RESOURCES *for the* FUTURE

Tree Planting as Climate Policy?

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Introduction

A broad consensus seems to have emerged regarding the use of forests to mitigate climate changes by drawing carbon dioxide (CO_2) from the atmosphere and sequestering it in forest biomass and long-lived wood products. The Trillion Tree Initiative proposes to vastly expand the area of forests across the globe,[1] and a bill in Congress proposes to grow additional forests by supporting private tree planting and refocusing public land management on carbon storage benefits.[2] Instead of using forest offsets as part of an economy-wide cap-and-trade scheme, these initiatives aim to directly expand the forest carbon sink as a climate change mitigation measure.

Planting trees has long been viewed as a publicly acceptable and politically safe way to address environmental problems, largely because forests provide many cobenefits, including watershed protection, recreation, and wildlife habitat. But can tree-planting policies be an effective means of achieving climate change mitigation goals? Depending on policy design, publicly funded tree planting could cut both ways in the forest sector, defining winners and losers, and may or may not enhance the nation's carbon sink.

Carbon cap-and-trade approaches rely on price signals to efficiently generate forest emissions offsets. Programs focused on tree planting or natural forest regeneration, or both, might achieve some of these benefits, but outcomes depend on a careful design of policy to account for the mechanics of the sector and its interactions with other parts of the economy. Efforts to significantly expand the US forest carbon sink would benefit from a careful consideration of the nation's history of tree planting and forest investment and the structure of timber supply and demand. Publicly funded tree planting in a competitive marketplace for land and forests could lead to offsetting adjustments in private investments, so tree-planting subsidies alone are unlikely to grow forests' climate benefits. This issue brief explores the potential effects and effectiveness of tree-planting programs for increasing the climate mitigation benefits of forests.

Forest Investment in the United States

In 1950, planted forests were rare in the United States, but they now account for 68 million acres (8 percent) of forests, and tree planting is an integral component of the timber-growing sector. Between 2011 and 2015, roughly 11.4 million acres were planted, resulting in a 2.5-million-acre net increase in planted forests.[3] The difference between these numbers reflects the reforestation of harvested forests but also the losses of forests to other land uses and planting failures. Given average planting densities, an annual average of 1 billion to 1.5 billion trees were planted over this period. Most (75 percent) of these trees were planted in the US

1 The World Economic Forum launched the Trillion Tree Initiative at its 2020 Annual Meeting as a means of restoring biodiversity and mitigating climate change. **https://www.weforum.org/agenda/2020/01/one-trillion-trees-world-economic-forum-launches-plan-to-help-nature-and-the-climate/**.

2 H.R. 5859, the Trillion Trees Act, "To establish forest management, reforestation, and utilization practices which lead to the sequestration of greenhouse gases, and for other purposes." Title I—Carbon Sequestration through Reforestation Activities. The bill emphasizes modifying public land law to include climate change mitigation benefits in the calculus of multiple use.

3 Based on author's calculations from data reported by Oswalt et al. (2014, 2018).

Southeast, where returns to forestry are high relative to other rural land uses because of good growing conditions, genetically improved trees, and widespread access to markets for timber (Oswalt et al. 2018, Table 43). At times, planting by noncommercial private landowners has been subsidized through various cost-share programs addressing reduced crop production, increased timber supply, or conservation benefits,[4] but the lion's share, and nearly all planting since 2000, has relied exclusively on private-sector capital. Ongoing investments in tree planting and timber growing through real estate investment trusts and timberland investment management companies, which dominate commercial forestry in the United States, have attracted billions of dollars of investment capital.

Forest investment in the United States has driven an orderly transition of the forest sector from harvests of old-growth forests to a near-exclusive focus on managing second-growth forests. Tree planting was incentivized by a growing scarcity of timber (signaled by increasing real timber prices) and supported by public policy through much of the twentieth century. The transition was well underway before the federal government shifted management of western old-growth forests away from timber production in the late 1980s and early 1990s. Private forests now provide more than 90 percent of all timber harvested in the United States, and planted forests now account for at least 36 percent of all timber harvests.[5]

Remarkably, forest investment fully offset the loss of 17.1 million forested acres to development between 1982 and 2012 by establishing new forests on pasture- and croplands.[6] These land use and forest dynamics resulted in a vast and growing reservoir of land-based carbon sequestered from the atmosphere—US forests capture more than 600 teragrams per year of carbon dioxide equivalents and more than 10 percent of economy-wide emissions (Woodall et al. 2015). This now well-appreciated climate benefit was not part of any policy design. Rather it was the unintended consequence of market demands for timber products and the derived demand for land in timber production—a classic positive production externality.

Future Prospects for Forests and Forest Carbon

Retaining forests on private lands depends on the superiority of forest returns over returns to crops and other uses. After a long period of declining cropland prices in the Southeast, a recent upturn in crop returns combined with stagnant timber prices has stabilized cropland area.[7] Recent US Forest Service reports predict that forest area has recently peaked and will begin to decline in response to these market trends (see USDA Forest Service 2012; Wear 2011). Overall, there was little net change in forest area between 2007 and 2012, and some recent state-level forest inventories have shown a slight decline in forest area.[8] Future forest area will depend on urbanization demands but also the returns to forestry versus agricultural land uses, as well as the various government programs affecting agricultural and forest land uses.

Future timber returns depend on the interaction of timber supply and demand. Timber supply has grown steadily over the past 30 years in response to forest investments and growth-enhancing technological change. But while the United States retains its position as the leading producer (and consumer) of wood products (Wear et al. 2016), timber production peaked in the late 1990s and is now about 20 percent below these peak levels. Declines in demand combined with expanded supplies resulted in a stagnation of timber prices and investment returns over the past 10 years, and the returns to timber growing relative to crop production declined, increasing incentives to switch

4 Federal programs have included the Agricultural Conservation Program, Forestry Incentives Program, and Conservation Reserve Program.

5 Based on the most recent inventory plot records from the USDA Forest Service Forest Inventory and Analysis (FIA) databases.

6 Based on data from the USDA National Resource Inventory (NRI) database.

7 Based on data from the NRI database.

8 Oswalt et al. (2018), Table 3, shows US forest area peaking in 2012 and then declining by 0.1 percent between 2012 and 2017; 21 states show declines in forest area over this period.

from forests to agricultural production in some areas[9].

Near-term prospects for expanding forest area and forest carbon capture seem limited, given these market changes. Indeed, recent projections suggest a slowing of forest carbon sequestration in the United States as forest area peaks and forests age. Parts of the western United States are expected to soon reach a carbon stasis and then become a carbon source (Wear and Coulston 2015). Business-as-usual projections of forest carbon developed for the 2016 US Biennial Report by the US Department of Agriculture (USDA) reflect this decline in forest area through 2050 (DOS 2016; USDA 2016). The combined effects of land use changes, production of various wood products, and forest growth dynamics and disturbances are predicted to result in an overall slowing of carbon sequestration rates within the forest sector (–33 percent from 2015 levels by 2050). If forest area were held constant over this period, carbon sequestration would still decline by about 25 percent, the amount of the decline caused by the aging of forests.

An evaluation of policy scenarios using the same models estimates how large-scale tree planting could affect the carbon storage benefits provided by forests. An afforestation program that increased forest area on private land in the East by 10 million acres and restored 5 million acres of persistently understocked public forests in the West would largely offset the expected losses in sequestration rates (forests in 2050 would sequester carbon at 95 percent the 2015 rate). With a more expansive program (30 million acres planted and 7 million acres restored), forests would sequester carbon at 104 percent of the 2015 rate in 2050.[10] Compared with the business-as-usual case, these aggressive afforestation programs would result in substantially more carbon being stored and provide high rates of return based on the social cost of carbon and current land values (Haight et al. 2019).

Policy Design

The USDA projections describe how afforestation programs would affect carbon dynamics but do not address policy design—that is, how forest area on private lands could be stabilized or expanded in the future. Federal programs have supported tree planting for a variety of purposes since the 1930s. First came the Agricultural Conservation Program (ACP), a program to reduce crop production, in 1936. This was followed by the Forestry Incentives Program (FIP) in 1974, superseded by the Stewardship Incentives Program (SIP) in 1990, programs focused on enhancing timber production. The Conservation Reserve Program (CRP), established in 1985, focuses on soil conservation and wildlife habitat. Under ACP, FIP, and SIP, nonindustrial landowners received partial reimbursements (generally about 50 percent) for tree planting and other management activities. Under the CRP (and previously under the Soil Bank Program), landowners receive annual payments over a contract period of up to 15 years for converting marginal cropland to grassland or forests.[11] The cost-sharing approach of FIP/SIP supports forest establishment and regeneration without control over subsequent land use decisions. CRP agreements bind land to a conservation status for the duration of the contract.

Policies that grow timber inventories (e.g., FIP/SIP-style cost sharing) face the prospect of amplifying downward pressure on timber prices and returns to forest management. Coupled with stable to increasing agricultural prices, the result would likely be a displacement of private investment capital from the forest sector and land switching from forest to agricultural uses. The countervailing effects of increased carbon on newly planted forests with loss of forests

9 Note that per-acre returns depend on prices as well as on the productivity of timber-growing technologies.

10 For comparison, the Conservation Reserve Program (CRP) funds the "retirement" of private marginal cropland to support conservation efforts, and the cap on the program has reached as high as 36.8 million acres and currently stands at about 24 million acres. This scenario anticipates a similar program (perhaps an extension of the current CRP) to compensate landowners for establishing forests in the eastern United States on other rural lands. Additionally, the nation's forest inventory includes areas that remain persistently understocked in trees in western regions—13 million acres, of which 9.2 million are located on federal forests.

11 Grassland far exceeds forest in the CRP.

and reduced management in other areas limit the policy's effects on carbon sequestration. This is a classic leakage problem where market forces offset the policy instrument through substitution.

The challenge for policymakers is to design policies that expand forest carbon benefits without harming current market participants and generating carbon leakage effects. The scale of carbon leakage and impacts on market participants would depend on the extent of the timber supply growth associated with the policy. One way to minimize leakage is to encourage tree planting where timber supply impacts would be minimal. Examples include the following:

- Expanding existing forest restoration initiatives, including those for bottomland hardwoods, longleaf pine, and shortleaf pine, where the focus is on reestablishing important ecological communities. In these cases, the effective restoration strategies have been developed and institutional frames are in place.
- Expanding tree planting in urban and low-density residential areas where cobenefits accrue to health and climate change adaptation efforts. Here, too, ecologically sound strategies and institutional frames are in place.
- Expanding tree planting in agricultural riparian areas where harvesting is unlikely because of best management practice regulations and high costs.
- Expanding funding for tree planting on public lands to reduce reforestation backlogs using restoration strategies to build resilient forest conditions.

These examples simultaneously provide cobenefits arising from watershed protection, enhanced biodiversity, and human health benefits, but such targeted approaches are unlikely to result in substantial carbon benefits.

Given concerns about leakage and market disruption, a tree-planting program based on the structure of the CRP likely would be a better model for generating climate benefits. The CRP's reverse auction structure has proven efficient at targeting environmental benefits, and contract lengths can be used to minimize timber supply impacts while carbon is sequestered.[12] Because contracts are of finite duration, timber supply effects would be deferred, though not eliminated. Still, an anticipated supply impact starting several years after program initiation and spread out over several years would limit disruptive changes in timber markets and allow private investors to adjust in an orderly fashion. Climate benefits would persist throughout the duration of the program.

In addition to timber supply impacts and leakage issues, to be successful, tree-planting programs would need to address some important constraints on planting activities:

- Limited tree nursery and seed capacity. Seedling nursery capacity has declined, and current nursery production is focused almost exclusively on commercial species. Policy would need to build out nursery and seed capacity.
- Insufficient ecological knowledge. Planting trees does not equate to establishing a well-functioning forest ecosystem, and forest restoration often involves treatments beyond planting trees. Foresters need to adapt strategies for establishing and restoring forests to a variety of ecosystem contexts and in the face of a changing climate. Policy would need to support research to translate ecological research into a suite of effective restoration strategies.
- Labor constraints. Tree planting may already be constrained by tight labor markets. Most tree planting in the United States is done by guest workers under H-2B visas, which have long been constrained by annual caps.[13] Especially in a full-employment economy, substantially increasing tree planting and other forest management activities

12 The CRP is an established program with a 38-year history at the USDA.

13 Forestry workers were the largest share of H-2B temporary nonagricultural workers between 1996 and 2001. Tree planting requires seasonal and mobile workers, and a majority of tree-planting contractors are guest workers (McDaniel and Casanova 2005).

may require addressing these labor supply issues, such as by relaxing visa caps.

Ultimately, tree-planting initiatives will have limited effects on forest area because they are supply-side interventions in a private market with growing supplies and stagnant prices. They “swim against the current” of expected landowner responses. Policies that address the demand side of the forest sector are likely to be more effective (Wear et al. 2007). Policy-driven demand growth is an alternative approach to increasing carbon sequestration that would raise prices and incentivize forest retention and private investment in tree planting and management. Forest bioenergy has the most potential for policy-determined demand growth, and recent studies show its strong potential for reducing the carbon density of US energy production while expanding forest carbon sequestration (see Favero et al. 2020). The use of mass timber in commercial construction is another avenue for growing timber demand, while also providing additional long-term carbon storage in wood products. Market fundamentals suggest that demand-side policies would outperform tree-planting programs in affording climate benefits.

Conclusions

Forests provide multiple benefits, which make them politically appealing and expedient policy instruments. If targeted in ways that minimize leakage, government-supported tree planting might help expand the nation’s forest carbon sink. Such a program would need to address not only how to target planting but also key constraints to reforestation, including the production of seedlings and labor supply. A program that successfully expands the area of US forests by roughly 15 million acres in the East and restores about 5 million acres of understocked forests in the West could stabilize carbon sequestration at 2015 levels through 2050 and give a high rate of return based on land costs and the social costs of carbon.

But these estimates beg the critical question of how to incentivize private landowners to grow more trees. High returns drove expansionary investment in the late twentieth century and at the start of the twenty-first, but current market conditions do not portend the same for the future. The use of a supply-side subsidy in a well-structured forest market ensures substantial leakage of carbon benefits. Absent a carbon cap-and-trade framework that would directly compensate landowners for carbon offsets, it appears that augmenting forest carbon benefits at a large scale in the United States would require a CRP-style forest carbon reserve, perhaps with much longer contracts (and higher costs), policy-driven demand growth for wood products, or some combination of the two. Perhaps counterintuitively, growth in the demand for wood is ultimately what can drive up the demand for forests and forest carbon in the ground.

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