

## **A GROWING NEED: INCREASING AGRICULTURAL AND URBAN FORESTATION TO COMBAT CLIMATE CHANGE**

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### ABSTRACT

Centuries of deforestation and reliance on carbon dioxide-emitting technologies have created a growing climate change crisis in the United States and across the globe. Since colonial times, the U.S. has lost approximately 74% of its forest cover. This dramatic loss of carbon-absorbing forest cover significantly contributes to global climate change but tends to receive far less policy attention than strategies focused on curbing carbon dioxide emissions. This Article argues that far more aggressive and innovative forestation policies are warranted across the country and proposes multiple potential policy approaches to increasing the nation's forest cover. After describing America's history of deforestation, this Article highlights several benefits of trees and some basic obstacles governments tend to encounter when seeking to increase tree planting and maintenance. The Article then examines existing federal, state, and local policies aimed at incentivizing reforestation and forest conservation, explaining why these approaches are not nearly aggressive enough to drive optimal levels of tree-related investment. This Article ultimately advocates for bold and innovative new policies at the federal government level, including expanded federal tax incentives and amendments to Farm Bill programs designed to increase farmer participation in agroforestry. The Article also describes specific ways for cities to better leverage the power of trees to improve citizens' health and well-being while also helping to slow the pace of climate change.

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## INTRODUCTION

Alaska's Tongass National Forest is the world's largest intact temperate rainforest.<sup>1</sup> This vast area, which is home to over 31 Alaskan communities and a diverse array of wildlife including bears, eagles, and salmon, also hosts millions of valuable old-growth cedar, hemlock, and spruce trees.<sup>2</sup> Incredibly, within months of President Donald J. Trump's announced support for a global initiative aimed at planting one trillion new trees,<sup>3</sup> his administration revealed plans to allow logging in 9.2 million acres of this unique forest.<sup>4</sup> To accelerate this new logging, the Administration proposed lifting the existing federal Roadless Area Conservation Rule<sup>5</sup> and expanding road construction.<sup>6</sup> President Trump's proposed plan would make thousands of acres of old-growth forest newly available for clear-cutting each year.<sup>7</sup> Not only would cutting thousands of acres of trees in the Tongass forest permanently harm environmental ecosystems and Alaskan communities, it would also significantly contribute to rising carbon dioxide concentrations in the global atmosphere.<sup>8</sup>

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1. See Gregory Wallace, *Trump Administration Proposes New Logging in Nation's Largest National Forest*, CNN POLITICS (Oct. 15, 2019), <https://www.cnn.com/2019/10/15/politics/alaska-national-forest-logging/index.html> (discussing the Tongass National Forest).

2. See *id.* (discussing wildlife in the Tongass National Forest).

3. Donald J. Trump, President of the United States, Address Before a Joint Session of the Congress on the State of the Union (Feb. 4, 2020).

4. Marc Heller, *How the Trump Admin Plans to Fast-Track Tongass Logging*, E&E NEWS (Oct. 22, 2019), <https://www.eenews.net/stories/1061347931>.

5. Special Areas, 36 C.F.R. pt. 294 (2012).

6. See Heller, *supra* note 4 (discussing a proposal to ease restrictions on road construction).

7. *Id.*

8. See generally Press Release, Alaska Wilderness League, Audubon Alaska, Center for Biological Diversity, Defenders of Wildlife, Earthjustice, GEOS Institute, Natural Resources Defense Council, Sierra Club, Southeast Alaska Conservation Council, The Wilderness Society, and Women's Earth and Climate Action Network, *Trump Administration Paves Way for Old-growth Clearcutting in Alaska's Tongass National Forest* (Oct. 15, 2019), <https://perma.cc/SYM7-ZV4H> (discussing the potentially disastrous impacts of clearcutting the Tongass temperate rainforest).

Since the dawn of the Industrial Revolution, carbon dioxide levels have steadily increased due to deforestation and increased uses of carbon-emitting technologies.<sup>9</sup> Ironically, these rising greenhouse gas levels are particularly impacting places like Alaska.<sup>10</sup> Alaska is warming more quickly than any other state in the country—nearly twice as fast as the global average.<sup>11</sup> Alaskan sea ice is also decreasing because seawater temperatures are steadily rising.<sup>12</sup> Climate change in Alaska has also led to other adverse effects, such as more frequent and powerful wildfires.<sup>13</sup> Fires in these cold regions are especially troubling because they break open permafrost and release carbon gases that have been trapped for hundreds or even thousands of years.<sup>14</sup>

Never has there been a more crucial time to promote reforestation than in this era when the federal government seems increasingly intent on chopping down trees. Trees remove carbon dioxide from the air, which helps minimize the effects of climate change.<sup>15</sup> Because the U.S. covers a massive geographic area and has a relatively temperate climate,<sup>16</sup> expanding the nation's forests could substantially decrease the amount of carbon dioxide (CO<sub>2</sub>) in the atmosphere.<sup>17</sup> The U.S. has approximately 749 million acres of forestland covering about 33% of the nation's total land area.<sup>18</sup> These vast forests remove nearly 13% of total U.S. greenhouse gas emissions per year and offset approximately 16% of annual carbon dioxide emissions, but those positive effects could be greater if there were more trees.<sup>19</sup>

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9. See Earth Observatory, *Changes in the Carbon Cycle*, NAT'L AERONAUTICS & SPACE ADMIN. (June 16, 2011) <https://earthobservatory.nasa.gov/features/CarbonCycle/page4.php> (describing human influences on Earth's carbon cycle).

10. See John Dos Passos Coggin, *New Report Highlights Alaska's Last Five Years of Dramatic Climate Change*, CLIMATE.GOV (Oct. 15, 2019), <https://www.climate.gov/news-features/understanding-climate/new-report-highlights-alaska%E2%80%99s-last-five-years-dramatic-climate> (describing how climate change is impacting Alaska).

11. *Id.*

12. *Id.* (reporting surface waters along Alaska's west coast were 4°F to 11°F warmer than average in 2019).

13. See generally Maria-José Viñas, *NASA Studies How Arctic Fires Change the World*, NAT'L AERONAUTICS & SPACE ADMIN. (Aug. 13, 2019), <https://climate.nasa.gov/news/2902/nasa-studies-how-arctic-wildfires-change-the-world/> (discussing the positive feedback loop of global warming and fires in the Arctic).

14. *Id.*

15. *Id.*; Stephen Leahy, *How to Erase 100 Years of Carbon Emission? Plant Trees—Lots of Them*, NAT'L GEOGRAPHIC (July 4, 2019), <https://www.nationalgeographic.com/environment/2019/07/how-to-erase-100-years-carbon-emissions-plant-trees/>.

16. See generally *North America*, ENCYC. BRITANNICA, <https://www.britannica.com/place/North-America/The-warm-temperate-zone> (last updated Nov. 10, 2020) (discussing the climate of the United States).

17. Leahy, *supra* note 15.

18. Steve Nix, *U.S. Forest Facts on Forestland*, THOUGHTCO. (Nov. 5, 2019), <https://www.thoughtco.com/us-forest-facts-on-forestland-1343034>.

19. Jennifer Schultz & Jocelyn Durkay, *State Forest Carbon Incentives and Policies*, NAT'L CONF. OF STATE LEG. (Jan. 24, 2018), <http://www.ncsl.org/research/environment-and-na01111111tural->

Reforestation, or the mass replanting of trees to regenerate forest landscapes,<sup>20</sup> is an underappreciated potential weapon against climate change. According to the United Nations' Intergovernmental Panel on Climate Change (IPCC), planting trees is "the only technology" currently available to remove atmospheric carbon dioxide at a large scale.<sup>21</sup> The IPCC's hypothesis was promoted by a major research article released in July 2019, which emphasized the great potential for global reforestation efforts to combat climate change.<sup>22</sup> The report also identified several areas in the world—including many regions within the U.S.—where trees could be planted without inhibiting agricultural growth or imposing on urban areas.<sup>23</sup>

This Article analyzes existing policies aimed at promoting reforestation within the U.S. and ultimately argues for certain specific policy strategies capable of significantly increasing tree planting activities. Implementing more aggressive and innovative reforestation policies at all levels of government has the potential to reduce the nation's CO<sub>2</sub> emissions and slow the pace of global warming quickly and powerfully.

Part I of this Article provides background information detailing carbon dioxide's effect on climate change, how humans are contributing to these effects, and how trees can help reduce atmospheric carbon dioxide levels. Part I also describes the potential benefits and detriments of increased forestation across the nation. Part II examines current U.S. reforestation policies at the federal, state, and local government levels, and highlights the strengths and weaknesses of these current strategies. Part III suggests that more aggressive federal tax incentives would be a cost-effective means of motivating farmers to embrace agroforestry practices capable of greatly decreasing atmospheric carbon dioxide levels. Part IV explains how stronger tree-related policies at the municipal level would drive rapid increases in forestation activities within urban settings.

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resources/state-forest-carbon-incentives-and-policies.aspx (The United States Forestry Service defines forest land as "land that is one acre or greater in size and has at least ten percent tree cover."); Leahy, *supra* note 15.

20. CAL FIRE, *Reforestation*, READYFORWILDFIRE.ORG, <https://www.readyforwildfire.org/prevent-wildfire/landowners-assistance/reforestation/> (last visited Nov. 11, 2020) (defining reforestation).

21. See Emily Atkin, *It's Not Enough to Stop Amazon Deforestation*, NEW REPUBLIC: APOCALYPSE SOON (Aug. 29, 2019), <https://newrepublic.com/article/154882/its-not-enough-stop-amazon-deforestation>.

22. Jean-Francois Bastin, et al., *The Global Tree Restoration Potential*, 365 SCI. 76, 76–78 (2019), <https://science.sciencemag.org/content/365/6448/76/tab-pdf>.

23. *Id.* at 77.

## I. CARBON DIOXIDE, HUMANS, AND TREES

There is broad scientific consensus that the global increase in atmospheric carbon dioxide levels documented in recent decades is largely attributable to human activities.<sup>24</sup> This section discusses how carbon dioxide contributes to a warmer atmosphere, how human activities throughout history—including activities involving trees—have increased carbon dioxide levels and created the current climate crisis, and why an increased focus on tree planting, maintenance, and preservation could help to address these challenges.

*A. Deforestation and Global Warming*

It is a well-established scientific fact that the increased level of carbon dioxide (CO<sub>2</sub>) in the atmosphere contributes to global warming.<sup>25</sup> CO<sub>2</sub> is a greenhouse gas and adds to the greenhouse effect, which occurs when certain gases in the atmosphere block heat from escaping.<sup>26</sup> This means that CO<sub>2</sub> absorbs heat within the atmosphere and gradually releases it over time.<sup>27</sup> Unlike oxygen or nitrogen, which are the most abundant molecules in the atmosphere, greenhouse gases absorb much of Earth's radiated heat, which causes the atmosphere to warm over time.<sup>28</sup> To some extent, this natural greenhouse effect is beneficial because without it, the planet's average temperature would be too cold to support most of the planet's ecosystems.<sup>29</sup> However, growing concentrations of greenhouse gases in the atmosphere over the past couple of centuries are raising temperatures and creating numerous costly secondary effects.<sup>30</sup> Global warming is shifting agricultural growing seasons, causing glaciers to shrink more rapidly, sea levels to rise, and making weather patterns in the summer and winter more extreme.<sup>31</sup>

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24. See generally *The Causes of Climate Change*, NAT'L AERONAUTICS & SPACE ADMIN., <https://climate.nasa.gov/causes/> (last updated Aug. 2, 2021) (providing background on several ways scientists have determined that human activity causes large increases in atmospheric CO<sub>2</sub> levels).

25. *Id.*; Georgios A. Florides & Paul Christodoulides, *Global Warming and Carbon Dioxide Through Sciences*, ENVI. INT'L (2009).

26. NAT'L AERONAUTICS & SPACE ADMIN., *supra* note 24.

27. *Id.*; Rebecca Lindsey, *Climate Change Atmospheric Carbon Dioxide*, CLIMATE.GOV (Sept. 19, 2019), <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide> (explaining that sunlight affects global warming by naturally warming the Earth's land and seas, which both continuously radiate heat back into the atmosphere).

28. NAT'L AERONAUTICS & SPACE ADMIN., *supra* note 24; Lindsey, *supra* note 27.

29. *The Greenhouse Effect*, UC MUSEUM OF PALEONTOLOGY BERKLEY, [https://ucmp.berkeley.edu/education/dynamic/session5/sess5\\_greenhouse.htm](https://ucmp.berkeley.edu/education/dynamic/session5/sess5_greenhouse.htm) (last visited Nov 13, 2020).

30. See generally *The Effect of Climate Change*, NAT'L AERONAUTICS & SPACE ADMIN., <https://climate.nasa.gov/effects/> (last updated Aug. 2, 2021) (discussing likely outcomes of climate change).

31. *Id.*

Unless dramatic actions are taken to reduce concentrations of greenhouse gases in the atmosphere, scientists predict that the warming—and its negative consequences—will only worsen in the coming decades.<sup>32</sup>

From a policy standpoint, reducing atmospheric CO<sub>2</sub> is a priority because CO<sub>2</sub> is the most abundant greenhouse gas and remains in the atmosphere longer than most other greenhouse gases.<sup>33</sup> Although CO<sub>2</sub> is released through natural processes such as respiration and volcanic eruptions,<sup>34</sup> it is also released through human activities such as burning fossil fuels or other carbon-based materials.<sup>35</sup> Some studies suggest that human-caused increases in atmospheric CO<sub>2</sub> levels are likely responsible for at least two-thirds of the temperature increases already experienced across the globe.<sup>36</sup> Indeed, researchers have suggested that CO<sub>2</sub> levels today are higher than they have been at any point in the last 800,000 years.<sup>37</sup>

The U.S. is one of the largest CO<sub>2</sub> emitters in the world, second only to China.<sup>38</sup> Since the Industrial Revolution in the late 1700s, emissions from fossil fuel combustion in the U.S. and elsewhere have consistently increased the atmospheric CO<sub>2</sub> levels.<sup>39</sup> Processes used to clear land for agricultural use, industry, and other human activities have also increased greenhouse gas concentrations.<sup>40</sup>

Although increased greenhouse gas levels are largely attributed to more recent human activities, the actions of early American settlers also significantly contributed to global warming. When colonization began in earnest in the early 1600s, roughly one billion acres of forest covered the nation.<sup>41</sup> The vast amounts of trees covering the nation in the 1600s intimidated European settlers and even prompted some logging aimed simply

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32. *Id.*

33. Duncan Clark & Carbon Brief, *How Long do Greenhouse Gases Stay in the Air?*, GUARDIAN (Jan. 16, 2012), <https://www.theguardian.com/environment/2012/jan/16/greenhouse-gases-remain-air>; See *What are the Main Man-Made Greenhouse Gases?*, GUARDIAN (Feb. 21, 2011), <https://www.theguardian.com/environment/2011/feb/04/man-made-greenhouse-gases> (reporting that CO<sub>2</sub> makes up around three-quarters of greenhouse gasses).

34. See generally NAT'L AERONAUTICS & SPACE ADMIN., *supra* note 24 (explaining atmospheric CO<sub>2</sub> occurs naturally and anthropogenically).

35. See generally *id.* (stating evidence shows atmospheric CO<sub>2</sub> levels have increased by over one third since the Industrial Revolution).

36. See Lindsey, *supra* note 27 (explaining that CO<sub>2</sub> is responsible for two-thirds of energy imbalance causing temperature rise). 27

37. See *id.* (explaining how carbon dioxide levels have increased).

38. *Id.*

39. Earth Observatory, *supra* note 9.

40. See Lindsey, *supra* note 2727 (showing that land use changes have contributed to increase in carbon dioxide emissions); see Ottmar Eenhof et al., *Summary for Policy Makers: Mitigation of Climate Change*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2014), [https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc\\_wg3\\_ar5\\_summary-for-policymakers.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_summary-for-policymakers.pdf).

41. See Stephanie Buck, *The First American Settlers Cut Down Millions of Trees to Deliberately Engineer Climate Change*, TIMELINE (Aug. 22, 2017), <https://timeline.com/american-settlers-climate-change-5b7b68bd9064> (discussing the acreage of forests in the United States before colonization).

at ridding the land of its dark forests.<sup>42</sup> Of course, over the ensuing 200 years, Americans continued to aggressively deforest large swaths of the nation's land.<sup>43</sup> They cut down over half of the Northeast's forests to clear land for agricultural use, support the logging industry, and provide wood for railroad companies.<sup>44</sup> Today, only 286 million acres of trees remain, meaning that the U.S. has already destroyed roughly 71.4% of its native forests.<sup>45</sup>

### B. Obstacles to Optimal Tree Planting and Conservation

Several obstacles have historically deterred governments and individuals across the U.S. from adequately investing in planting and maintaining trees. The most basic among them is that existing markets and policies tend to insufficiently promote tree protection and planting.<sup>46</sup> Planting and maintaining large numbers of trees is expensive. One recent study determined that an average tree costs about \$18 annually for watering and maintenance alone.<sup>47</sup> Because those who plant and maintain trees rarely capture all the societal benefits of their actions, few governments and individuals are willing to voluntarily make optimal levels of investment in tree planting.<sup>48</sup>

#### 1. Location-Related Constraints on Tree Planting

Climatological constraints further impede tree planting and complicate tree-related policymaking. As the popular motto "Right Tree, Right Place"

42. *Id.*; See George H. Stankey, *Historical Roots of Wilderness Concept*, 29 Nat'l Res. J. 9, 14–19 (1989).

43. Buck, *supra* note 41; see Stankey, *supra* note 42, at 20–21 (describing attitudes towards the wilderness in the new world).

44. See National Geographic Society, *Deforestation*, NAT'L GEOGRAPHIC: RES. LIBR., ENCYCLOPEDIA ENTRY (last updated July 16, 2019) ("In North America, about half of the forests in the eastern part of the continent were cut down from the 1600s to the 1870s for timber and agriculture."), <https://www.nationalgeographic.org/encyclopedia/deforestation/>; See also Stankey, *supra* note 42, at 18 ("Much of the drive to subdue the wilderness was not motivated by the desire to convert it into civilization as it was to capture the values it held—its timber, its minerals, its soils.").

45. Buck, *supra* note 41.

46. See David J. Nowak, *Assessing the Benefits & Economic Values of Trees*, in ROUTLEDGE HANDBOOK OF URBAN FORESTRY 152, 158–161 (Francesco Ferrini et al. eds. 2017) (discussing unmonetized externalities of tree planting). 127

47. See E. GREGORY MCPHERSON ET AL., CTR. FOR URB. FOREST RES., DEP'T OF LAND, AIR, WATER RES., U.C., DAVIS, COASTAL PLAIN COMMUNITY TREE GUIDE: BENEFITS, COSTS, AND STRATEGIC PLANTING 28 (2006), [https://www.fs.fed.us/psw/publications/documents/psw\\_gtr201/psw\\_gtr201guide.pdf](https://www.fs.fed.us/psw/publications/documents/psw_gtr201/psw_gtr201guide.pdf) (applying the average cost of tree maintenance on the Coastal Plains).

48. See Kyla Mandel, *Planting Trees Helps Fight Climate Change but We Need Billions More Seedlings*, NAT'L GEOGRAPHIC (Mar. 2, 2021), <https://www.nationalgeographic.com/environment/article/planting-trees-helps-fight-climate-change-but-we-need-billions-more-seedlings> (explaining underinvestment, workforce, rate of return, and yield challenges associated with reforestation efforts).

suggests, certain regions and climates are only capable of supporting the growth of certain tree species.<sup>49</sup> These locational constraints make it difficult to promote increased forestation as a solution to climate change because it is not always clear which tree species are best suited for any given location. In some locales tree planting is not cost-justifiable at all.<sup>50</sup> In fact, in some locations, planting too many trees of the same species could ultimately harm or destroy delicate ecosystems.<sup>51</sup> For instance, given the large quantity of water that trees require to survive, planting too many in a given area may have major adverse effects on the area's groundwater supply.<sup>52</sup> Similarly, overplanting trees in the upstream areas of a watershed can potentially deplete water resources and indirectly impose damages hundreds of miles downstream.<sup>53</sup>

The extended time it takes for many types of trees to mature only further complicates policymaking related to tree planting and maintenance. Because some trees take upwards of 50 years to mature, some have reasoned that certain forested land may be more valuable in the short term if used differently.<sup>54</sup> Once trees are planted, the land is often largely unavailable for most other uses, including agricultural activities and real estate development.<sup>55</sup>

## 2. Potential Warming Effects of Tree Planting

Some opponents of tree planting have argued that it might actually increase global warming, even though in most cases planting trees produces net benefits in the fight against climate change.<sup>56</sup> One line of arguments made

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49. See *Right Tree in the Right Place*, ARBOR DAY FOUND., <https://www.arborday.org/trees/righttreeandplace/> (last visited Feb. 13, 2020) (interpreting a factor list to determine what type of tree will thrive in specific locations and climates).

50. See *id.* (suggesting that it is not cost-justifiable to plant a tree that will not survive or grow due to poor planning).

51. See Daniel B. Blanco, *We Can't Just Plant Billions of Trees to Stop Climate Change*, DISCOVER MAG. (July 10, 2019), <https://www.discovermagazine.com/planet-earth/we-cant-just-plant-billions-of-trees-to-stop-climate-change> (Many commercial tree farms practice monoculture, the growth of a single plant species over a large area of land. Unfortunately, monoculture practices can generate additional environmental costs because a greater biodiversity of plant life often fosters more healthy ecosystems and decreases wildfire risks.).

52. *Id.*

53. Jessica Vomiero & Jesse Ferreras, *Reality Check: Will Planting 1 Billion Hectares of Trees Slow Down Climate Change?*, GLOBALNEWS.CA (July 9, 2019), <https://globalnews.ca/news/5471379/planting-trees-climate-change-theory/> (discussing potential harmful effects of using tree planting to mitigate climate change).

54. *Natural Forest Management*, FOOD & AGRIC. ORG. OF THE UNITED NATIONS, <http://www.fao.org/forestry/sfm/en/> (last updated Nov. 4, 2020).

55. *Id.*

56. Alan Buis, *Examining the Viability of Planting Trees to Help Mitigate Climate Change*, NAT'L AERONAUTICS & SPACE ADMIN. (Nov. 7, 2019), <https://climate.nasa.gov/news/2927/examining-the-viability-of-planting-trees-to-help-mitigate-climate-change/>.

against tree planting and maintenance relates to the equipment commonly used for such activities, which is typically gas-powered and thus emits carbon dioxide.<sup>57</sup> Vehicles for transporting saplings, chain saws for pruning, chippers to clear unhealthy trees, and other tools used in the process of planting and caring for trees can emit large amounts of CO<sub>2</sub>, which surely offset some of the decarbonization effects of tree planting.<sup>58</sup>

A few tree planting adversaries argue that trees themselves could increase global warming because of their darker color.<sup>59</sup> Under this theory, an increase of darker-toned trees across a landscape decreases the planet's albedo or reflection of light back into space, causing more heat to remain in the atmosphere.<sup>60</sup> It is true that some tree leaves absorb more sunlight than other types of land cover such as fields or bare ground.<sup>61</sup> Accordingly, planting those tree species may decrease the Earth's surface albedo by reflecting less sunlight back into space and thereby slightly increase global warming.<sup>62</sup> However, in most cases it is highly doubtful that these potential adverse effects outweigh the potential carbon-reducing power of trees.

### C. The Many Benefits of Trees

In addition to helping reduce atmospheric CO<sub>2</sub> levels, trees provide multiple other valuable benefits. The following materials describes some of the many societal benefits of trees, many of which are not fully captured by those who plant and maintain them.

#### 1. Trees Decrease Atmospheric CO<sub>2</sub>

Trees directly absorb CO<sub>2</sub> in their stems and leaves while they grow. Trees use roots to take in water, chloroplasts to take in carbon dioxide from the air, and energy from the sun to create a photosynthetic reaction that

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57. MCPHERSON ET AL., *supra* note 47, at 18.

58. *See id.* (explaining that CO<sub>2</sub> emissions released while planting and maintaining trees with these machines offsets up to 8% of the overall CO<sub>2</sub> reduction obtained by planting the trees).

59. Buis, *supra* note 56; Brent D. Matthies & Lauri T. Valsta, *Optimal Forest Species Mixture with Carbon Storage and Albedo Effect for Climate Change Mitigation*, 123 *ECOLOGICAL ECON.* 95–105 (Mar. 2016).

60. *See generally* Matthies & Valsta, *supra* note 59 (explaining how leaves of different colors affect sunlight absorption); *see* Jordan Hanania, et al., *Albedo*, *ENERGY EDUC.* (Jan. 31, 2020), <https://energyeducation.ca/encyclopedia/Albedo> (explaining albedo).

61. *See* Matthies & Valsta, *supra* note 59. (citing research comparing the albedo of bare land and boreal forest cover).

62. Gabriel Popkin, *How Much can Forests Fight Climate Change?*, *NATURE* (Jan. 15, 2019), <https://www.nature.com/articles/d41586-019-00122-z>.

reorganizes the molecules into sugar and oxygen.<sup>63</sup> This sugar is further broken down for the tree to use as energy while the excess oxygen is released back to the atmosphere.<sup>64</sup> On average, it takes an acre of forest to absorb twice the amount of CO<sub>2</sub> produced by the average car's annual mileage.<sup>65</sup> Besides CO<sub>2</sub>, trees trap other greenhouse gases and airborne pollutants, removing them from the atmosphere in ways that help promote healthy respiratory systems in humans and animals.<sup>66</sup>

Because trees sequester large amounts of CO<sub>2</sub>, destroying trees reverses many of their positive benefits. Trees contain large quantities of carbon-based compounds that are turned into wood, leaves, and other essential tree parts.<sup>67</sup> Therefore, deforestation releases large amounts of carbon back into the atmosphere because the carbon-using tissues in harvested trees no longer need that carbon and thus emit much of it into the air.<sup>68</sup>

## 2. Broader Societal Benefits of Trees

In addition to reducing atmospheric CO<sub>2</sub> levels, trees provide other benefits to the ecosystems and individuals around them. For example, trees strategically planted near buildings have been proven to provide an array of health benefits for workers, patients, and students because they incentivize outdoor activities and are aesthetically pleasing.<sup>69</sup> The ability to view trees and green spaces from work or school windows increases learning and work productivity.<sup>70</sup> And trees near hospitals have even proven to decrease recovery time in patients.<sup>71</sup> One study providing a “comprehensive summary of existing literature on the health impacts of urban trees” mentions greater neighborhood tree canopy cover has been associated to a “12% lower

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63. See generally Sci. & Tech. Concepts Middle Sch., *What is Photosynthesis*, SMITHSONIAN SCI. EDU. CTR.: STEMVISIONS BLOG (Apr. 12, 2017), <https://ssec.si.edu/stemvisions-blog/what-photosynthesis> (explaining the process of photosynthesis). 41

64. See *id.* (showing that trees not only sequester CO<sub>2</sub>, but also purify the air by providing more oxygen).

65. Keystone 10 Million Trees Partnership, *All About Trees*, TENMILLIONTREES.ORG (last visited Aug. 3, 2021), <http://www.tenmilliontrees.org/trees/>.

66. *Id.*; see also David J. Nowak, *The Effects of Urban Trees on Air Quality*, U.S. DEP'T OF AGRIC.: N. RSCH. CENT. (2002), [https://www.nrs.fs.fed.us/units/urban/local-resources/downloads/Tree\\_Air\\_Qual.pdf](https://www.nrs.fs.fed.us/units/urban/local-resources/downloads/Tree_Air_Qual.pdf) (discussing direct and indirect effects of urban vegetation on local and regional air quality).

67. R. Phillip Bouchard, *Trees and Carbon Dioxide: What is the True Connection?*, MEDIUM.COM: PHILIPENDIUM (Sept. 23, 2018), <https://medium.com/the-philipendium/trees-and-carbon-dioxide-what-is-the-truth-c7f8c9d12602>.

68. *Id.*

69. Tree Advisory Board, *Benefits of Planting Trees*, CITY OF BOWLING GREEN, KY., <https://www.bgky.org/tree/benefits> (last visited Nov. 14, 2020).

70. See MCPHERSON ET AL., *supra* note 47, at 26 (explaining that seeing trees eases mental fatigue). 47

71. *Id.*

prevalence of obesity in preschool children.”<sup>72</sup> Because trees tend to induce more outdoor interactions, they may likewise help reduce levels of domestic violence and foster safer and more sociable neighborhood environments.<sup>73</sup>

Trees provide a multiplicity of benefits for homeowners as well. They cast shade on homes, lowering the inside temperatures and thereby reducing demand for electric power to cool homes on hot days.<sup>74</sup> This increase in shade can greatly decrease a household’s energy bills during the summer.<sup>75</sup> Likewise, trees can serve as windbreaks in yards, reducing winter heating bills by lowering the wind chill near homes.<sup>76</sup> In some settings, trees can even increase housing prices.<sup>77</sup> One study determined that neighborhood trees could increase median neighborhood prices by more than \$9,000.<sup>78</sup>

Trees likewise provide valuable habitat for wildlife, including shelter and food for a wide variety of birds and small animals.<sup>79</sup> For example: flowers, fruits, and woody parts of trees provide sustenance for some wildlife; bacteria and fungi contained in some tree parts make nesting easier for birds; many trees contributed to increased soil fertility; and many types of trees are capable of providing structures for burrowing by certain land animals.<sup>80</sup>

### 3. Specific Benefits of Urban Trees

In addition to providing valuable benefits to individuals and animals, trees often have positive broader impacts on urban communities. In many urban areas, tree canopies produce valuable shade in parking lots and along streets where cars park. By shading asphalt surfaces and parked vehicles, trees reduce hydrocarbon emissions—or Volatile Organic Compounds (VOCs)—from gasoline, which can evaporate out of leaky fuel tanks and

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72. Wolf et al., *Urban Trees and Human Health: A Scoping Review*, 17 INT’L J. ENV’T RSCH. PUB. HEALTH, June 18, 2020, at 14 (citing Lovasi et al., *Neighborhood Safety and Green Space as Predictors of Obesity Among Preschool Children from Low-income Families in New York City*, 57 PREVENTATIVE MEDICINE 189, 189–193 (2013)).

73. MCPHERSON ET AL., *supra* note 4747, at 25.

74. Ram Pandit & David Laband, *Energy Savings from Tree Shade*, 69 ECOLOGICAL ECON. 1324, 1324 (2010).

75. *Id.* at 1326.

76. *Landscape Windbreaks and Efficiency*, U.S. DEP’T ENERGY, <https://www.energy.gov/energysaver/design/landscaping-energy-efficient-homes/landscape-windbreaks-and-efficiency> (last visited on Feb. 13, 2020).

77. *Big Trees Make your Property Value Grow*, BRIGHTVIEW (Jan. 5, 2018) <https://www.brightview.com/resources/article/big-trees-make-your-property-value-grow#:~:text=Good%20tree%20cover%20increased%20property,without%20trees%20or%20quality%20landscaping.>

78. Geoffrey H. Donovan et al., *Urban Trees, House Price, and Redevelopment Pressure in Tampa, Florida*, 38 URB. FORESTRY & URB. GREENING 330, 334 (2019).

79. *Trees Provide Habitat for Wildlife*, URB. FORESTRY NETWORK, <http://urbanforestrynetwork.org/benefits/wildlife.htm> (last visited Nov. 12, 2020).

80. *Id.*

worn hoses.<sup>81</sup> These reductions in evaporated VOCs help even more to slow the rate of climate change.<sup>82</sup>

Healthy trees can also reduce pollution from storm water runoff.<sup>83</sup> Tree leaves intercept and store rainfall, and tree roots can increase the rate at which rainfall infiltrates soil and the water storage capacity of the soil itself.<sup>84</sup> These benefits are particularly important for cities, since federal law requires states and localities to control nonpoint-source pollution such as runoff from pavements, buildings, and landscapes.<sup>85</sup> Trees can likewise reduce wastewater treatment costs because nurseries can often be irrigated with tertiary treated wastewater rather than fresh water.<sup>86</sup> Irrigating nurseries with wastewater may even help to further clean the water because the soil acts as a natural filter.<sup>87</sup>

## II. THE ROOTS OF THE PROBLEM: EXAMINING EXISTING U.S. TREE POLICIES

Despite well-established evidence that trees are critical tools in the fight against climate change and provide numerous other valuable benefits, much of the nation's existing policy structure seems more tailored to promote deforestation than to encourage reforestation. Part II describes several current federal and local policies aimed at encouraging forestation and explains why these incentives, programs, and goals are not nearly aggressive enough to help decrease the nation's net CO<sub>2</sub> emissions levels.

The nation's underinvestment in tree planting and maintenance is attributable—at least in part—to a simple positive externality problem: individuals and businesses that plant and maintain trees ordinarily bear all, or nearly all, of the cost of doing so but reap only some of the benefits.<sup>88</sup> As highlighted above, trees can produce shade along public sidewalks, clean the air, absorb atmospheric CO<sub>2</sub>, decrease stormwater pollution, and serve other valuable functions.<sup>89</sup> Many of these benefits accrue to those other than those who plant and maintain trees.

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81. MCPHERSON ET AL., *supra* note 4747, at 22.

82. *See generally* California Urban Forestry Act, PUB. RES. §§ 4799.07-.09 (1978) (describing that urban forestry improves the health and quality of urban environments).

83. MCPHERSON ET AL., *supra* note 4747, at 23.

84. *Id.*

85. *Id.*

86. *Id.* at 24.

87. *Id.*

88. *See* Mandel, *supra* note 48 (citing problems with underinvestment in nurseries and training); *see also* Heather A. Sander et al., *The Value of Urban Tree Cover: A Hedonic Property Price Model in Ramsey and Dakota Counties, Minnesota, USA*, 69 *ECOLOGICAL ECON.* 1646, 1646 (2010) (citing data on different urban forestation efforts and their associated costs and benefits).

89. *Supra* Part I.C; *see* Sander et al., *supra* note 88, at 1646–48 (discussing unmonetized positive externalities of trees).

Market forces alone have proven inadequate to produce socially optimal investments in trees. Because trees create positive externality problems, there is a need for governments to intervene more aggressively to help correct this market failure.<sup>90</sup> Unfortunately, existing federal, state, and local government incentives and policies are not strong enough to effectively do so. The following subsections describe some of the nation's existing forestation policies and highlight how they are falling short in driving optimal levels of tree-related investment.

### *A. Federal Policy Approaches*

Existing federal tax incentives, the 2018 Farm Bill (Farm Bill) programs, and loan guarantees in the U.S. fail to incentivize optimal levels of tree planting and forest conservation. Most existing federal incentive programs related to trees are unsuccessful at encouraging farmers to embrace agroforestry practices because they are too complicated, not sufficiently advertised, or not enticing enough to persuade citizens to act.<sup>91</sup>

#### 1. Federal Tax Incentives

Although the Internal Revenue Code (IRC) offers multiple tax incentives that encourage certain forestry practices, existing incentives have largely proven ineffective at promoting forestation goals.<sup>92</sup> For example, one IRC provision allows qualified timber properties to claim special tax deductions for reforestation expenditures through an accelerated amortization schedule.<sup>93</sup> Under IRC § 194(a), a taxpayer may claim a deduction using “amortization of the amortizable basis of qualified timber property based on a period of 84 months.”<sup>94</sup> In subsection (b) of that section, a farmer may treat certain reforestation expenditures as a deduction.<sup>95</sup> However, § 194 applies

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90. See Sander et al., *supra* note 88, at 1649; see, e.g., Fransico Escobedo & Jennifer Seitz, *Costs of Managing an Urban Forest* (Sch. Forest Res. Conservation Department, Univ. Fla./Inst. Food & Agric. Sciences Extension, Document No. FOR217, 2019), <https://edis.ifas.ufl.edu/pdf/FR/FR27900.pdf> (discussing costs and benefits associated with management and planning urban forests).

91. See generally *Agroforestry Practices*, U.S. DEP'T AGRIC. NAT'L AGROFORESTRY CTR., <https://www.fs.usda.gov/nac/practices/index.shtml> (last visited Nov. 12, 2020) (defining agroforestry and its benefits); see also A. Armstrong et al., *Adoption of the Conservation Reserve Enhancement Program in the New York City Watershed: The Role of Farmer Attitudes*, 66 J. SOIL & WATER CONSERVATION 337 (2011) (analyzing farmer and landowner attitudes towards agroforestry and conservation initiatives).

92. U.S. DEP'T AGRIC., FOREST LANDOWNERS' GUIDE TO THE FEDERAL INCOME TAX 13, 98, 105, 122, 126 (Feb. 2013), [https://www.fs.usda.gov/sites/default/files/legacy\\_files/FS\\_Landowners\\_Tax\\_Guide.pdf](https://www.fs.usda.gov/sites/default/files/legacy_files/FS_Landowners_Tax_Guide.pdf) (referencing incentives in sections 48, 126, 162, 175, and 194 of the Internal Revenue Code).

93. 26 U.S.C. § 194.

94. *Id.* § 194(a).

95. *Id.* § 194(b).

only to “qualified timber property,” which means that a taxpayer must have commercial quantities of trees used solely for the commercial production of timber products.<sup>96</sup> Moreover, this tax incentive cannot be used in conjunction with other reimbursements provided under governmental reforestation cost-sharing programs.<sup>97</sup>

Although § 194 is arguably the IRC’s most direct tax incentive for reforestation expenditures, it fails to effectively encourage long-term reforestation investments for a multitude of reasons.<sup>98</sup> Among other things, § 194 does not provide incentives for small farms because it targets only large commercial timber companies.<sup>99</sup> Accordingly, it rewards only those taxpayers who plant trees for the purpose of harvesting them later. These limitations ironically provide greater incentives for less environmentally-friendly actors because once commercially harvested trees are cut they stop sequestering carbon and may even release much of their previously stored carbon back into the atmosphere.<sup>100</sup> Moreover, § 194 allows farmers to collect only one-time deductions for their reforestation efforts,<sup>101</sup> thus failing to continuously encourage them to plant and maintain trees. Such incentives would better reward continued maintenance and preservation of trees if they somehow allowed for deductions over several years rather than a single deduction.

Another tree-related incentive provision in the IRC excludes cost-share payments that are currently available through environmentally friendly programs.<sup>102</sup> Section 126 protects farmers that participate in these programs from entering into a higher tax bracket and ensures that the money farmers receive from the programs is tax free at the end of the year.<sup>103</sup> This includes participation in any state program where payments are made to farmers for the purpose of restoring the environment, improving forests, or providing a habitat for wildlife.<sup>104</sup> Unfortunately, § 126 does not directly incentivize tree planting; it simply provides farmers with a monetary safe haven for

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96. *Id.* § 194(c)(1) (defining qualified timber). 93

97. *Id.* § 194(c)(3)(B).

98. Steven H. Bullard & Thomas J. Straka, *Structure and Funding of State-Level Forestry Cost-Share Programs*, 5 N. J. APPLIED FORESTRY 132, 133 (1988).

99. 26 U.S.C. § 194(c)(1); U.S. DEP’T AGRIC., *supra* note 92, at 15; *See* U.S. DEP’T AGRIC., AMERICA’S DIVERSE FAMILY FARMS, 3 (2020) (defining a small family farm as having a gross cash farm income of less than \$350,000 a year).

100. Blanco, *supra* note 51.

101. 26 U.S.C. § 194(a) (explaining the deduction is based on a period of 84 months).

102. INTERNAL REVENUE SERV., U.S. DEP’T TREASURY, PUB. NO. 225, CAT. NO. 11049L, FARMER’S TAX GUIDE, at 12 (2020), <https://www.irs.gov/pub/irs-pdf/p225.pdf>.

103. *Id.*; 26 U.S.C. § 126; *Id.* § 126(b)(1)(B) (excluding funds received from under a list of programs from taxation provided they do not significantly increase recipient’s annual income).

104. *Id.* § 126(a)(8).

participation in particular programs.<sup>105</sup> Accordingly, the provision does little to encourage farmers to plant more trees. To better incentivize farmers to engage in tree planting programs, the IRC would need to allow for direct reimbursement for sustained reforestation efforts.

One other noteworthy federal forestation tax incentive is IRC § 175. Section 175 allows for a deduction of expenses incurred for the purpose of soil or water conservation, the prevention of erosion of land, or for endangered species recovery on agricultural land.<sup>106</sup> Deductible actions include the establishment of windbreaks and planting of trees to reduce or prevent erosion.<sup>107</sup> Section 175 is the only IRC section that promotes forestation for the sole reason of protecting the environment.<sup>108</sup> Although § 175 is a positive step, it is unfortunately not strong enough to drive significant increases in private reforestation activities.

## 2. Farm Bill Programs

In addition to offering general tax incentives, the federal government has crafted certain policies designed specifically to encourage farmers to plant trees. At least three programs administered by the United States Department of Agriculture (USDA) encourage reforestation, but none have proven highly effective at driving tree planting and maintenance on U.S. farms. Six programs administered by the Natural Resources Conservation Service (NRCS), a sub-agency of the USDA, that encourage farmers to maintain in-place foliage have also done little to promote the planting of new trees.<sup>109</sup>

The USDA's existing tree-related programs include the Forestry Stewardship Program, the Conservation Reserve Program (CRP), and the Conservation Reserve Enhancement Program (CREP). The Forestry Stewardship Program primarily helps landowners plan for, and maintain, healthy forests.<sup>110</sup> Under the CRP and CREP, the federal government essentially leases private farmland for the purpose of planting native species

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105. *See id.* § 126 (providing only taxation standards for program fund awards and exceptions to those standards).

106. 26 U.S.C. § 175 (a) (applying to those engaged in the business of farming); *see id.* § 175(b) (explaining that farmers may deduct up to 25% of their gross farm income derived from farming).

107. *Id.* § 175(a); *Id.* § 175(c)(1).

108. *Id.* § 175(c)(1).

109. *See Conservation Programs*, U.S. DEP'T AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/index> (last visited Nov. 12, 2020) (explaining and naming the six conservation programs: The Environmental Quality Incentives Program, Conservation Stewardship Program, Agricultural Management Assistance Program, Healthy Forests Reserve Program, and Regional Conservation Partnership Program).

110. *Forest Stewardship*, U.S. DEP'T AGRIC., <https://www.fs.usda.gov/managing-land/private-land/forest-stewardship> (last visited Jan. 18, 2020).

as a means of conserving the “natural land.”<sup>111</sup> Farmers are compensated under the legislation for voluntarily taking their land out of production and allowing the federal government to maintain native tree species on the property.<sup>112</sup>

Programs administered by the NRCS similarly provide funding for private land conservation and stewardship. These programs encourage farmers to maintain current forestry conservation measures but do not incentivize new planting. For example, the Environmental Quality Incentives Program, Conservation Stewardship Program, and Healthy Forest Reserve Program encourage environmental management and stewardship by providing farmers with various modest assistance programs.<sup>113</sup> The Healthy Forest Reserve Program specifically helps landowners restore, enhance, and protect forestland through limited conservation easements and funds.<sup>114</sup> Although it is the only federal program to list carbon dioxide sequestration as a positive benefit of reforestation, it does not encourage new planting.<sup>115</sup>

As just described, existing federal Farm Bill tree programs reward farmers’ conservation efforts but do not go nearly far enough to promote optimal levels of tree planting. Today’s Farm Bill reforestation programs have generally been unsuccessful at encouraging reforestation for a multitude of reasons, including the reality that most farmers are not aware of them. Meanwhile, some other programs have proven less than effective, in part, because they provide only educational tools and no monetary incentives. And even those programs that do provide monetary incentives are not rewarding enough to entice many farmers to participate in them. To address these efficiencies, the government should revise federal reforestation policies to.

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111. *Conservation Reserve Enhancement Program*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-enhancement/index> (last visited Jan. 18, 2020).

112. *Id.*; *see also Conservation Reserve Program*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index> (last visited Jan. 18, 2020) (describing the Conservation Reserve Program).

113. *Environmental Quality Incentives Program*, U.S. DEP’T AGRIC., NAT’L RES. CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/equip/> (last visited Aug. 4, 2020); *Conservation Stewardship Program*, U.S. DEP’T AGRIC., NAT’L RES. CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/> (last visited Aug. 4, 2020); The Conservation Stewardship Program provides funding for existing agricultural producers who are already practicing conservation methods. *Id.* The more the farmer invests in conservation, the more funding they are likely to receive for those efforts; *Healthy Forests Reserve Program*, U.S. DEP’T AGRIC., NAT’L RES. CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/easements/forests/>; *see also Farm Bill*, U.S. DEP’T AGRIC., NAT’L RES. CONSERVATION SERV., <https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/farmbill/> (last visited Aug. 4, 2021).

114. *Healthy Forests Reserve Program*, *supra* note 113.

115. *See id.* (explaining that the program promotes the restoration or protection of forestland rather than planting new trees).

### 3. Agricultural Loan Guarantees

There are two federal loan programs used to incentivize certain farming activities. These programs should be reworked to encourage tree planting on private agricultural lands. First, the federal Farm Service Agency (FSA)<sup>116</sup> makes and administers direct loans to farms in an effort to help “keep America’s agriculture growing.”<sup>117</sup> These loans, which are financed and serviced by the FSA with funding from the USDA budget,<sup>118</sup> help farmers in several ways: to become owner-operators of family farms; to improve or expand current operations; to increase farm productivity; and to assist with land stewardship to help preserve land for future generations.<sup>119</sup>

Second, loan guarantee programs are another type of federal loan assistance available to farmers.<sup>120</sup> Under these programs, a bank provides the loan funding rather than the FSA.<sup>121</sup> However, if a farmer defaults on the loan, the FSA “guarantees” the loan against 95% of significant loss of principal or interest.<sup>122</sup> Loans to farmers are obviously far less risky to banks when the FSA guarantees them in this way, so these programs can make it much easier for farmers to secure the financing they need on reasonable terms.<sup>123</sup> Conceivably, these programs could be similarly used to help farmers to finance various eligible tree planting and maintenance activities.

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116. *See Farm Ownership Loans*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/farm-ownership-loans/index> (last visited Jan. 18, 2020) (explaining the FSA’s authority as an agency of the USDA to issue farm ownership loans and their purpose).

117. *See id.* (explaining the types of farm ownership loans available).

118. *Id.*

119. *Id.*; *See also Direct and Guaranteed Farm Loans: Providing Loans to Family Farmers & Ranchers to Purchase Land & Assets, or Finance Annual Operating Expenses*, NAT’L SUSTAINABLE AGRIC. COAL., <https://sustainableagriculture.net/publications/grassrootsguide/farming-opportunities/farm-ownership-operating-loans/#basics> (last visited Nov. 12, 2020) (explaining what farm loans are available and how they work).

120. *See id.* (“Direct loans are made and administered by local FSA offices, while guaranteed loans are made and administered by banks, credit unions, community development financial institutions (CDFIs), or other lenders.”).

121. *Id.*

122. *Guaranteed Farm Loans*, U.S. DEP’T AGRIC., <https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/guaranteed-farm-loans/index> (last visited Nov. 13, 2020).

123. *Farm Service Agency Definition of Family Farm for Loan Programs*, CTR. FOR RURAL AFFS. (July 18, 2010), <https://www.cfra.org/node/2856>. Besides general loan requirements, a farmer applying for a loan under the Farm Bill must run a ‘family farm.’ *Id.* A family farm under the FSA definition means that the farmer’s family provides most of the day-to-day labor, that a family member is the ‘decision maker’ of the farm, and that family members provide both physical labor and management for the farm. If all these requirements are met, then the farmer runs a family farm and can apply for either a Direct or Guarantee loan under the Farm Bill. *Id.*; *see* NAT’L SUSTAINABLE AGRIC. COAL., *supra* note 119 (stating that other requirements include but are not limited to: being a U.S. Citizen, having no previous debt forgiveness from the FSA, being unable to secure a loan elsewhere without the FSA’s help, and being able to show sufficient farm managerial experience through education).<sup>119</sup>

### B. Existing State and Local Urban Forestry Policies

In addition to encouraging more tree planting in rural areas, the government could do much more to incentivize tree planting in urban settings. States and municipalities across the country vary significantly in their approaches to tree planting and conservation policies. The materials that follow highlight several examples of local policies designed to encourage urban forestry.

#### 1. Tree Canopy Goals

Some cities in the U.S. adopted specific tree canopy goals designed to encourage increased tree planting in urban areas.<sup>124</sup> An urban tree canopy is a layer of tree leaves, branches, and stems that provides shade.<sup>125</sup> Tree canopy goals are simple standards that promote urban forestry and the various benefits these activities can provide,<sup>126</sup> including increased shade cover, carbon dioxide absorption, and improved green spaces.<sup>127</sup> As suggested in Part I, many of these benefits accrue to parties other than the municipal governments in which the trees are situated.<sup>128</sup> Nonetheless, large cities are increasingly implementing tree canopy goals.<sup>129</sup> For instance, the City of Phoenix, Arizona, implemented a “Tree Canopy and Shade Master Plan” in 2010 that seeks to increase the use of tree canopy shade to address urban heat issues.<sup>130</sup> To date, the city’s approach largely appears to be succeeding.<sup>131</sup> Since its implementation, Phoenix has recorded annual benefits that include removal of 1,700 tons of air pollution, sequestration of 35,400 tons of carbon, production of 89,200 tons of oxygen, and about 91.7 million cubic feet of avoided storm water runoff.<sup>132</sup>

Other cities in Arizona and across the U.S. have similarly reaped significant benefits from tree canopy goals and planning. Tempe, Arizona,

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124. Michael Leff, Davey Inst. & U.S. Forest Serv., *Tree Canopy Goals for US Cities*, VIBRANT CITIES LAB (2016), <https://www.vibrantcitieslab.com/resources/tree-canopy-goals-for-us-cities/>.

125. *Urban Natural Resource Stewardship: Urban Tree Canopy*, U.S. DEP’T AGRIC. FOREST SERV., <https://www.nrs.fs.fed.us/urban/utc/> (last visited Nov. 12, 2020).

126. *Urban Tree Canopy*, CTR. FOR WATERSHED PROT., <https://www.cwp.org/urban-tree-canopy/> (last visited Nov. 14, 2020).

127. Nowak, *supra* note 46, at 152.

128. *Id.* at 157.

129. *Id.* at 153.

130. *Forests and Sustainable Cities: Inspiring Stories from Around the World*, FOOD & AGRIC. ORG. OF THE U.N. 11 (2018), <http://www.fao.org/3/i8838en/i8838en.pdf>.

131. See generally Mike Sunnucks, *Phoenix Looks to Increase Planting of New Trees, Improve Shade Canopy*, ROSE L. GROUP REP. (Jan. 2, 2020), <https://roselawgroupreporter.com/2020/01/phoenix-looks-to-increase-planting-of-new-trees-improve-shade-canopy/> (describing how Phoenix is moving forward with the tree canopy project).

132. *Community Forest Assessment*, DAVEY RSCH. GRP. 1 (2014), [https://www.itreetools.org/documents/405/Phoenix\\_Community\\_Forest\\_Assessment\\_1.2.15-Final.pdf](https://www.itreetools.org/documents/405/Phoenix_Community_Forest_Assessment_1.2.15-Final.pdf).

adopted an Urban Forest Tree Canopy plan to become a “20 minute city” by the year 2040.<sup>133</sup> The city plans to use a city urban forester, landscape architects, and community members to help it meet its goal.<sup>134</sup> Tempe claims that the tree canopy will not only enhance community beautification and livability though encouraging outdoor activities but will also enhance property values, expand shade to maximize urban cooling, support biodiversity and wildlife habitat, and improve walkability for those who do not, or cannot, use automobile transportation.<sup>135</sup> Many Eastern U.S. cities are also adopting tree canopy goals. Philadelphia recently launched a ten-year urban forest plan to increase the city’s tree canopy by 10% in ten years.<sup>136</sup> The city plans to target areas in need of trees to reduce the urban heat island and mitigate the impact of climate change.<sup>137</sup>

While citywide tree canopy goals are the most common local-level approach to promoting tree planting, they are not the only strategy. For example, several east coast states created a regional urban canopy goal.<sup>138</sup> The Chesapeake Bay Program plans to increase the regional urban tree canopy by 2,400 acres by the year 2025.<sup>139</sup> It is believed that the increased canopy will provide better air and water quality as well as habitat benefits throughout the region.<sup>140</sup> Each state participating in the program has its own specific canopy goal to reach by 2025, and most member states plan to reach that goal through local municipality engagement.<sup>141</sup>

## 2. Tree Giveaway Incentives

Some other cities have sought to promote urban forestry through tree giveaway programs that give citizens one or more free trees to plant on their own land. One recent study found that private land is often the most

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133. *City of Tempe Urban Forestry Master Plan*, CITY OF TEMPE 4 (2017), <https://www.tempe.gov/home/showdocument?id=54581>. The goal of becoming a “20 minute city” is so that residents can walk 20 minutes in the summer to any municipal hub without worrying about their health or the heat. *Id.*

134. *Id.* at 25.

135. *Id.* at 16–18.

136. See Frank Kummer, *Philadelphia Launching 10-Year ‘Urban Forest’ Plan After Startling Tree Decline*, PHILA. INQUIRER (Dec. 5, 2019), <https://www.inquirer.com/science/climate/philadelphia-climate-change-forest-trees-canopy-heat-island-20191205.html> (reporting that the city plans to increase the tree canopy from 20% to 30%).

137. See *id.* (explaining that the community forestry manager is targeting the vulnerable areas of the city that need trees to reduce local temperatures).

138. *Tree Canopy Outcome Management Strategy: 2015-2025*, CHESAPEAKE BAY PROGRAM 1–4 (2015), [https://www.chesapeakebay.net/documents/3b\\_Urban\\_Tree\\_Canopy\\_final.pdf](https://www.chesapeakebay.net/documents/3b_Urban_Tree_Canopy_final.pdf). The States participating in the Chesapeake Bay Program include Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia, and Washington DC. *Id.* at 5.

139. *Id.* at 3.

140. *Id.*

141. *Id.* at 6–12.

advantageous place to increase tree canopies,<sup>142</sup> and some cities could increase tree canopies up to 30% by increasing urban forests on private land.<sup>143</sup> For example, between 2011 and 2019, the City of Vancouver, Washington, increased its canopy by 18.6% just through encouraging planting in residential areas.<sup>144</sup> Programs like this induce residents to enhance their surrounding by planting trees, thereby helping to address the externality problems associated with such actions. Residents are more likely to participate in tree giveaway programs when they receive trees for free. Their resulting participation ultimately benefits cities, and the world, through improved storm water runoff systems, increased shade, and greater carbon dioxide sequestration.<sup>145</sup>

Tree giveaway programs have proven enormously successful in certain Californian communities. For instance, Riverside, California, uses a tree giveaway program to increase its tree canopy and encourage citizens to internalize the broad societal benefits trees provide.<sup>146</sup> The city's yearlong program also allows for Riverside Public Utility customers to purchase up to five pre-qualified trees and receive a \$35 rebate per tree.<sup>147</sup> In theory, citizens could receive five trees for free if they are \$35 or less.

Other cities across the country have similarly succeeded in increasing their tree canopy through tree giveaway programs. Utilities in Colorado Springs, Colorado, partnered with the Arbor Day Foundation to provide free trees to the first 300 citizens that showed interest in participation.<sup>148</sup> Unlike Riverside, California's sweeping incentives, Colorado Springs' incentives are limited to the first 300 people, and those participants may only retrieve a tree from a specified nursery.<sup>149</sup> The Colorado Springs Utilities' tree giveaway program is smaller than Riverside's, offers fewer incentives, and has more hoops to jump through. Nevertheless, Colorado Springs' tree

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142. Press Release, City of Vancouver, Wash., Urban Forestry Seeks to Make a Difference with Annual Yard Tree Giveaway (Oct. 14, 2020), <https://www.cityofvancouver.us/publicworks/page/urban-forestry-seeks-make-difference-annual-yard-tree-giveaway> 142 (referencing a 2011 study supporting private tree planting in cities); see also NOWAK ET AL., U.S. DEP'T AGRIC., NRS-62, SUSTAINING AMERICA'S URBAN TREES AND FORESTS 4 (2010), [https://www.fs.fed.us/openspace/fote/reports/nrs-62\\_sustaining\\_americas\\_urban.pdf](https://www.fs.fed.us/openspace/fote/reports/nrs-62_sustaining_americas_urban.pdf) (explaining private lands dominate the overall urban forest composition).

143. See City of Vancouver, Wash., *supra* note 142.

144. *Id.*

145. Telephone Interview with Christian Bennett, Assistant Civil Engineer II, City of Sacramento Dep't of Water Res. Div. of Water Supply (Mar. 17, 2020) [hereinafter *Interview with Christian Bennett*].

146. *Energy Rebates*, CITY OF RIVERSIDE PUB. UTILITIES, <https://www.riversideca.gov/utilities/residents/rebates-energy.asp#menu8> (last visited Aug 3, 2021).

147. *Id.* Additionally, between March 1 and June 30, customers can receive a free tree up to a \$35 value if they bring their utility bill to participating retail stores. *Id.*

148. *Arbor Day Foundation Tree Give Away*, COLO. SPRINGS UTIL., <https://www.csu.org/Pages/treegiveaway.aspx> (last visited Mar. 1, 2020) (advising that citizens must follow the three steps listed online to receive their free tree from the nursery).

149. See *id.* (stating vouchers for the free tree must be used at Harding Nursery).

giveaway website stated that all available trees were claimed during the giveaway, which indicates that Colorado Springs boosted its tree canopy by 300 trees.<sup>150</sup>

Some states use tree giveaway or rebate programs to encourage tree planting. For example, the State of Maryland provides citizens with a \$25 coupon off the purchase of a native tree at participating nurseries across the state.<sup>151</sup> This statewide approach is more inclusive than a city tree canopy goal because it allows all residents of the state to participate. To receive a tree in Maryland, residents simply need to print the online coupon then present it at a participating nursery.<sup>152</sup> Maryland and participating nurseries split the cost of providing \$25 off a tree. The state uses funding from violators of the Clean Air Act to value each coupon at \$20.<sup>153</sup> Then, the participating nurseries absorb the remaining \$5.<sup>154</sup> This collaboration is possible through the belief that planting trees will provide ecological, economic, and quality-of-life benefits to all citizens of the state.<sup>155</sup>

Although state and local tree giveaway programs are a promising step forward in incentivizing increased urban forests on private land, educating participating residents about these programs and persuading them to properly participate remains a major challenge in many parts of the country.<sup>156</sup> Participants often receive little education on tree maintenance after receiving their free trees.<sup>157</sup> While most participants receive a pre-qualified “Right Tree, Right Place” tree, they seldom get user-friendly post-planting instructions regarding how to water, plant, or care for the tree.<sup>158</sup> Trees planted through these programs that never reach maturity do not absorb CO<sub>2</sub>, provide ample shade, or produce other benefits. These trees become little more than a waste of effort and precious government dollars.

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150. See generally *id.* (“All trees have been claimed for 2021.”).

151. *Marylanders Plant Trees*, MD. DEP’T NAT. RES., <https://dnr.maryland.gov/forests/Pages/MarylandersPlantTrees/Introduction.aspx> (last visited Nov. 12, 2020).

152. *Id.*

153. *Id.*

154. *Id.*

155. *Id.* Mentioned benefits include protection of air and water quality, reduction of energy costs, increased property values, and beautified neighborhoods and highways. *Id.*

156. See Vi D Nguyen et al., *Branching Out to Residential Lands: Missions and Strategies of Five Tree Distribution Programs in the U.S.*, 22 URB. FORESTRY & URB. GREENING 24, 25 (2017) (explaining the challenges to tree planting programs).

157. See CITY OF RIVERSIDE PUB. UTILITIES, *supra* note 146 (omitting any additional form education or training on tree maintenance). 146

158. See ARBOR DAY FOUND., *supra* note 49 (inferring that a planter should consider that every tree species has specific needs for survival). Right Tree, Right Place trees have a better chance of survival for the area in which they are planted. *Id.*

### 3. Local Incentives to Preserve Existing Trees

Recognizing the importance and value of maintaining and preserving existing trees, some state and local governments have implemented policies aimed specifically at protecting urban trees that are already in the ground.<sup>159</sup> For instance, Chicago, Illinois has adopted a detailed set of tree protection guidelines applicable in that city.<sup>160</sup> Among other things, these guidelines seek to protect street trees by minimizing construction activities near them.<sup>161</sup> Hawaii adopted a different approach, hosting local educational programs focused on improving the health and viability of trees in that state's communities.<sup>162</sup>

Chicago and Hawaii also take other steps to incentivize urban forest protection. Chicago adopted detailed guidelines to help promote citywide protection of street trees, in part because many street cleaning crews or construction builders carelessly operate around street trees.<sup>163</sup> In the past, city workers often snapped nearby branches when working on power lines or accidentally swept the lower canopy away when cleaning streets.<sup>164</sup> Tree guidelines deter these types of damage, providing better protection for street trees so that they are more likely to reach maturity. Moreover, Hawaii's educational programs provide much-needed local instruction on forestation by addressing educational gaps that might otherwise limit effective tree giveaway programs. With proper education, local residents are more likely to actively and properly participate in urban forestation opportunities provided to them.<sup>165</sup>

In recent decades, more cities have begun to recognize the need for specific rules to regulate tree urban maintenance.<sup>166</sup> Without tree protection ordinances, it is difficult for cities to protect and maintain the existing trees needed for healthy and beautiful urban environments.<sup>167</sup> Such ordinances provide specific protections for heritage and street trees and specify requirements for the replacement of dead, dying, or diseased trees.<sup>168</sup>

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159. See CITY OF TEMPE, *supra* note 133, at 25 (expressing need to educate citizens on forestry); See also COLO. SPRINGS UTIL., *supra* note 148 (providing a link for tips on tree planting and care).

160. *Tree Protection Guidelines for Decap Review*, CITY OF CHI. BUREAU OF FORESTRY (2004), [https://www.chicago.gov/content/dam/city/depts/streets/supp\\_info/TreeProtectionGuidelines.pdf](https://www.chicago.gov/content/dam/city/depts/streets/supp_info/TreeProtectionGuidelines.pdf).

161. *Id.*

162. *Kaulunani Urban & Community Forestry Program*, DEP'T LAND RES. DIV. OF FORESTRY & WILDLIFE, FORESTRY PROG., <https://dlnr.hawaii.gov/forestry/lap/kaulunani/> (last visited at Aug. 3, 2021).

163. CITY OF CHI. BUREAU OF FORESTRY, *supra* note 160.160

164. *Id.*

165. *Interview with Christian Bennett*, *supra* note 145. 145

166. See, e.g., Am. Fork City, Utah, Ordinance 7-11-63 (2007), <https://www.americanfork.gov/DocumentCenter/View/515/City-Tree-Ordinance-PDF?bidId=>.

167. See *id.* at 1 (specifying how the American Fork City Council wanted to promote maintenance to improve the "aesthetic quality, wildlife habitat, and appearance of the City").

168. See, e.g., CITY OF SAN MATEO, CAL., MUN. CODE ch. 13.40 (2021).

Unfortunately, many citizens have no knowledge of these ordinances or of how to find city rules regarding tree maintenance.<sup>169</sup>

A few cities even adopted detailed guidelines designed to educate citizens about pre-existing tree maintenance. As an example, the City of Falls Church, Virginia, produced a Tree Preservation and Replacement Guide for single-family residential homes.<sup>170</sup> This guide provides residents with city guidelines, hand drawn depictions of how to care for existing trees on the lot, and replacement instructions for dead trees.<sup>171</sup> The guidelines also include a detailed description of how to calculate tree canopy size and growth.<sup>172</sup> Such guides can be valuable to the extent that they use pictures and accessible language that are far easier for average citizens to understand and follow.

### *C. Not Nearly Enough*

In summary, existing federal, state, and local policies are a noble start toward an effective set of tree planting policies in the U.S., but they do not do nearly enough to promote an optimal level of tree planting in this country. Existing federal tax incentives and Farm Bill programs are not strong or clear enough to incentivize widespread participation. State and local policies similarly fail to encourage broad participation or to adequately educate citizens on these issues. In light of these deficiencies, federal, state, and local governments must improve the promotion of reforestation in rural and urban settings and the many benefits those additional trees could provide.

## III. STRENGTHENING FEDERAL AGROFORESTRY INCENTIVES

Money may not grow on trees, but it can certainly promote tree planting. In light of this reality, there are multiple ways the federal government could majorly increase tree planting activity in rural settings. In particular, Congress could greatly increase agroforestry across the nation by enacting stronger, simpler, and more inclusive tax incentives. The federal government could also attach new tree planting requirements to Farm Bill loan programs.

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169. *Interview with Christian Bennett, supra* note 145. 145

170. *See Tree Preservation and Replacement Guide for Development and /or Redevelopment on Single Family Residential Lots*, CITY OF FALLS CHURCH (2019), <https://www.fallschurchva.gov/DocumentCenter/View/157/Urban-Forestry-Development-Guidelines?bidId=> (showing checklists, graphs, and images for tree planting and preservation).

171. *Id.*

172. *Id.* at 6–9.

### A. Legislating New Agroforestry Tax Credits

Congress could drive major increases in meaningful agroforestry across the U.S. by expanding tax per-tree incentive programs available to farms—large and small—that require educational classes and ongoing certification of tree preservation. There is particularly great opportunity for such agroforestry on small farms which, according to the USDA, comprise approximately 90% of U.S. farms and accounted for 49% of U.S. farmland in 2019.<sup>173</sup>

#### 1. Incentivizing Farms of All Sizes to Plant Trees

The most straightforward way to encourage more small farmers to voluntarily participate in agroforestry is to increase the size of financial incentives for those who participate. For instance, Congress could offer per-tree tax credits for the planting of qualifying trees and agreeing to continue to maintain them for a certain number of years into the future. If, under such an approach, a farmer planted 25 qualifying trees on his farm and was eligible to deduct \$100 per tree from his federal tax liability, he would earn a \$2,500 tax credit. Farmers would presumably opt to plant trees under such programs only to the extent they were able to avoid taking significant amounts of land out of production.<sup>174</sup> After the taxpayer claims its initial tax credit in the year the trees are planted, the farmer could potentially even receive smaller annual tax credits in subsequent years for maintaining the trees and completing a periodic recertification process.

Participants in per-tree tax credit programs should be required to complete educational sessions. USDA officials would lead these lessons instructing farmers on tree maintenance and spacing requirements, watering practices, and other related matters. Trees qualifying under these programs could even vary from region to region and could be selected based on their capacity to sequester large amounts of carbon dioxide upon reaching maturity in particular parts of the country. In short, adopting new per-tree tax credits would address many of the agroforestry tax incentive deficiencies by opening

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173. AMERICA'S DIVERSE FAMILY FARMS, *supra* note 99, at 4. 99

174. See generally *The Future of Agriculture*, ECONOMIST: TECH. Q. (June 9, 2016), <https://www.economist.com/technology-quarterly/2016-06-09/factory-fresh> (explaining various forms of technology farmers have used to maximize efficiency of a low producing land, rather than taking the land out of production); cf. Erin Murphy, *Unexpected Number of Iowa Farmers Volunteer Flood-Damaged Land to be Taken out of Production*, SIOUX CITY J. (Dec. 22, 2019), [https://siouxcityjournal.com/news/state-and-regional/unexpected-number-of-iowa-farmers-volunteer-flood-damaged-land-to/article\\_052dd02a-736f-5f30-9100-de1533a251f1.html](https://siouxcityjournal.com/news/state-and-regional/unexpected-number-of-iowa-farmers-volunteer-flood-damaged-land-to/article_052dd02a-736f-5f30-9100-de1533a251f1.html) (explaining that after flooding in 2019, an increased number Iowan farmers voluntarily took land out of production for federal compensation through a natural flood plain conversation program).

the door for small farms to participate and ensuring that participants have enough money and education to integrate trees.

### *B. Adding Tree Requirements to Federal Farm Loan Programs*

A second potential federal policy strategy capable of increasing agroforestry would be to require all new Farm Bill loan applicants to participate in a reforestation program. One option is to offer such requirements in exchange for discounted interest rates. Another is to simply have mandatory requirements for all loan or loan guarantee recipients. Under such expanded programs, the FSA would likely be empowered to determine the required quantities and types of trees planted, which would surely vary across different regions of the country.<sup>175</sup> In climates where tree planting benefits are very limited, loan applicants could perhaps alternatively agree to take on other prescribed climate change mitigation measures.<sup>176</sup> Loan applicants could again be required to complete educational tree maintenance sessions from FSA or USDA officials describing such things as the potential benefits of best practices for strategies such as alley cropping, forest farming, riparian forest buffers, silvopasture, or windbreak trees.<sup>177</sup>

## IV. IMPROVING URBAN FORESTRY POLICIES

Because urban forests constitute some of the largest and most manageable forests in the nation,<sup>178</sup> state and local urban forestry policies are also an important element of any comprehensive forestry policy strategy. Urban forestry is the science of managing trees and forest resources in urban communities to leverage the physiological, sociological, economic, climate change-fighting and aesthetic benefits that trees can provide.<sup>179</sup>

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175. See NOWAK ET AL., *supra* note 142, at 10, 11 (positing better data collection may improve planned forestry).

176. See Brie Mazurek, *10 Ways Farmers Can Fight Climate Change*, CULTIVATING HEATHY FOOD SYS. (Sept. 7, 2018), <https://cuesa.org/article/10-ways-farmers-can-fight-climate-change>. (listing a variety of ways farmers can help reduce climate change, such as carbon farming, drip irrigation, planting hedgerows, reducing livestock methane emissions, farming organic, and including renewable energy onsite such as wind turbines or solar panels).

177. See U.S. DEP'T AGRIC., *supra* note 91 (listing common practices in agroforestry).

178. See *generally* NOWAK ET AL., *supra* note 142 (discussing urban forestry in the United States).  
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179. Andrea Becker, *Rates of Deforestation & Reforestation in the U.S.*, HEARST SEATTLE MEDIA 93, <https://education.seattlepi.com/rates-deforestation-reforestation-us-3804.html> (last visited Aug. 30, 2019).

### A. State-Mandated Tree Canopy Goal Requirements for Cities

State governments should create statutes that mandate city-wide tree canopy goals to motivate municipal engagement in urban forestry. These goals, requiring cities to incrementally expand their tree canopies within prescribed time periods, would promote greater CO<sub>2</sub> absorption while also increasing the shading and beautification of urban areas.<sup>180</sup> Of course, each municipality would be free to determine how best to increase its own tree canopy, whether through planting more public street trees, imposing new requirements on real estate developers, or persuading residents to plant trees on their own land. The following subsections explore each of these potential strategies.

#### 1. Expanding Tree Planting Efforts on City-Owned Lands

The most direct and predictable way a city can increase its tree canopy is by simply planting more trees along streets, in public parks, and on other city-owned lands.<sup>181</sup> Such publicly owned tree planting might be increased through new requirements for trees along newly built city streets, sidewalks, or in medians. Specific provisions in such ordinances should detail rules for planting, maintenance, and removal of trees within public rights-of way.<sup>182</sup>

Benefits of increased trees along roads include aesthetic benefits, potential increases in property values, more effective flood control, and decreases in storm water runoff and erosion.<sup>183</sup> Street trees also help buffer urban noise for neighborhoods located directly next to busy streets and may forewarn drivers of upcoming turns.<sup>184</sup> Officials in Tempe, Arizona, suggest that street trees may extend the life of sidewalks and asphalt in that sunny city while also helping to decrease urban heat island effects.<sup>185</sup> The average annual cost of a street tree in the U.S. is only \$18, which includes the costs of planting, pruning, permitting, and ultimate removal as necessary.<sup>186</sup> In contrast, Tempe's study concluded that an individual street tree may save the city around \$100 or more in energy, carbon, air quality, storm water,

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180. NOWAK ET AL., *supra* note 142, 5–7.

181. See CITY OF TEMPE, *supra* note 133, at 17–18 (presenting merits of planting trees in along streets, in public parks, and city-owned lands). 133

182. Robert Bardon et al., *Developing Successful Tree Ordinances*, N.C. STATE EXTENSION PUBL'NS (June 18, 2019), <https://content.ces.ncsu.edu/developing-successful-tree-ordinances>.

183. CITY AND CNTY. OF HONOLULU DEP'T PARKS & RECREATION DIV. OF URBAN FORESTRY, URB. REFORESTATION MASTER PLAN I-1, I-5 (2006); MCPHERSON ET AL., *supra* note 47, at 23–25. 47

184. NOWAK ET AL., *supra* note 142, at 6. 175

185. CITY OF TEMPE, *supra* note 133, at 20. 133

186. MCPHERSON ET AL., *supra* note 47, at 28. 47

aesthetic, and other management costs,<sup>187</sup> making it well worth the investment.

To further encourage urban forestry and to compensate cities for the myriad of positive externalities associated with urban trees, states should offer grants to cities for engaging in urban tree planting. California's Urban Forestry Act,<sup>188</sup> a state grant program administered through CAL FIRE, specifically funds urban forestry through such an approach.<sup>189</sup> Among other things, grants under this program are targeted at socioeconomically disadvantaged cities and neighborhoods.<sup>190</sup>

## 2. Expanding Tree-Related Permitting Requirements for Real Estate Development

Cities can also place some of the financial cost of increasing urban tree canopies on private real estate developers. Many cities have long employed this approach through ordinances requiring new parking lots built within the city to include a certain number of trees per parking space. For instance, the city of Athens, Georgia, requires that one tree be planted for every seven parking spaces.<sup>191</sup> Specific provisions in these ordinances require that the trees must be evenly distributed and not planted farther than ten feet or closer than three feet from the edge of parking lots.<sup>192</sup> To maximize CO<sub>2</sub> sequestration potential, cities can likewise impose restrictions related to the trees themselves, such as requirements that mature parking lot trees have a minimum canopy circumference of seven feet. Particularly in warmer climates, a permitted parking lot might also limit trees to certain species that are relatively tolerant of hot, dry conditions, have strong branch attachments, are resistant to attacks by pests, and are unlikely to leave vehicles covered with sticky residues.<sup>193</sup>

Parking lot tree requirements already produce substantial benefits in a number of cities. For instance, a study conducted in Davis, California, determined that parking lot trees dramatically improved air quality and reduced parking lot temperatures by as much as 36°F, vehicle cabin

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187. CITY OF TEMPE, *supra* note 133, at 12. 133

188. CAL. PUB. RES. CODE § 4799.12 (2018).

189. *See* CAL FIRE, *Urban & Community Forestry*, CA.GOV <https://www.fire.ca.gov/programs/resource-management/resource-protection-improvement/urban-community-forestry/> (last visited Feb. 13, 2020) (explaining how grants will be administered and for what purposes).

190. CAL. PUB. RES. CODE §§ 4799.12, 4799.08(a)(1)(H), 4799.08(a)(3), 4799.09(a) (2018).

191. ATHENS-CLARKE CNTY., GA., CODE § 8-7-15(j) (2021).

192. *See, e.g., id.* at §8-7-15(j)(8).

193. *See generally* MCPHERSON ET AL., *supra* note 47, at 61–62 (explaining that a planter should consider the characteristics of different types of trees when choosing which tree to plant in a specific area).

temperatures by over 47°F, and fuel tank temperatures by nearly 7°F.<sup>194</sup> Another Davis study found that parking lot trees even greatly reduced components of smog by preventing emissions from evaporating.<sup>195</sup> A study conducted in Sacramento, California, estimated that annual benefits provided by that city's existing parking lot tree requirements were valued at approximately \$700,000 for improved air quality.<sup>196</sup> The City predicted that increasing its parking tree shade from 8% to 50% would bump those annual benefits to \$4 million.<sup>197</sup>

Rather than simply mandating tree planting, cities can alternatively offer discounts on development impact fees to motivate real estate developers to plant trees or to plant more than the mandatory number. In many cities, development impact fees are imposed on new development projects.<sup>198</sup> These fees usually fund the public improvements necessary to provide services to new homes, offices, stores, schools, and other uses.<sup>199</sup> Offering discounts on these fees to developers who agree to plant and maintain more trees is a potentially powerful way to increase a city's urban tree canopy, particularly in cities where there is significantly real estate development activity.

### 3. Residential Tree Planting Programs and Other Residential Incentives

Offering tree giveaway programs or other incentives for tree planting in residential areas is one other means of helping cities to achieve tree canopy goals. Promoting tree planting on private urban land has great potential to help cities toward those goals because such a high proportion of land in most cities is privately owned.<sup>200</sup> Tree giveaway programs encourage residents to plant trees in their own yards by offering them free trees or rebates on pre-

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194. *Where are all the Cool Parking Lots*, CTR. FOR URBAN FOREST RES., U.S. DEP'T AGRIC. FOREST SERV. 2, <https://sactree.com/assets/files/greenprint/toolkit/b/CoolParkingLots.pdf> (last visited Nov. 12, 2020); *see also* McPherson et al., *Where Are all the Cool Parking Lots?*, GLOBALBIOENERGY.ORG, at 2, [http://www.globalbioenergy.org/uploads/media/Where\\_are\\_all\\_the\\_cool\\_parking\\_lots\\_1.pdf](http://www.globalbioenergy.org/uploads/media/Where_are_all_the_cool_parking_lots_1.pdf) (last visited Aug. 3, 2020) (presenting research on two problems related to tree shade in parking lots).

195. *See generally* MCPHERSON ET AL., *supra* note 47, at 22.

196. CTR. FOR URBAN FOREST RES., *supra* note 194, at 3. 194

197. *Id.*

198. *Impact Fees*, NAT'L APARTMENT ASS'N, <https://www.naahq.org/advocacy/policy-issues/impact-fees> (last visited Aug. 3, 2021); *see, e.g., Impact Fees*, CITY OF PHOENIX, <https://www.phoenix.gov/pdd/devfees/impactfees> (last visited Feb. 13, 2020); *see generally* Gregory S. Burge, *The Effects of Development Impact Fees on Local Fiscal Conditions*, in MUNICIPAL REVIEWS & LAND POLICIES (Gregory K. Ingram & Yu-Hung Hong eds, Lincoln Inst. Land Pol'y 2010) (2010), [https://www.lincolnst.edu/sites/default/files/pubfiles/2063\\_1386\\_LP2009-ch07-The-Effects-of-Development-Impact-Fees-on-Local-Fiscal-Conditions\\_0.pdf](https://www.lincolnst.edu/sites/default/files/pubfiles/2063_1386_LP2009-ch07-The-Effects-of-Development-Impact-Fees-on-Local-Fiscal-Conditions_0.pdf) (discussing the effects of impact fees on local fiscal conditions).

199. Burge, *supra* note 198, at 182.

200. NOWAK ET AL., *supra* note 142, at 4.

qualified trees.<sup>201</sup> Additional residential incentive strategies include offering reductions in water bills or stormwater fees for citizens who plant one or more trees,<sup>202</sup> providing property tax breaks for trees on private land,<sup>203</sup> and approvals of higher density development permits for residential developers who dedicate higher percentages of a project's land to trees.<sup>204</sup>

The potential benefits of increased tree planting in residential urban areas are numerous and go far beyond potential reductions in atmospheric carbon dioxide levels (which, one study estimated to be 0.1 pounds of carbon sequestration per square foot).<sup>205</sup> As highlighted above, trees may also increase property values, aid stormwater drainage, and help decrease flooding in residential areas.<sup>206</sup>

Cities that choose to offer property tax discounts for tree planting and maintenance might additionally find it worthwhile to adopt enforcement-related provisions to ensure that tax discount recipients properly maintain their trees. For example, one possible enforcement measure could be to require that the landowner allow a municipal arborist to visit participants' homes once every five years to certify the number and type of trees on the residential lot.

Of course, residential tree planting programs may not be justifiable in all cities or climates. For instance, trees can sometimes interfere with rooftop solar panels, which require direct sunlight access to fully function.<sup>207</sup> Similarly, some desert cities recommend treeless, xeriscaped yards to promote water conservation.<sup>208</sup> Likewise, some underprivileged communities may be less willing to participate, creating inequity issues.<sup>209</sup> One study suggested that lack of education, low socio-economic status, and

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201. City of Vancouver, Wash., *supra* note 142; MD. DEP'T NAT. RES., *supra* note 151; CITY OF RIVERSIDE PUB. UTILITIES, *supra* note 146.

202. MOORE ET AL., STONE ENVIRONMENTAL INC., TREE CREDIT SYSTEMS & INCENTIVES AT THE SITE SCALE 8–16 (2014) (discussing stormwater fee discounts and other incentives); U.S. ENV'T PROT. AGENCY, EPA-833-F-09-001, MANAGING WET WEATHER WITH GREEN INFRASTRUCTURE MUNICIPAL HANDBOOK: INCENTIVE MECHANISMS 1–5 (2009).

203. MOORE ET AL., *supra* note 202, at 15–16; Schultz & Durkay, *supra* note 19.

204. *Promoting Better Forestry on Private Lands*, VIBRANT CITIES LAB, <https://www.vibrantcitieslab.com/toolkit/promoting-better-forestry-on-private-lands/> (last visited Aug. 5, 2021).

205. MCPHERSON ET AL., *supra* note 47, at 19.

206. NOWAK ET AL., *supra* note 142, at 6, 7.

207. Marla Dickerson, *Hey, Your Shade Trees are Blocking My Solar Panels*, LOS ANGELES TIMES (Nov. 15, 2008), <https://www.latimes.com/archives/la-xpm-2008-nov-15-fi-solarspat15-story.html>.

208. *See* NOWAK ET AL., *supra* note 142, at 11 (discussing water conscious vegetation efforts in low rainfall areas); *see also* Kim Rutledge et al, *Xeriscaping*, NAT'L GEOGRAPHIC: RES. LIBRARY, ENCYCLOPEDIA ENTRY (last updated Jan. 21, 2011), <https://www.nationalgeographic.org/encyclopedia/xeriscaping/> (defining the practice of xeriscaping as landscaping with minimal use of water and drought resistant native vegetation).175

209. Geoffrey H. Donovan & John Mills, *Environmental Justice and Factors that Influence Participation in Tree Planting Programs in Portland, Oregon, U.S.*, 40 ARBORICULTURE & URBAN FORESTRY 70, 74–75 (2014).

average household age were all significant detrimental factors for participation in planting programs.<sup>210</sup> Many communities in the study that had low participation rates in such programs were primarily comprised of renters and had higher rates of criminal activity.<sup>211</sup> In such communities, even greater financial investment may be needed to achieve robust levels of engagement.<sup>212</sup>

Despite these potential challenges, there are numerous success stories of urban forestry in residential areas. For instance, New York City has already succeeded in planting one million trees.<sup>213</sup> New York City's tree giveaway program was the largest in the country.<sup>214</sup> The city successfully provided 195,465 trees to residents and ultimately achieved its goals of increasing tree coverage in the city, improving air quality, providing more shade, and offsetting climate change.<sup>215</sup>

### *B. Managing Large Increases in Urban Forestry Activities*

The large increases in urban trees possible under some of the policy approaches just described would create new tasks for cities, most of which are manageable through education and careful planning. Urban forestry master plans are one way for cities to coordinate these new tree management efforts while also creating jobs, clarifying maintenance requirements, and providing educational opportunities for local residents.

#### 1. Hiring More City Arborists

Cities can help residents maintain trees by adding specific new city employee positions for individuals focused on tree maintenance. Many cities already employ one or more "arborists," who care for city trees.<sup>216</sup> Adding arborists is a valuable way for cities to ensure they are maintaining city tree health, holding developers to their tree-related development requirements,

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210. *Id.* at 74–75.

211. *Id.* at 75.

212. *Id.* at 75; see also Elgin Tucker, *Economic Status and Its Influence on Tree Planting in Urban Areas*, YALE ENV'T REV. (Aug. 25, 2014), <https://environment-review.yale.edu/economic-status-and-its-influence-tree-planting-urban-areas-0> (discussing results of the U.S. Forest Service's study in Portland, Oregon determining influential factors of citizen participation in a city-wide tree planting program).

213. *Mayor de Blasio Celebrates One Millionth Tree with Former Mayor Michael Bloomberg, Bette Midler, Volunteers, and Community Members*, NYC.GOV (Nov. 20, 2015) (noting the City partnered with a private company, New York Restoration Project, to meet this large goal).

214. Brent Lomas, *Here's How NYC Hit its 1 Million Tree Target in 2015*, LIVABL (Jan 14, 2016), <https://www.livabl.com/2016/01/how-nyc-hit-million-tree-target-2015.html>.

215. *Id.*

216. See, e.g., *Caring for Urban Trees*, N.Y. DEP'T OF ENV'T CONSERVATION, <https://www.dec.ny.gov/lands/120460.html> (last visited Aug. 3, 2021) (discussing the need for urban tree care and the role of arborists).

and otherwise supporting tree planting and conservation efforts within the city.

Funding for new arborist positions could justifiably come from multiple revenue sources, including water and sewer funds and city general funds. The use of water and sewer funds for these positions is sensible because tree roots can potentially impact water and sewer lines and trees can benefit storm water drainage systems.<sup>217</sup> Funding arborist salaries through general city funds is also arguably justifiable given the broader citywide benefits of trees highlighted above.<sup>218</sup>

## 2. Expanding Tree Maintenance Requirements

With the help of arborists, cities should also impose and enforce ordinances designed to ensure that tree planting and maintenance activities within their boundaries are sensible and appropriate. “Right Tree, Right Place” requirements must be followed to build any successful urban tree canopy.<sup>219</sup> And since every city has unique geological features that restrict or promote tree growth, arborists’ input is needed to ensure that decisions are appropriate given the specific soil types, weather, and other unique environmental factors in any given community.<sup>220</sup>

Cities and their residents must also consider water and sewer line locations when planting trees.<sup>221</sup> Tree roots grow down into the ground, which is where most, if not all, water and sewer lines are located.<sup>222</sup> Trees on streets, in parking lots, and in residential areas may damage water and sewer lines.<sup>223</sup> To avoid tree-root damage, city arborists should either provide a pamphlet to companies or hold educational workshops to help workers navigate the planting requirements.

Urban tree canopies can create challenges for electric utilities as well.<sup>224</sup> Many power line companies are responsible for maintaining surrounding

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217. *See generally* City of Riverside Public Works Dep’t, URBAN FORESTRY POLICY MANUAL, CITY OF RIVERSIDE (2007), <https://riversideca.gov/PDF2/Urban-Forestry-Policy.pdf> (providing guidelines on tree planting, management, and removal considering impacts to current and future infrastructure).

218. *See generally* *An Introduction to City Finances*, CITY OF PORTLAND BUDGET OFF., [https://www.portlandoregon.gov/cbo/article/18178#\\_Toc44398653](https://www.portlandoregon.gov/cbo/article/18178#_Toc44398653) (last visited Nov. 13, 2020) (summarizing the finance structure based on source and use of funds in Portland, Oregon).

219. ARBOR DAY FOUND., *supra* note 49.

220. *Id.*

221. *See, e.g.*, LANCASTER, PA., CODE §§ 260-301, <https://www.ecode360.com/30007662> (demonstrating a city ordinance that requires a tree planting plan).

222. CITY OF RIVERSIDE, *supra* note 217, at 29–30; *Cf.* WILLIAM MOST & STEVEN WEISSMAN, BERKELEY LAW CTR. FOR LAW, ENERGY & THE ENV’T, TREES AND POWER LINES: MINIMIZING CONFLICTS BETWEEN ELECTRIC POWER INFRASTRUCTURE AND THE URBAN FOREST 7–14 (2012) (discussing similar concerns with underground power lines and trees).

223. CITY OF RIVERSIDE, *supra* note 217, at 29–30.

224. CITY OF RIVERSIDE, *supra* note 217, at 30–33. 222

trees to prevent power line damage and potential fires.<sup>225</sup> However, cities should also still be aware of the potential hazards that overall increase of tree canopy can pose and take those issues into account in their planning. Many cities provide online guidelines for city tree maintenance to help mitigate such challenges. For example, the City of Bellevue, Washington, delineates the city's responsibilities versus residents' responsibilities for tree maintenance and provides information regarding how to sustainably water and prune city trees.<sup>226</sup>

### 3. Expanding Educational Programs

Lastly, residents participating in tree giveaway programs offered by a city must have access to accurate information on how to keep new trees alive for such programs to ultimately be successful. Tree maintenance and proper watering is essential to tree survival and canopy growth.<sup>227</sup> Some cities provide online pamphlets that describe planting and maintenance requirements.<sup>228</sup> However, not all residents participating in tree giveaway programs have access to online information.<sup>229</sup> Accordingly, informational pamphlets outlining proper tree maintenance and "help line" telephone numbers staffed by city arborists are crucial to promoting proper tree maintenance after planting the giveaway trees. Arborists can additionally host regular educational and training programs for participating citizens to review maintenance requirements and provide venues for residents to easily ask questions. Ideally, cities would specifically assign arborist services to underprivileged communities to further engage citizens in those communities

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225. See MOST & WEISSMAN, *supra* note 222, at 5, 13–15; City of Pasadena Dep't of Water and Power, *Tree Trimming & Power Lines*, CITY OF PASADENA, <https://ww5.cityofpasadena.net/water-and-power/treesandpowerlines/> (last visited Mar. 1, 2020) (stating California law requires utility companies to maintain specified clearances). 204

226. *Street Trees & Arterial Landscapes*, CITY OF BELLEVUE, <https://bellevuewa.gov/city-government/departments/parks/nature-and-environment/street-trees-arterial-landscapes> (last visited Aug. 5, 2021).

227. See generally CITY OF RIVERSIDE, *supra* note 217, at 7 (explaining that trees are a valuable resource that must be maintained).

228. See, e.g., *Tree Planting Instructions*, CITY OF FORT LAUDERDALE, <https://gyr.fortlauderdale.gov/greener-government/natural-resources-preservation/growing-our-green-canopy/tree-planting-care-maintenance/tree-planting-instructions> (last visited Nov. 13, 2020) (listing a series of tree planting instructions); see also CITY OF RIVERSIDE, *supra* note 217, at 6.

229. Kathryn Zickuhr & Aaron Smith, *Digital Differences*, PEW RESEARCH CTR (April 13, 2012), <https://www.pewresearch.org/internet/2012/04/13/digital-differences/> (explaining internet use remains strongly correlated with age, education, and household income). Individuals are unlikely to have access to the internet if their household income is below \$20,000 a year and residents who are above a certain age are unlikely to want to use the internet for finding information. *Id.*; but see Camille Ryan & Jamie Lewis, *Computer and Internet Use in the United States: 2015*, AMERICAN CMTY. SURV. REP. 2 (2017), <https://www.census.gov/content/dam/Census/library/publications/2017/acs/acs-37.pdf> (finding that 78% of American households had computer and that 77% of households had access to broadband internet).

and to address environmental injustice issues.<sup>230</sup> Although very few such post-tree giveaway educational programs exist, many municipalities do reach out to participating residents to check on planted trees.<sup>231</sup> Most programs also have post-delivery communication in the form of online surveys, check-up emails, and in-person observations.<sup>232</sup> These surveys and check-ins include questions regarding the tree giveaway process, whether residents watered their tree, and the current health of newly planted trees.<sup>233</sup> Collectively, efforts like these can help to ensure that residents have the information necessary to help their new trees grow and become valuable fixtures on their land and in their communities.

#### CONCLUSION

Increased tree planting is necessary to ebb the continual rise of global atmospheric CO<sub>2</sub> concentrations. Although the carbon-reducing power of trees is common knowledge, existing policies in the U.S. fail to encourage tree planting at a pace capable of meaningfully reducing CO<sub>2</sub> levels. The policies fall short in promoting tree planting and conservation throughout the country, from small rural farms to urban settings in the nation's largest cities.

In light of these challenges and President Trump's announcement initiating the U.S.'s participation in the Trillion Trees project, there is a need for new federal state and local policies to more aggressively encourage tree planting. Market failures resulting from tree-related externalities have long prevented citizens and businesses from adequately engaging in forestation activities. Congress should address these challenges through a new tax credit program and expanded loan guarantee program provisions designed to incentivize more tree planting on the nation's agricultural lands. Local governments should also assist in this effort by adopting tree canopy goals, imposing additional tree-related requirements on real estate developers, and adopting or expanding tree giveaway programs. If adopted, such innovations in the nation's reforestation policies would significantly reduce America's contribution to global warming and simultaneously beautify cities and farms throughout the country.

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230. Donovan & Mills, *supra* note 209, at 75.

231. Nguyen et al., *supra* note 156, at 30.

232. *Id.*

233. *Id.*