger. Developing more reliable offset markets, pioneering new carbon-project financing approaches, aligning on accounting methodologies for a broader list of carbon offset projects, and raising awareness about the importance of land-use and forestry in solving the climate crisis—these steps will all be pivotal in translating success in land-use and forestry policy in the U.S. to success in these areas abroad. Consequently, the U.S.-focused land-use and forestry policy actions proposed here should be seen as the first step in a much larger process of developing a globally-focused policy—one that will provide a longer-term solution to the climate crisis we currently face.

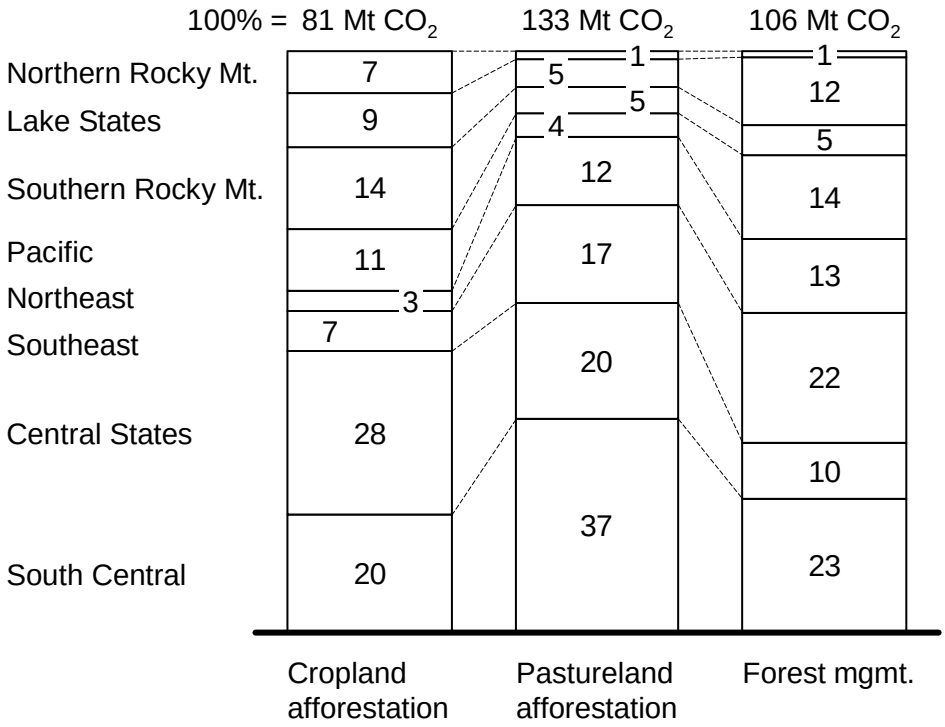
Table V: Definitions of carbon stocks and flux



** Dead wood includes all non-living woody biomass (standing, lying or in soil); litter includes non-living biomass with diameter less than 7.5 cm lying on ground; soil includes all organic material in soil to depth of 1 meter (but excluding roots of aboveground biomass).*

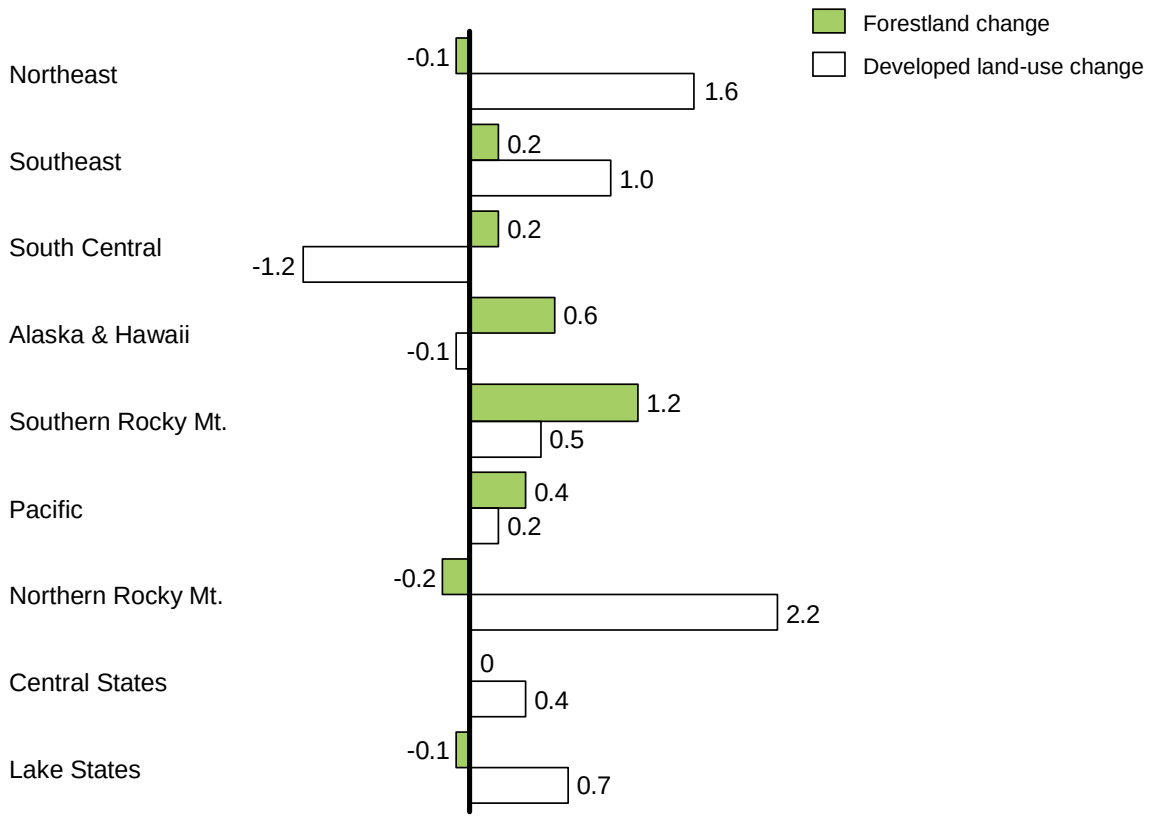
Source: EPA, 2007; team analysis.

Table VI: Conservation opportunity breakdown by region, Percent



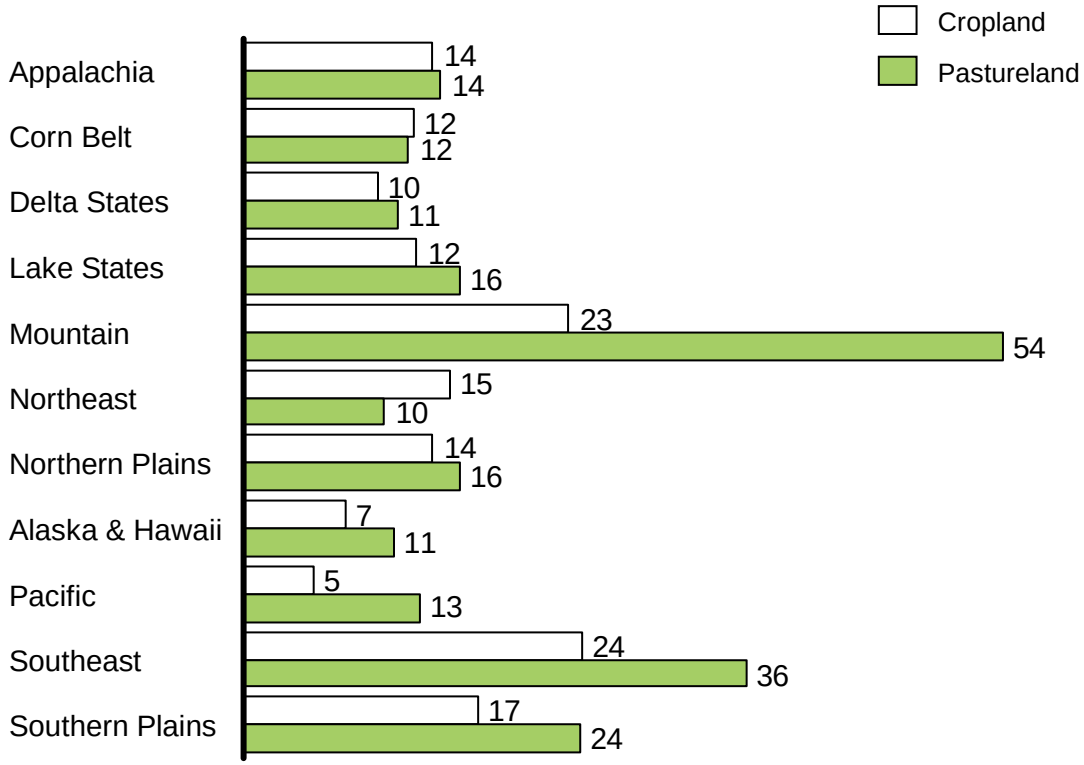
Source: McKinsey Greenhouse Gas Abatement Mapping Initiative, 2007

Table VII: Comparative land-use changes by region, 1997-2002, Percent



Source: USDA

Table VIII: Land value growth rates, 2005-2006, Percent



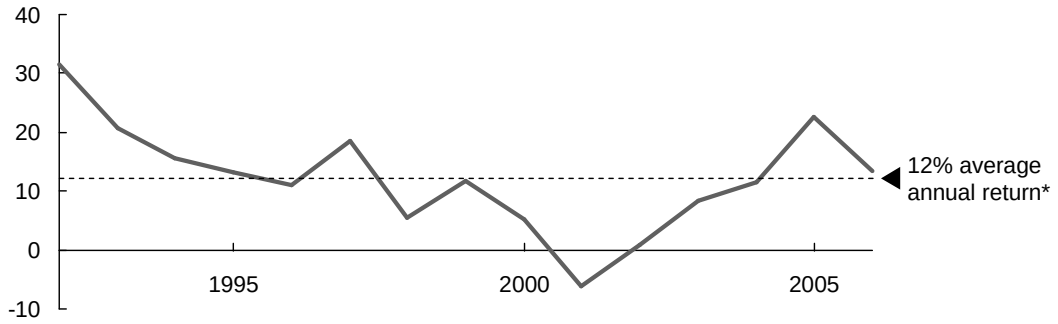
Source: USDA

Table IX: California's Climate Action Reserve

Description	• Registers and tracks verified greenhouse gas (GHG) emission reductions
Project types	• Forest conservation (avoided deforestation) • Afforestation/reforestation • Forest conservation management • Livestock waste management • Landfill methane capture and combustion
Accounting protocols	• Additionality assured by requiring activities to reduce GHGs significantly more than standard practice in an industry and ensuring projects are not driven by regulatory or other requirements • Reserve accredits and trains verifiers • Reserve makes all carbon reduction tons ("CRT") public and tracks them to prevent double selling (each CRT has a unique serial number imbedded with information that identifies the project type, location, developer and year)
Success-to-date	• Reserve's forestry protocols adopted by California Air Resources Board (ARB) (October, 2007) • Launched The Climate Registry to support entities across the U.S. to report GHG emissions reductions (May 2007)

Source: http://www.climateregistry.org

Table X: Annual returns from U.S. timberland, 1992-2006
Percent



** Annual return = (Net Incomet + Capital Valuet)/ Capital Value t-1)-1*
Source: Hancock Timber Resources Group

ADDITIONAL REFERENCES

- **Land-use and land values**
  - USDA, Economic Research Services: http://www.ers.usda.gov/Briefing/LandUse/
  - USDA, National Agriculture Statistics Service: http://www.nass.usda.gov/index.asp
  - U.S. Forest Service, Forest Inventory and Analysis National Program: http://fia.fs.fed.us/
- **Conservation and greening project carbon benefits**
  - USDA, 1605(b) Greenhouse Gas Registry Guidelines (including sequestration estimates by forest type by region): http://www.usda.gov/oce///global_change/gg_reporting.htm
  - Winrock International publications (including reports on cost-effectiveness of forest offset options in various U.S. regions): http://www.winrock.org/publications.asp
  - EPA, "Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture," November 2005: http://www.epa.gov/sequestration/greenhouse_gas.html
- **Smart Growth**
  - The Smart Growth Network: http://www.smartgrowth.org/about/default.asp
  - EPA: http://www.epa.gov/livablecommunities/
- **Carbon offset mechanisms**
  - California Climate Action Reserve, including accounting guidelines: http://www.climateregistry.org/
  - The Northeast's Regional Greenhouse Gas Initiative (RGGI): http://www.rggi.org/
  - Clean Development Mechanism: http://cd4cdm.org/

- Provisions of S.2191: America's Climate Security Act of 2007 (Lieberman-Warner climate bill), including proposed offset mechanism: http://www.govtrack.us/congress/bill.xpd?bill=s110-2191

- **Land protection**
  - The Pacific Forest Trust: http://www.pacificforest.org
  - National Parks Conservation Association: http://www.npca.org/
  - Conservation Reserve Program: http://www.nrcs.usda.gov/programs/crp/
  - Land Trust Alliance: http://www.lta.org
  - The Nature Conservancy: http://nature.org
  - The North Shore Alliance: www.northshorelandalliance.org