Forest Carbon Resource Guide

Topic 5: Linking Forest Carbon Modeling with State Decision-Making

Table of Contents

Introduction

Managing forest ecosystems under a changing climate requires flexible and adaptive approaches to meet the needs of today as well as the challenges of tomorrow. The current and future management of forests needs to be informed by the best available data and modeling tools to ensure resilient management strategies and the balancing of trade-offs between ecosystem services. Environmental policy and planning provide *opportunities* to respond to both the pressures of climate change and the needs of society; in addition to being data- and science-informed, intervention development should incorporate political, social, and economic realities in order to maximize effectiveness and equity. Data and modeling tools can be used to inform decision-making from state-level Forest Action Plans to increasingly localized parcel-level management interventions, allowing managers to balance trade-

offs between both ecosystem services and management priorities. When used together with stakeholder engagement, community outreach, and public communication, decision-makers and managers can prioritize and plan for rapidly changing conditions to ensure healthy and vibrate forests into the future.

This Resource Guide first discusses the importance of prioritizing environmental, social, and economic synergies and efficiencies in policy-development. It next examines tradeoffs and co-benefits associated with diverse forest carbon interventions. Last, it lays out existing state-level policies and programs impacting forest carbon.

Prioritizing Synergies and Efficiencies in the Forest Carbon Space

The forest sector has a role to play in both climate change adaptation and mitigation, the latter through carbon storage and sequestration, as well as displaced carbon emissions (via product substitution). Mitigation activities, or strategies, include any actions to minimize climate change by reducing sources of greenhouse gas (GHG) emissions from forest management, enhancing carbon sequestration, and storage of forest carbon in biomass (both living and dead) and in soil. Forest management strategies designed to maximize atmospheric carbon dioxide removals include a variety of diverse mitigation activities – strategic selection among them will depend on the ecological, social, economic, and political realities in a given area.

Although tradeoffs may exist between management objectives, managing forests for their mitigation potential need not in all cases come at the expense of other forest and environmental priorities. In fact, managing forests for climate change adaptation, mitigation, and resilience can, in many cases, be carried out in tandem with management for additional forest values (or co-benefits), such as timber production, increased biodiversity, aesthetic and recreational values, habitat protection, and water filtration, among many others. Carbon modeling can help to tease out which mitigation activities might maximize carbon benefits for different locations, forest types, etc.; determining a favorable mitigation strategy for a given forest within a landscape requires additional assessment of the land to evaluate its potential for treatment, intervention, or protection, alongside careful consideration and prioritization of desired management outcomes.

As forest managers seek to prioritize multiple management objectives, they (as well as policymakers devising forest carbon interventions) will need to be aware of how any given management practice may differentially impact a diversity of management objectives, positively or negatively. This knowledge

will help to identify synergies, efficiencies, and existing tradeoffs across management practices. As an example, leaving residual patches in temperate climate hardwood stands during timber harvest may help to maintain higher carbon stocks and reduce management-related emissions. Although a carbon-beneficial action, this mitigation activity will reduce the amount of timber produced during each harvest (a trade-off); on the other hand, it may synergize well with other high-priority values for the landowner, such as increased biodiversity, improved habitat for wildlife and game, more desirable post-harvest aesthetics, and increased natural regeneration via seed production of residual trees (co-benefits). Similarly, synergies and efficiencies can be identified, assessed, and prioritized in the forest carbon policy space.

Acknowledging Tradeoffs & Co-Benefits in Carbon Management

Ecosystems are managed for a variety of reasons; forest carbon storage and sequestration is just one such management priority. While managing for carbon *may* have ecological, social, and economic co-benefits, these co-benefits cannot be assumed; exclusive prioritization of carbon in management and planning could, in some cases, have detrimental impacts on forest health, productivity, resilience, and adaptive capacity, among other concerns. The balancing of co-benefits and trade-offs between forest carbon and other management goals takes careful consideration with a localized understanding of an ecosystem's specific context. For example, the priority for coastal forests may be prioritizing sea level rise and biodiversity as opposed to carbon management.

It is important to note that prioritizing forest health and resilience can bolster long term storage of carbon by protecting current carbon stocks and reducing risk of catastrophic disturbance; thus, a management activity may be carbon-beneficial (or a co-benefit) even where it is not the primary, or an explicit, objective. Furthermore, forests provide not just mitigative but adaptive capacity to landscapes; management considerations need to remain flexible in response to the complexities of managing forests under a changing climate and future growing conditions.

Table 1 (from McKinley et al, 2011), explores the uncertainty, co-benefits, and trade-offs associated with important carbon mitigation strategies, or activities. Whether co-benefits can be expected, or tradeoffs and uncertainty should be concerns, for a given forest landscape will depend on location-specific ecological as well as social conditions and institutions. Table 1 provides important elements for consideration that forest managers and policymakers alike would benefit from assessing at the local or regional level.

Table 1. Uncertainty, co-benefits, and trade-offs of proposed carbon mitigation strategies. Table source: McKinley et al. 2011.

Mitigation Strategy	Uncertainty	Co-benefits	Trade-offs
Avoided deforestation	low: uncertainty about leakage; uncertainty about risk of disturbance	any watershed protection, biodiversity, wildlife habitat, recreation opportunities depend on type of avoided deforestation	lost economic opportunities affecting farmers or developers directly
Afforestation	low-moderate: depends on where afforestation is done; uncertainty about biophysical effects, leakage, and risk of disturbance	erosion control, improved water quality; any biodiversity and wildlife habitat improvements depend on type of afforestation	lower streamflow, lost revenue from agriculture, demand for agricultural water; increased release of N_2O reduces the carbon benefit
Decreasing C outputs (harvest)	moderate: uncertainty about how to influence landowner behavior efficiently to decrease harvest; leakage effects could be significant	increased old-growth seral stage; structural and species diversity, wildlife habitat; effects on benefits depend on landscape condition	displaced economic opportunities affecting forest owners, forest industry, and employees
Increasing forest growth	low	higher wood production, potential for quicker adaptation to climate change	lower streamflow, loss of biodiversity; release of N_2O reduces the carbon benefit; greater impacts of disturbance on carbon storage
Biomass energy	moderate: uncertain technology	increased economic activity in forest products industries, could reduce costs of forest restoration efforts	intensive forest management on larger area, lower carbon storage in forests
Product substitution	moderate: difficulty demonstrating additionality, limitations in expanding wood use in construction applications	increased economic activity in forest products industries	active forest management on larger area, lower carbon storage in forests
Urban forestry	high: net carbon benefit depends on many factors	any shading, reducing energy use for cooling, wildlife habitat, recreation projects depend on type of project	high maintenance requiring inputs of water, energy, and nutrients, particularly if forests were not the native ecosystem and with poor

			species choice; release of N_2O reduces the carbon benefit
Fuel treatments	high: benefits have not yet been examined at landscape scale; large unknowns remain about carbon benefits	lower risk from fire and insects; increased economic activity; possible offsets from use of wood	lost economic opportunities to firefighting businesses and employees; lower carbon on site

Notes: We define uncertainty as the extent to which an outcome/result is not known. All the listed mitigation strategies have a risk of leakage and reversal, which could compromise carbon benefits and permanence, respectively.

Carbon-Informed Policymaking

U.S. states are striving to develop policies and programs that lower greenhouse emissions. Forests have the ability to play a unique role in that they contribute to sequestration, storage, as well as substitution; accordingly, forests are becoming integral to state climate plans and adjacent policy areas. Improved understanding of forest carbon through the estimation and modeling of carbon dynamics and carbon accounting will help elucidate the carbon implications of diverse forest management activities. However, much attention must be paid to the strategic selection of levers or policy mechanisms to achieve the desired behavioral change and carbon (and sustainable forest management) results.

Forest carbon policies and incentive programs should have projected carbon benefits as well as no projected net losses to other environmental considerations (e.g., water quality, forest health, wildlife habitats, biodiversity, etc.); there must additionally be sufficient implementation capacity in order to achieve the desired, or modeled, shifts in management practices. The latter takes into consideration project scale, available resources, and local barriers to implementation or adoption (including social, political, and economic realities), among other factors.

Analysis and strategic selection and development of policies and other interventions will incorporate local context, needs, and realities. The majority (58%) of US forestland is under private ownership (with strong variation across states and regions – e.g., 73% in the Northern Region, see Hoover and Riddle, 2021). If policies and programs do not effectively shift the cost-benefit analyses of forest use decision-making among this large group, the projected carbon benefits associated with shifts in forest management are unlikely to come to fruition. Careful attention should be paid to *why* landowners and land managers are not currently engaging in activities deemed carbon-beneficial (e.g., cost considerations, knowledge gaps, risk aversion, other barriers or conflicting priorities) and what the opportunity costs of such a behavioral shift

might be. Answering these questions will help to inform strategic intervention development, including the necessary technical and financial assistance as well as potential regulations that may most effectively and equitably achieve carbon goals.

The Policy Landscape

There is a wide range of opportunities to create a positive impact on forests, carbon, and climate through policy and program design. Figure 1 highlights key examples of what policies often target in the forest carbon space.

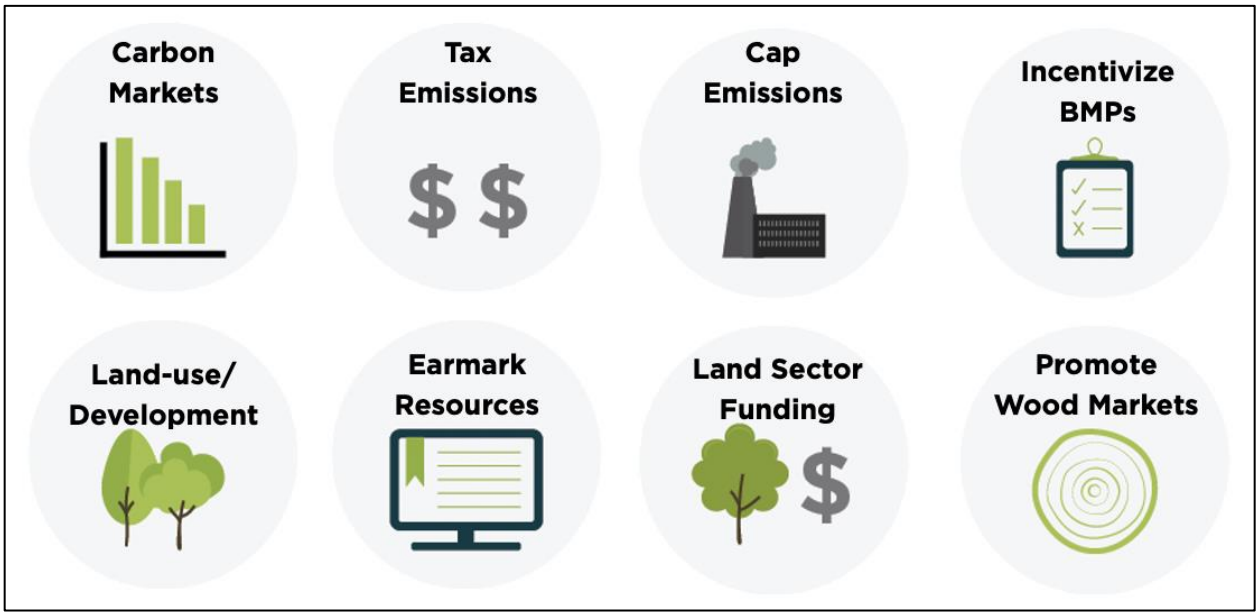


Figure 1. Examples of what forest carbon policies often target

Table 2 categorizes the existing forest carbon policy landscape across private and public lands. It is important to note that these policies, regardless of land ownership, do not operate in isolation from one another. Statutes governing embodied carbon and urban growth boundaries, for instance, will collectively impact the demand for and supply of wood products, together informing forest manager behavior. That said, we have strived to categorize these policies to illustrate intent, design, and the land ownerships for which they were specifically crafted. While some policies and programs were developed to explicitly address carbon and climate concerns, others stand to have significant carbon co-benefits without carbon being the primary, or explicit, target (e.g., those encouraging or facilitating forest health or conservation).

Table 22. Existing Policy Landscape

Ownership Category	Policy/ Program Type
Public Lands	State Forest Certification
	No Net Loss
	Urban Forestry and Municipal Programs
Private Lands	Forestland Protection and Conservation Partnerships
	Urban Growth Boundaries
	Forest Property Taxes
	Renewable Portfolio Standards
	Cost Share Programs
	Conservation Easements
Public and Private Lands	Forest Best Management Practices (BMPs)
	Emissions Trading Scheme (ETS)
	Embodied Carbon Policies
	Wood Use Requirements

Public Lands

Public lands are owned and managed by local, state, tribal, and federal governments. Nearly 40% of the United States is pubic land, which includes national forest, national parks, wildlife refuges, rangelands, state trust lands, state parks, and municipal parks (Headwater Economics, 2019). 84 million acres, or about 11% of all U.S. forestland, is managed by state and local governments (Hoover and Riddle, 2021), making these lands crucial in the implementation of climate-smart policies.

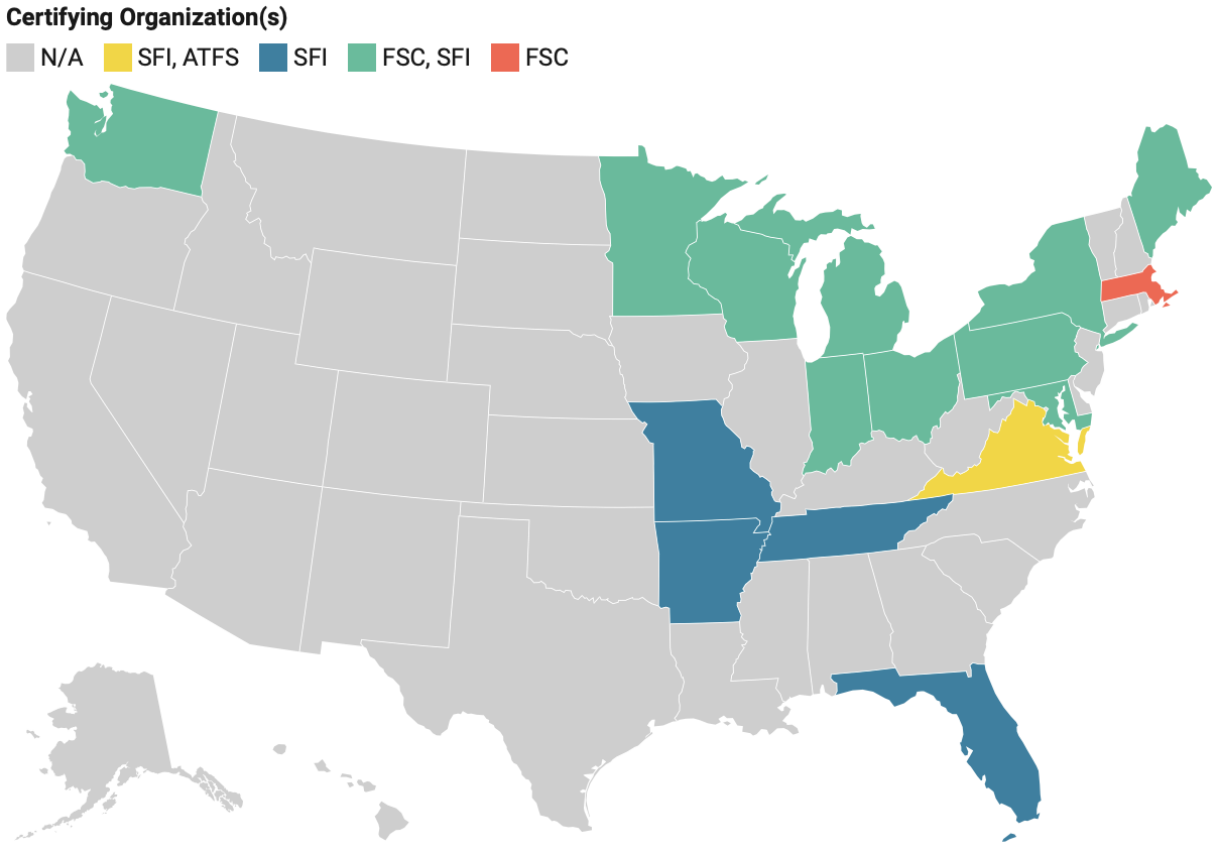
State Forest Certification

Some states have had all of their state forest lands certified. While such action does not necessarily suggest a change in forest management activities, it provides transparent, third-party assurances for a certain standard of sustainable forest management. This involves the implementation of mechanisms for monitoring, tracing, and labeling forest related products, where the quality and quantity of forest management is judged against standards set by a certifying body (WWF, n.d).

Certification bodies used by states include the Forest Stewardship Council (FSC), the Sustainable Forestry Initiative (SFI), and the American Tree Farm System (ATFS). These bodies uphold specific forest management requirements, such as meeting or exceeding all applicable laws and regulations, recognizing and respecting the rights of workers and Indigenous Peoples', monitoring and assessing forest conditions, and establishing long-

term tenure and use rights that lead to environmental and social co-benefits (FSC, n.d) (SFI, n.d) (ATFS, n.d).

Figure 2. State Forest Certification



As of 2022, state forests in 16 states are certified by one or more certifying bodies, with ten states certified by FSC and SFI, four states certified by SFI, one state certified by FSC, and one state certified by SFI and ATFS (Figure 2).

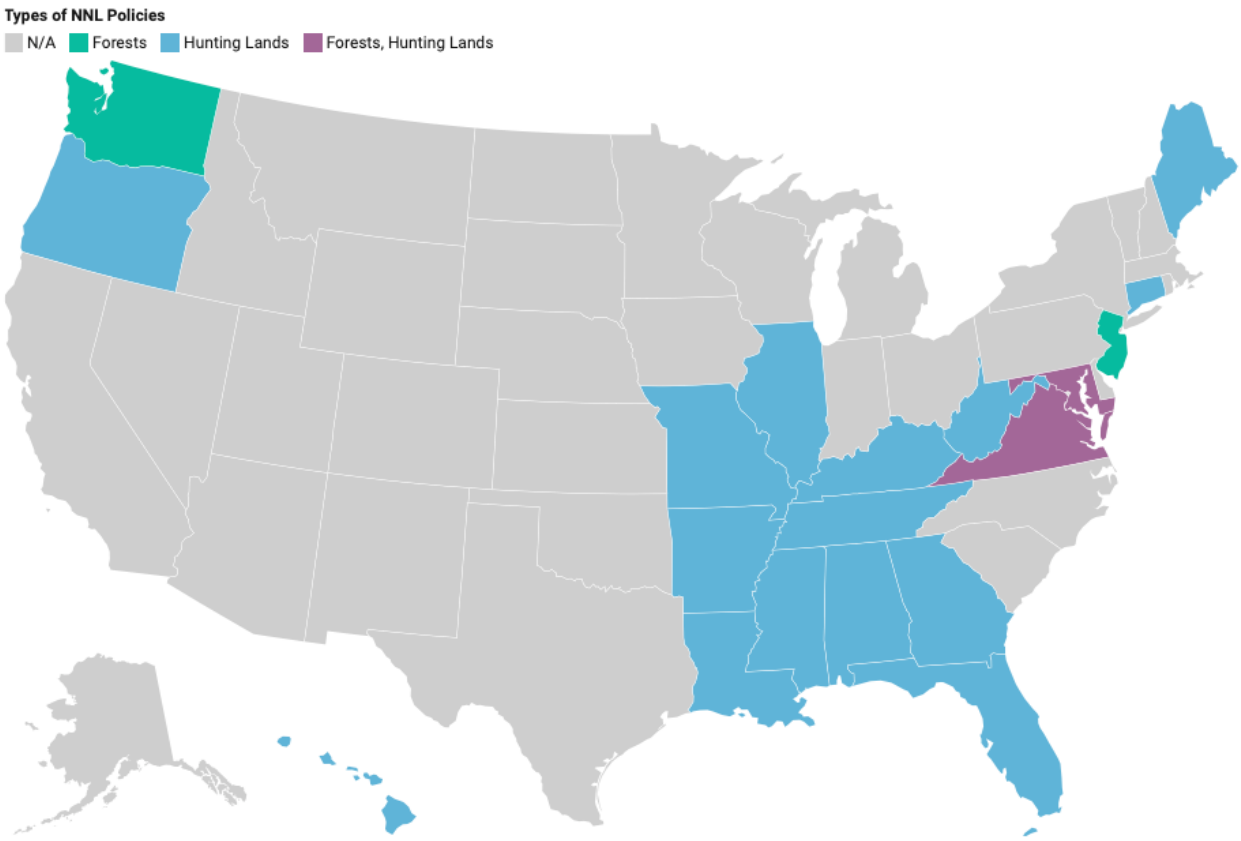
No Net Loss

No net loss (NNL) policies refer to measures to avoid or minimize net losses, where any losses of forestland are balanced or outweighed by gains. In the US, NNL policies typically apply to wetlands, hunting lands, and forests.
States with NNL policies usually require the government agency tasked with regulating that sector (e.g., the Departments of Natural Resources or similar agencies) to ensure that the same amount of public land is maintained.

NNL of forest policies target sustainable forest management and a set level of tree canopy cover deemed satisfactory. This is accomplished through increasing forest cover where needed, avoiding conversion to other land uses, protecting forests and increasing resilience, mitigating permitted losses, and

monitoring resiliency and carbon (Connecticut Department of Energy and Environmental Protection, 2020). One example, the Maryland Forest Preservation Act of 2013, highlights the importance of forests as a natural climate solution, and proposes specific activities such as timber stand improvement, conservation practices, and reforestation. The legislation sets out to achieve a goal having 40% of all land in Maryland covered by tree canopy.

Figure 3. No Net Loss



As Figure 2 demonstrates, a small minority of states (36%) have a NNL policy for hunting lands or forests. Of these 18 states, 78% exclusively have a hunting lands policy. Only four states (Maryland, Virginia, New Jersey, and Washington) have legislation referencing no net loss of forestland.

Urban Forestry and Municipal Programs

Urban forestry relates to planning and management efforts to improve urban tree health for the purpose of providing ecosystem services to an urban environment. With over 141 million acres of forests in cities and towns across the U.S., urban forestry and municipal programs are essential to promoting sustainable development and climate resiliency (USFS, n.d). Further, debates surrounding tree inequity (defined as the uneven distribution of urban trees in

neighborhoods that are socioeconomically disadvantaged) have given rise to urban forestry as a necessary solution in addressing inequities in the built environment (AFF, n.d).

Variations in capabilities, priorities, and functionality at the municipal level make it difficult to generalize the structure and mechanisms used in delivering forestry programs to urban areas. Cities with such programs will usually outline tree management goals (e.g., tree canopy density, trimming, tree removal) with a mix of regulatory, educational, and public outreach tools to achieve their objectives. Additionally, some municipalities coordinate with urban planning departments to make trees essential parts of urban infrastructure.

In terms of national policy, the U.S. Forest Service's Urban & Community Forestry Program provides technical, financial and educational assistance surrounding nature-based solutions and green jobs to cities (USDA, n.d). In fiscal year 2021, USDA distributed over $31 million to non-profits and state agencies for the purpose of urban forestry. The program's Ten-Year Urban Forestry Action Plan, which outlines specific goals, actions and recommendations for improving urban and community forestry, supports "the integration of urban forestry into all scales of city, regional and state-scale master plans" (USDA, 2015).

One example of a state with strong urban and community forestry policies is New York. The New York State Urban and Community Forestry Program (UCF) is a partnership between cities, non-profits, volunteers, the private sector, and government that aims to provide support communities in planning, management and education surrounding urban forests (New York DEC). This collaborative model allows cities to be flexible with how they interact with state level policies, as cities all have different wants, needs, levels of capacity and environmental constraints. Funding is distributed via competitive cost-share grants by the State of New York and the U.S. Forest Service.

Additionally, the New York State Urban Forestry Council (UFC) administers New York ReLeaf, a state level program that brings together experts in the urban forestry sphere to provide resources, such as technical expertise, information, and potential funding sources (UFC, n.d). Examples of such technical assistance include guidelines for creating tree ordinances at the city level, which provide the framework for managing community forests (UFC, n.d). This is significant, as tree ordinances are part of the legal framework that outline forestry programs, municipal responsibilities, and passing regulations and minimum standards for management. These adjustable and flexible documents can help municipalities link to state level policies that provide funding and education. These are meant to be adjustable based on the local wants and needs, which vary greatly across the state.

Private Lands

Almost 60% of U.S. forest land is privately owned. Accordingly, there are several policies and programs directed toward private landowners, corporations, and tribal communities; buy-in from these groups is essential in the pursuit of sustainable forest management activities. A management practice identified as carbon-beneficial (e.g., through carbon modeling and related assessments) will remain purely theoretical if it is not adopted on the ground. Policies and programs, accordingly, seek to shape private landowner behavior vis-à-vis their forests both via regulations (e.g., urban growth boundaries) and incentives (e.g., property tax credits).

Urban Growth Boundaries

Urban growth boundaries (UGBs), in an attempt to curtail urban sprawl, allow for urban development inside a specific boundary while preserving the open or agricultural spaces beyond it (South Carolina Department of Health and Environment, n.d). As such, UGBs established by local municipalities are primarily used to establish zoning regulations and make land use policy decisions. In turn, these boundaries impact private landowners by limiting development, land use change, and forest loss.

State governments in Oregon, Washington, and Tennessee mandate the use of UGBs by cities and/or counties. While other states lack such strict requirements, metropolitan areas (e.g., Miami-Dade County, Florida; Boulder, Colorado) across the U.S. have adopted UGBs to contain urban development and conserve natural spaces.

Forestland Protection and Conservation Partnerships

Forestland protection programs and conservation partnerships enable landowners to maximize the conservation outcomes on their land, such as supporting wildlife, conserving soil, and improving water quality (USDA, 2021).

Many of these programs are administered at the federal level by the USDA Natural Resources Conservation Service (NRCS), which offers financial and technical assistance through Farm Bill conservation programs (NRCS., n.d). Technical assistance includes developing forest management plans as well as tangible assistance to better enable landowners to actively manage their land. Meanwhile, financial assistance programs help landowners manage their land in a sustainable way by lowering financial barriers to entry. Most programs offer a combination of both technical and financial assistance (NRCS, n.d). Table 3 provides an overview of major programs for forestland owners.

Table 3. Federal Conservation Programs

Program	Description
Forest Stewardship Program (FSP)	FSP works in partnership with state forestry offices to connect private landowners with information they may need to manage their forestlands (USFS, n.d)
Forest Legacy Program (FLP)	FLP partners with state agencies to encourage conservation and protection of privately owned lands, through easements and land purchases (USFS, n.d).
Environmental Quality Incentives Program (EQIP)	EQIP is a voluntary program for non-industrial landowners to provide them with financial and technical assistance to manage for environmental benefits. This program conserves natural resources while improving agricultural practices (NRCS., n.d)
Forest Land Enhancement Program (FLEP)	FLEP replaces both the Forest incentives program and stewardship incentive program. State forestry agencies encourage long term sustainability through financial, technical, and educational assistance (USFS, n.d).

U.S. states assist in connecting landowners to and administering federal resources, as well as overseeing their own state-level technical and financial assistance programs (HFRP, 2006). For instance, in California, the state-level Forest Conservation Program (FCP) provides financial assistance for forest conservation, preservation, and restoration efforts (California WCB, n.d). Project examples include forest thinning and stand enhancement.

Cost Share Programs

Cost share programs provide federal and state funding to forest landowners for the purpose of reducing the cost of implementing conservation practices (Chizmar, 2021). In general, to be eligible for these programs, landowners must establish certain management practices, such as soil conservation, timber stand improvement, forestland erosion control, and pre-commercial thinning.

In recent decades, the goals associated with of cost share programs have shifted toward the protection of forest health and ecosystem quality, while remaining committed to supporting a supply of sustainable timber stock for private landowners (Chizmar, 2021).

Forest Property Taxes

Property tax is a tax on property measured by the property's value. Some states collect forest property tax on both the value of the land as well the value of the trees; others collect the tax on the value of the land only (National Timber Tax, n.d). These taxes can be categorized into four types: ad valorem property tax, flat property tax, yield tax, and severance tax. Ad valorem property taxes consider the value of the land and the trees form the basis for tax collection (National Timber Tax, n.d). This is different from a flat property

tax, under which the same amount of money per acre is collected on any acre of timberland regardless of its value. A yield tax is tax on the value of the harvested timber, while a severance tax is a flat tax on a specific unit of volume harvested.

A key goal of favorable tax treatment for forests is to ensure that forests remain forests. By giving this prioritization to forestland and open space land, policymakers seek to counteract or minimize economic pressures for forest conversion as well as (in some cases) motivate sustainable management practices.

Property tax systems are generally designed so that 1) all property, without enumeration, is taxable unless specifically exempt, or 2) that only such classes of property as are specifically enumerated are taxable (National Timber Tax, n.d). Property is usually taxed on the basis of its fair market value. Taxation is subject to several issues, including whether the property constitutes real property, tangible personal property, or intangible property, and who owns the property and to what use the property is put, which may entitle full or partial exemption from taxation.

Meanwhile, forest property tax programs offer landowners abatements, exemptions, and reductions by reducing (or eliminating`) tax liability. These incentives come in several forms, which are shown in Table 4.

Table 4. Forest Tax Types

Tax Type	Definition	Example
Forest Exemption	Exemptions remove forest land and timber (or timber alone) from property tax rolls either for a term of years, or indefinitely. To qualify for exemption, forest tracts may need to comply with certain forest management requirements. (Williams, 1968)	Michigan Qualified Forest Program: In exchange for managing their forests in a sustainable fashion, the landowner will receive an exemption from the local school operating millage.
Forest Rebate	Landowners who engage in some approved activity (e.g., tree planting) may subsequently apply for abatement of a portion of the taxes levied on the value of their land, timber, or both. The rebate may be given in the form of a direct cash payment or as a reduction from the total amount of taxes owed. (Hickman n.d.)	Minnesota Sustainable Forest Incentive Act: Provides direct incentive payments to property owners to encourage sustainable use of forest lands. Property owners can receive a payment for each acre of qualifying forest land they enroll in SFIA. In return, they agree not to develop the land and to follow a forest management plan

		while they are in the program.
Modified Assessment	If fair market value in highest and best use is retained as the basic valuation standard, forest assessments may be set (reevaluated on a regular basis) or calculated using a reduced assessment ratio. Alternatively, fair market value may be abandoned in favor of another valuation standard such as current use value. (Hickman n.d.)	Washington Open Space Taxation Act: Allows property owners to have their open space, farm and agricultural, and timber lands valued at their current use rather than at their highest and best use.
Modified Rate	Provide that forestland and timber are to be assessed like other forms of property, but that a different tax rate, lower than otherwise applicable, is to be used in computing the tax. (Hickman n.d.)	Michigan Commercial Forest Program: Landowners do not pay ad valorem general property taxes. Instead, CF landowners pay a specific tax. The CF specific rate for 2022-2026 is $1.35 per acre annually. The specific rate increases 5 cents every 5 years.
Yield Tax	Provide for a conceptual separation of land and timber values. Land values normally remain subject to the annual property tax, although sometimes in modified form. Timber values go untaxed until the time of harvest. At this juncture a gross income tax, equal to some percentage of the stumpage value of the products cut, is imposed. (Hickman n.d.)	California Timber Yield Tax: Standing timber is exempt from local ad valorem tax system and instead is subject to a state tax at the time of harvest. Valued at the present worth of the income and no less than two dollars. Yield tax of 2.9%.
Severance Tax	Occupation or privilege tax that is levied in addition to some form of property tax. Timber severance taxes are levied at the time timber is cut and are normally computed as a fixed amount per unit of product removed. (Hickman n.d.)	New Mexico Severance Tax: Individuals engaging in the business of severing natural resources must pay a tax of 0.125% of the gross value of the severed material.

Conservation Easements

Similar to property tax incentives, conservations easements seek to combat economic pressures for forest conversion. They are voluntary agreements between landowners and a government agency or land trust that permanently limits uses of the land in order to protect its conservation values (Land Trust Alliance, n.d). According to the National Conservation Easement Database, there are over 201,525 conservation easements on 33.5 million acres of land (NCED, n.d). Conservation easements help to maintain and improve water quality, protect wildlife habitats, protect scenic views, or to promote healthy forests and sustainable agriculture.

When landowners enter into a conservation easement, they continue to own and manage the land privately, making these arrangements unique from regulatory land use policies. However, once an agreement has been made, the

accompanying restrictions are perpetual and applicable to both present and future owners.

As a result of voluntarily agreeing to a conservation easement, landowners receive state and federal tax advantages. Federal income tax deductions, state income tax credits, estate tax reductions and exclusions, and property tax incentives are offered in different configurations across U.S. states.

Renewable Portfolio Standards

Renewable Portfolio Standards (RPS) mandate that a certain percentage of electricity sold by providers come from renewable sources like wind, solar, and bioenergy (NCSL, n.d). In the U.S., thirty states have RPS while three states have voluntary renewable energy goals (NCSL, n.d).

There are several distinguishing factors influencing the design of a RPS, including the renewables target, applicable sectors, and rate impact cap. A RPS target sets the percentage of electricity that must come from renewables, usually by a given calendar year. This target is often broken down by applicable sectors such as investor-owned utilities (IOUs), municipalities and electric cooperatives, and municipal and cooperative utilities. Some states limit how much RPS can increase electricity rates, also known as cost caps or rate impact caps (CPI, 2012).

Especially significant for forestry is whether RPS include woody biomass (e.g., woody material from trees or shrubs) as eligible sources of renewable energy. In states that allow for such an inclusion, wood wastes and residues are often eligible while whole trees are excluded from consideration.

Public and Private Lands

While certain policy types target either public or private lands, there are some that depend on the context and statutory environment of a state. The best example of this is best management practice (BMP) programs, which can either impact public actors, private actors, or both. Further, policies impacting public or private procurement (such as embodied carbon policies and wood use requirements) impact private as well as public timber producers.

Forest Best Management Practices

Forest Best Management Practices (BMPs) were introduced following the passage of the Clean Water Act (CWA) to reduce nonpoint source pollution. BMPs outline management practices for a diversity of land types with a primary aim of protecting soil and water quality (Cristan, 2014). Since 1972, BMPs have been implemented in all 50 states. A dozen states require mandatory adherence while others have adopted a voluntary approach, with some states somewhere in the middle between a regulatory and non-

regulatory regime. Table 5 summarizes the BMP regulatory status in U.S. states.

Table 5: BMP Regulatory Status (NASF, 2019)

Status	States	Count
Non-regulatory states	Indiana, South Carolina, Minnesota, Wyoming, Colorado, South Dakota, Louisiana, Tennessee, Arkansas, Texas, Mississippi, Hawaii, Illinois, Iowa, Missouri, North Dakota, Kansas, Rhode Island, Oklahoma, Nebraska, and Connecticut.	21 states
States with some local government regulation	Maine, Utah, Virginia, Arizona, and New York.	5 states
Quasi-regulatory states	Florida, Michigan, Montana, Vermont, Ohio, Alabama, New Hampshire, North Carolina, Georgia, Wisconsin, and New Mexico.	11 states
Regulatory states	Maryland, California, Washington, Delaware, Idaho, West Virginia, Oregon, Alaska, Massachusetts, Kentucky, Pennsylvania, Nevada, and New Jersey.	13 states

Forest BMPs outline management practices for approaches to forest roads, skid trails, log landings, stream side management zones, stream crossings, timber harvesting, forest regeneration, and much more. These practices are monitored closely as they have been found to be related to site productivity, water quality, reduced erosion, and reduced water sediment (Cristan, 2004).

Depending on the particularities of the state, regulatory regimes may require that management practices be implemented on public and/or private lands. In quasi-regulatory states, the law establishes regulations for water quality and silvicultural activities, but not stipulations on how those regulations are to be met. Five states operate on a local approach to BMPs, where local regulations exist without state-level policy (NASF, n.d). In some localities in Maine, logging operations are subject to random site evaluation to monitor BMP implementation (MFS, 2014). In states that take a non-regulatory approach, agencies rely on education and awareness to get information to landowners. While these programs lack the mandatory nature of regulatory BMPs, the difference in landowner implementation is not large between regulatory (94.95%), and non-regulatory (93.82%) regimes (NASF, n.d).
While a majority of states monitor the implementation of BMPs, 19 states do not. This is for various reasons, such as a lack of agency authority to inspect private lands without permission and budgetary constraints that prevent monitoring activities from occurring (NASF, n.d).

Embodied Carbon Policies

In the context of construction, embodied carbon is the amount of carbon a building has released before it becomes operational. This includes the processes of material extraction, transportation, and manufacture. Findings ways to reduce embodied carbon is a vital component to combatting the climate crisis, as building-related emissions are projected to double by 2050 (Pomponi and Moncaster, 2016). Importantly, life-cycle inventory analyses (LCAs) reveal that the lumber, wood panels, and other forest products used in construction store more carbon, emit less GHGs, and use less fossil energy than steel, concrete, brick, or vinyl, whose manufacture is energy intensive and produces substantial emissions (Malmsheimer et al., 2008).

Embodied carbon policies impact all steps of the building process – from zoning to procurement. They may operate via implementing emission limits, incentivizing sustainable practices, and prioritizing the procurement of products that will decrease embodied carbon. Policies targeting embodied carbon will directly or indirectly incentivize the use of wood products in construction given that, when harvested sustainably, wood has less embodied carbon than other construction materials, such as concrete and steel. See Resource Guide 4 for more details on how product substitution (i.e., the substitution of less emissions-intensive products for more emissions-intensive products) impacts a state carbon accounting.

Procurement policies, such as "Buy Clean" and material-specific variations, focus on the acquisition of building materials; some embodied carbon policies may place carbon limits on procurement, and infrastructure projects (CNCA, n.d). Building codes set design requirements, minimum standards and quality, and allowable materials for the construction of buildings in a particular locality (ICC, 2018). City zoning policies that seek to decrease embodied carbon have specific emissions requirements for each zoning designation, and limit zoning when needed to fulfil those requirements (CNCA, n.d). Waste recycling and material reuse policies require buildings be deconstructed instead of completely demolished (CNCA, n.d).

State-level examples include Colorado's "Buy Clean CO" program, which phases in requirements for environmental product declarations (EPDs) and global warming potential limits for asphalt, cement, concrete, glass, steel, and wood for state funded projects (RMI, 2021). Additionally, New York Senate Bill S542A requires the Office of General Services to establish guidelines concerning the procurement of low-carbon concrete for state projects (New York State Senate, 2021). Contractors would need to follow these guidelines and certify that their materials meet guideline targets.

At the federal level, in 2021, the Biden Administration issued an executive order which uses the procurement power of the federal government to meet five goals: 100% carbon-pollution free electricity by 2030, 100% zero emission vehicle acquisitions by 2035, net zero emissions from federal procurement no later than 2050, a net zero emissions building portfolio by 2045, and net zero emissions from federal operations by 2050 (White House, 2021).

Wood Use Requirements

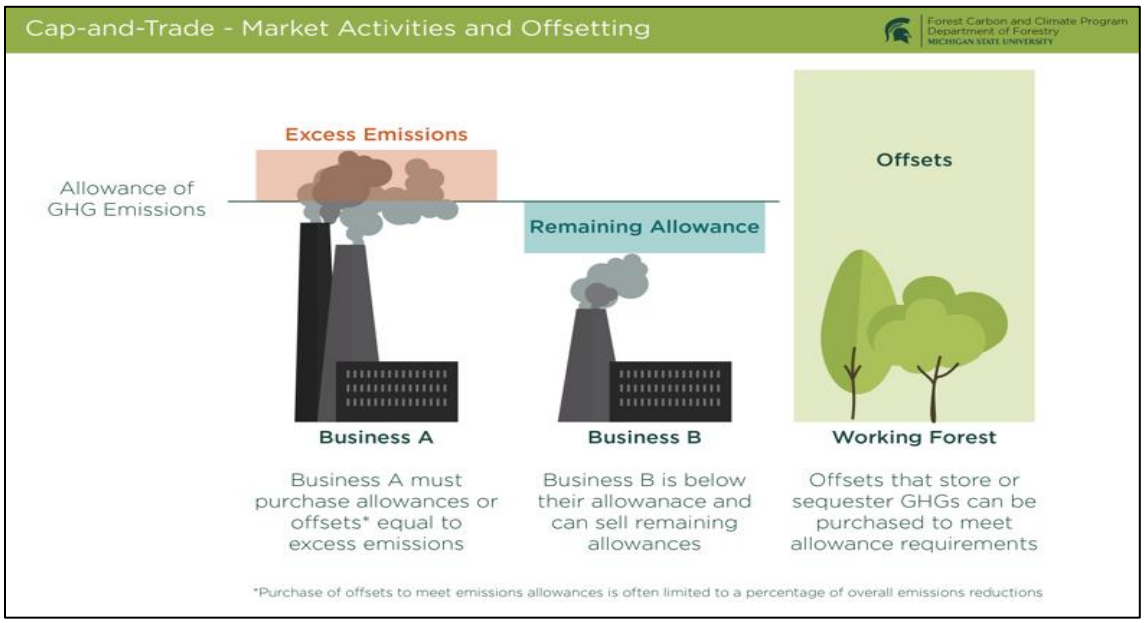
Wood use requirements are related to the use of wood products for construction and the public procurement of timber. A key objective of these policies is to set specific purchasing requirements for federal, state, or local governments when buying paper, furniture, and other wooden products. For instance, the Michigan Procurement Policy Manual requires the state government to give "preference to wood or paper products that derive from sustainably managed forests or procurement systems that are certified by an independent third party using an identified certificate program" (Michigan DTMB, 2022).

Another area pertains to the construction of public or government-funded infrastructure projects, in which wood products are used as an alternative to other materials (e.g., steel, cement, plastics). These policies seek to avoid emissions associated with traditional materials, e.g., by substituting wood from sustainably managed forests for non-wood materials used in the construction process, which, in most cases, reduces overall GHG emissions (Smith et al., 2014).

Emissions Trading Scheme

A carbon market describes any trading system through which countries, companies, individuals, and other entities may buy or sell units of greenhouse-gas emissions to meet their required or voluntary emissions limits (UNFCCC, n.d). Carbon offsetting, the process by which entities account for emissions by purchasing calculated and third-party verified reductions elsewhere (Figure 4), is central to carbon markets' functioning and trading of credits (Goodward, 2010). Forests are an important and growing source of such carbon credits, both domestically and internationally.

Figure 4. A demonstration of the target and offsetting mechanisms for a cap-and-trade market.



While voluntary markets are not regulated by government bodies, compliance markets, also referred to as cap-and-trade programs, are created and regulated by mandatory national, regional, or international carbon reduction programs. In the U.S., only California, Oregon, and Washington have compliance cap-and-trade systems, while much of the Northeast is involved in the Regional Greenhouse Gas Initiative (C2ES, n.d).

Beyond perhaps their primary goals of emissions reductions, states with compliance markets seek to bolster state-level forest sustainability by encouraging the development of forest carbon projects within their states. Both California and Washington require that at least 50% of carbon credits be purchased from in-state carbon projects or have direct in-state environmental benefits, thereby prioritizing and encouraging in-state carbon project development. Oregon does not allow for forest carbon offsets in the same way, but, rather, allows entities to buy Community Climate Investment credits (CCIs), which will go toward supporting direct in-state environmental (not necessarily carbon) improvements.

Notably, however, California and Washington all also cap the ability to offset emissions with carbon credits. For example, in the first and most lenient compliance period, Washington allows only 5% of an entity's compliance obligation to be met via offset credits. This, in some ways, caps the impact an ETS may have on impacting state-level forest carbon management.

Innovative Policies

Incentivizing Voluntary Carbon Markets

As a tool to combat the growing climate emergency, Voluntary Carbon Markets (VCMs) carry several important *potential* benefits. They enable investors, governments, NGOs, businesses, and private landowners to purchase verified emissions reductions in the form of carbon credits, putting money into climate programs and incentivizing the reduction of carbon emissions. They also do this with no, or limited, state involvement or funding, making incentivizing voluntary carbon markets a politically attractive option as well as a budget-friendly one.

States can play a role in strengthening the credibility and assurances of, knowledge about, and scale of voluntary carbon markets in order to maximize the associated carbon benefits. Table 6 outlines recommendations made by the World Economic Forum for creating large-scale transparent carbon credit trading markets (WEF, 2021).

Table 6. Recommendations for Scaling Carbon Markets

1	Establish a set of "Core Carbon Principles" (CCPs) and a taxonomy of additional attributes to ensure high integrity and market liquidity
2	Establish core carbon reference contracts that can be traded on exchanges to concentrate liquidity and unlock its associated benefits
3	Build strong market infrastructure to ensure resilient, flexible markets that can handle large-scale trade volumes and can do so transparently
4	Build legitimacy in using carbon credits by aligning on a shared vision for, and understanding of, the role of carbon credits in supporting the achievement of net-zero goals
5	Improve the integrity of voluntary carbon markets through stronger processes, guidelines and frameworks
6	Support a clear demand signal to drive the development of liquid markets and scaled-up supply

Incentivizing Innovative Wood Use

The incentivization of new and novel wood uses through the creation of new markets or the bolstering of existing markets for low value timber, harvest residuals, and wood waste remains a key pathway to mitigating climate change. The creation or bolstering of these markets not only provides a new pathway for carbon storage within the wood products sector but also provides additional revenue streams for landowners and forest managers, reducing pressures for forest conversion in the process. Interest is growing for

new, innovative markets in products such as mass timber, wood-derived bioproducts such as fuel, adhesives, or foam, energy sources, and other composite wood products. Policy and planning can help foster and encourage growth in new and existing markets through a variety of mechanisms.

Available policy tools include the implementation of clean fuel standards, public procurement policies, investment mechanisms, and workforce development. Clean fuel standards, such as California's Low-Carbon Fuel Standard, enable the financial viability of innovate wood uses by providing a market for woody biomass. Additionally, public procurement policies (e.g. Buy Clean California) drive wood markets by incentivizing clean wood product procurement, while investment mechanisms like Climate Catalyst Fund defray upfront costs to market entry and long-term participation (Pasternack et al., 2022).

References

American Forests. (n.d). Tree Equity. https://www.americanforests.org/our-programs/tree-equity/

American Tree Farm System. (n.d). Standards for Certification. https://www.treefarmsystem.org/certification-american-tree-farm-standards

Bipartisan Policy Center. (2022). Inflation Reduction Act Summary. https://bipartisanpolicy.org/blog/inflation-reduction-act-summary-energy-climate-provisions/

Cabiyo, B., et al. (2021). Innovative Wood Use can Enable Carbon Beneficial Forest Management in California. https://doi.org/10.1073/pnas.2019073118

Carbon Neutral Cities Alliance. (n.d). City Policy Framework for Dramatically Reducing Embodied Carbon. https://www.c40knowledgehub.org/s/article/City-policy-framework-for-dramatically-reducing-embodied-carbon?language=en_US

California Wildlife Conservation Board. (n.d). Forest Conservation Program. https://wcb.ca.gov/Programs/Forest

Center for Climate and Energy Solutions. (n.d). Market Based State Policy. https://www.c2es.org/content/market-based-state-policy/

Chizmar, S. (2021). State Cost Share Programs for Forest Landowners in the Southern United States: A Review. Journal of Forestry. https://academic.oup.com/jof/article/119/2/177/6077856?login=false

Connecticut Department of Energy and Environmental Protection. (2020). No Net Loss Presentation. https://portal.ct.gov/-/media/DEEP/climatechange/GC3_Webinar_Series/No-Net-Loss-Presentation-12-17-20.pdf

Climate Policy Initiative. (2012). Renewable Portfolio Standards: The High Cost of Insuring Against High Costs. https://www.climatepolicyinitiative.org/renewable-portfolio-standards-the-high-cost-of-insuring-against-high-costs/

Cristan, R., et al. (2016). Effectiveness of Forestry Best Management Practices in the United States: Literature Review. Forest Ecology and Management. https://doi.org/10.1016/j.foreco.2015.10.025

Forest Stewardship Council. (n.d). Mission and Vision: Protecting Forests for Future Generations. https://us.fsc.org/en-us/what-we-do/mission-and-vision

Global CCS Institute. (n.d). Facilities Database. https://co2re.co/FacilityData

Global Witness. (2022). Carbon Trading Continues: What's Wrong with the Voluntary Market. https://www.globalwitness.org/en/campaigns/greenwashing/carbon-trading-continues-whats-wrong-with-the-voluntary-market/

Goodward, J. and Kelley, A. (2010). Bottom Line on Offsets. https://www.wri.org/research/bottom-line-offsets

Hammond, G. and Jones, C. (2010). Embodied Carbon. http://greenbuildingencyclopaedia.uk/wp-content/uploads/2014/07/Full-BSRIA-ICE-guide.pdf

Headwaters Economics. (2019). Public Land Ownership in the United States. https://headwaterseconomics.org/public-lands/protected-lands/public-land-ownership-in-the-us/

Hickman, C. (n.d). Property Taxes and the Loss of Private Forests. https://www.timbertax.org/statetaxes/Property_Tax_Paper_PDC.pdf

Hoover, K. and Riddle, A. (2021). U.S. Forest Ownership and Management: Background and Issues for Congress. Congressional Research Service. https://sgp.fas.org/crs/misc/R46976.pdf

ICC. (2018). International Building Code. Chapter 28. https://codes.iccsafe.org/content/IBC2018/chapter-23-wood

Land Trust Alliance. (n.d). What Can You Do? https://www.landtrustalliance.org/what-you-can-do/conserve-your-land/questions

Maine State Legislature. (2014). Maine Forest Best Management Practices Summary. https://lldc.mainelegislature.org/Open/Rpts/sd392_m34_2013.pdf

Malmsheimer, R., et al. (2008). Forest Management Solutions for Mitigating Climate Change in the United States. https://www.ntc.blm.gov/krc/uploads/399/Forest%20Management%20Solutions%20for%20Mitigating%20Climate%20Change.pdf

McKinley, D. C., Ryan, M. G., Birdsey, R. A., Giardina, C. P., Harmon, M. E., Heath, L. S., ... & Skog, K. E. (2011). A synthesis of current knowledge on forests and carbon storage in the United States. Ecological applications, 21(6), 1902-1924.

Michigan DNR. (2020). Forest Action Plan. https://www.michigan.gov/dnr/-/media/Project/Websites/dnr/Documents/FRD/Mgt/ForestActionPlan_Forestry_2020.pdf?rev=7753bf4ccceb4b6da4adf2badaa8e5b0&hash=C1C3EC3F7275544D64E8501DE2D4EC62

Michigan DTMB. (2022). Michigan Procurement Policy Manual. https://www.michigan.gov/-/media/Project/Websites/dtmb/Procurement/documents/MPPM/Chapter_1__Introduction_and_Overview_of_the_Michigan_Procurement_Manual.pdf

National Association of State Foresters. (2019). Protecting the Nations Water. https://www.stateforesters.org/wp-content/uploads/2019/12/NASF-2019-BMP-Final.pdf

National Conference of State Legislature. (n.d). State Renewable Portfolio Standards and Goals. https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx

National Grid. (n.d). What is Carbon Capture and Storage? https://www.nationalgrid.com/stories/energy-explained/what-is-ccs-how-does-it-work

National Timber Tax. (n.d). State Tax Laws. https://www.timbertax.org/statetaxes/

New York Department of Environmental Conservation. (n.d). Urban and Community Forestry. https://www.dec.ny.gov/lands/4957.html

New York State Senate. (2021). Senate Bill S542A. https://www.nysenate.gov/legislation/bills/2021/S542

New York State Urban Forestry Council. (n.d). What is Releaf? https://nysufc.org/releaf/

Pomponi, F. and Moncaster, A. (2016). Embodied carbon mitigation and reduction in the built environment – What does the evidence say?, Journal of Environmental Management, Volume 181. Pages 687-700, ISSN 0301-4797

Reiter, B. (2022). States Look to Attract CCS Projects Through Laws Shifting Long Term CO2 Storage Liabilties. https://www.nixonpeabody.com/insights/articles/2022/05/02/states-look-to-attract-ccs-projects-through-laws-shifting-long-term-co2-storage-liabilities

RMI. (2021). Colorado Passes Embodied Carbon Legislation. https://rmi.org/colorado-passes-embodied-carbon-legislation/

Smith, P., et al. (2014). Agriculture, Forestry and Other Land Use. https://pure.iiasa.ac.at/id/eprint/11115/

South Carolina Department of Health and Environment. (n.d). Urban Growth Boundaries. https://scdhec.gov/sites/default/files/docs/HomeAndEnvironment/Docs/ModelOrdinances/UrbanGrowthBoundary.pdf

Sustainable Forestry Initiative. (n.d). The SFI Forest Management Standard. https://forests.org/forestmanagementstandard/

The Intergovernmental Panel on Climate Change. (n.d). IPCC. https://www.ipcc.ch/

United States Department of Agriculture. (2015). Ten Year Urban Forestry Action Plan. https://urbanforestplan.org/wp-content/uploads/2015/11/FinalActionPlanSummary_11_16_15.pdf

United States Department of Agriculture Farm Service Agency. (2021). USDA Offers New Forest Management Incentive for Conservation Reserve Program. https://www.fsa.usda.gov/state-offices/Wisconsin/news-releases/2021/usda-offers-new-forest-management-incentive-for-conservation-reserve-program

United States Department of Agriculture NRCS. (n.d). Environmental Quality Incentives Program. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/eqip/

United States Department of Agriculture NRCS. (2006). Healthy Forest Reserve Program. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_006635.pdf

United States Department of Agriculture NRCS. (n.d). Programs. https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/

United States Forest Service. (n.d). Forest Legacy. https://www.fs.usda.gov/managing-land/private-land/forest-legacy

United States Forest Service. (n.d). How the Forest Stewardship Program Works. https://www.fs.usda.gov/managing-land/forest-stewardship/program

United States Forest Service. (n.d). Urban Forests. https://www.fs.usda.gov/managing-land/urban-forests

United States Forest Service. (n.d). Urban and Community Forest Program. https://www.fs.usda.gov/managing-land/urban-forests/ucf

Williams, Ellis. T (1968). State Forest Tax Law Digest. United States Department of Agriculture, Forest Service. Miscellaneous Publication.

World Economic Forum. (2021). How to Scale Effective Voluntary Carbon Markets in 6 steps. https://www.weforum.org/agenda/2021/01/scale-voluntary-carbon-markets/

World Research Institute. (2022). Tax Amendments Act of 2021. https://www.wri.org/update/45q-enhancements

White House. (2021). President Biden Signs Executive Order Catalyzing Americas Clean Energy Economy Through Federal Sustainability. https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/08/fact-sheet-president-biden-signs-executive-order-catalyzing-americas-clean-energy-economy-through-federal-sustainability/

WWF. (n.d). Forest Certification. https://wwf.panda.org/discover/our_focus/forests_practice/forest_sector_transformation_updated/forest_certification/

Additional Resources

Webinars/videos

Griscom, B. (2021, October 19). Global mitigation potential from land-using sectors [Forum presentation]. 10th Forestry and Agriculture GHG Modeling Forum, Session 2: State-of-the-art assessment of mitigation potential from forestry and agriculture, Virtual Event (starts at 07:05 in the video; access code: E+t.7f).

- *Presentation comparing global and country-level mitigation potential from land-using sectors based on synthesis of existing literature and modeling using integrated assessment models (IAMs)*

Kurz, W. (2021, October 19). The Carbon Balance of Canada's Forest Sector: Opportunities for Natural Climate Solutions or threats from Climate Change? [Forum presentation]. 10th Forestry and Agriculture GHG Modeling Forum, Session 2: State-of-the-art assessment of mitigation potential from forestry and agriculture, Virtual Event (starts at 01:30:30 in the video; access code: E+t.7f).

- *Discussion of the potential for natural climate solutions from the Canadian forest sector under climate risk*

Larsen, K. (2021, November 30). What do policy makers need to know? [Forum presentation]. 10th Forestry and Agriculture GHG Modeling Forum, Session 4: Modeling to Inform Policy: Research Needs and Recent Advances, Virtual Event (starts at 01:07:58 in the video; access code: 10FA2021).

- *Discussion on using modeling and analysis to speak to policymakers and how to make data and analysis relevant for informing climate and energy policy*

Ohrel, S. (2021, October 19). US mitigation potential from agriculture and forestry [Forum presentation]. 10th Forestry and Agriculture GHG Modeling Forum, Session 2: State-of-the-art assessment of mitigation potential from forestry and agriculture, Virtual Event **(starts at 49:10 in the video; access code: E+t.7f).**

- *Presentation discusses latest modeling of potential U.S. mitigation, using multiple state-of-the-art agriculture and forest sector models*

Peer reviewed resources

Latta, G.S., Baker, J.S. and Ohrel, S., 2018. A Land Use and Resource Allocation (LURA) modeling system for projecting localized forest CO2 effects of alternative macroeconomic futures. Forest Policy and Economics, 87, pp.35-48. https://doi.org/10.1016/j.forpol.2017.10.003

- *Study seeks to address uncertainties in future forest markets and the potential land use, land use change, and forestry (LULUCF) contribution to US GHG reduction goals by modeling US forest GHG accounts per different simulated demand scenarios across a grid of over 130,000 USDA Forest Service Forest Inventory and Analysis (FIA) forestland plots over the conterminous United States*

Millar, C. I., Stephenson, N. L., & Stephens, S. L. (2007). Climate change and forests of the future: managing in the face of uncertainty. Ecological applications, 17(8), 2145-2151.

- *Outlines a conceptual framework for managing forested ecosystems under an assumption that future environments will be different from present but that we cannot be certain about the specifics of change; encourages flexible approaches that promote reversible and incremental steps, and that favor ongoing learning and capacity to modify direction as situations change*

Nepal, P., Buongiorno, J., Johnston, C.M.T., Prestemon, J. and Guo, J., 2021. Global forest products trade model. International Trade in Forest Products: Lumber Trade Disputes, Models and Examples; Kooten, GC, van Voss, L., Eds, pp.110-141.

- *Book chapter introduces the Global Forest Products Model (GFPM), including general model structure, the mathematical formulation of the model, and key similarities and differences between GFPM and other modeling approaches*

Robert C. Abt & Karen L. Abt (2013) Potential Impact of Bioenergy Demand on the Sustainability of the Southern Forest Resource, Journal of Sustainable Forestry, 32:1-2, 175-194, https://doi.org/10.1080/10549811.2011.652044

- *Article develops two hypothetical demand scenarios based on the use of woody biomass in renewable electricity generation and uses these scenarios in a model of timber supply in the U.S. South to evaluate the effects on both timber markets and forest resource sustainability*

Steffen W., Rockstrom J., Richardson K.,... Schellnhuber, H.J. (2018). Trajectories of the Earth System in the Anthropocene. PNAS. Vol 115(33):8242-8259. https://doi.org/10.1073/pnas.1810141115

- *Study explores the risk that self-reinforcing feedbacks could push the Earth System toward a planetary threshold that, if crossed, could prevent stabilization of the climate at intermediate temperature rises and cause continued warming on a "Hothouse Earth" pathway even as human emissions are reduced, and examines the evidence that such a threshold might exist and where it might be*

Non- Peer reviewed resources

Kilgore, Michael A.; Ellefson, Paul B.; Funk, Travis J.; Frey, Gregory E. 2017. State property tax incentives for promoting ecosystem goods and services from private forest land in the United States: a review and analysis. e-Gen. Tech. Rep. SRS–228. Asheville, NC: U.S. Department of Agriculture Forest
Service, Southern Research Station. 174 p.

- *50-State 2015 review and analysis of financial incentives provided by State property tax programs as a means of promoting ecosystem services from private forest land*

Ohrel, S.B., Beach, R.H., Adams, D., Alig, R., Baker, J., Latta, G.S., McCarl, B.A., Rose, S.K. and White, E., 2010. Model Documentation for the Forest and Agricultural Sector Optimization Model with Greenhouse Gases (FASOMGHG). RTI International. RTI Project, (0210826.016).

- *Documentation for the Forest and Agricultural Sector Optimization Model with Greenhouse Gases (FASOMGHG), a dynamic nonlinear programming model that simulates the allocation of land over time to competing activities in both the forest and agricultural sectors and the associated impacts on commodity markets as well as environmental impacts of changing land allocation and production practices, including detailed accounting for changes in net greenhouse gas (GHG) emissions*

Simpson, R.D. and Vira, B. (2010) 'Assessing intervention strategies', in Ash, N., Blanco, H., Brown, C., Garcia, K., Henrichs, T., Lucas, N., Raudsepp-Hearne, C., Simpson, R.D., Scholes, R., Tomich, T.P., Vira, B. and Zurek, M. (Eds.): Ecosystems and Human Well-Being: A Manual for Assessment Practitioners, Island Press, London.

- *This chapter provides practical guidance into considering the tradeoffs associated with diverse environmental interventions. It discusses various considerations (e.g., social and institutional conditions, project scale, implementer capacity) and how they might impact expectations for intervention effectiveness.*