Legislative Council Staff
Nonpartisan Services for Colorado's Legislature

Room 029 State Capitol, Denver, CO 80203-1784
Phone: (303) 866-3521 • Fax: (303) 866-3855
lcs.ga@state.co.us • leg.colorado.gov/lcs

Memorandum

July 26, 2019

TO: Interested Persons

FROM: Christina Van Winkle, Senior Environmental Analyst, 303-866-6289

SUBJECT: The Role of Colorado's Forests in Greenhouse Gas Mitigation

Summary

This memorandum provides information regarding programs in Colorado that address deforestation and forest degradation, and the role that forests can play in mitigating greenhouse gas emissions. Forests are increasingly being recognized for the critical role they play in combating climate change by sequestering and storing carbon from the atmosphere. A number of global initiatives are now focused on forest landscape restoration approaches to reduce deforestation and restore the ecological integrity of forest ecosystems, thereby increasing carbon storage capacity, as well as securing a stream of other goods and services (e.g., soil and water conservation, biodiversity habitat, and recreation). This memorandum provides an overview of Colorado's forest resources and management approaches, as well as a list of federal, state, and local programs that promote forest stewardship and tree planting.

Contents

Forests and Climate Change

Forestland, defined as land that has at least 10 percent tree cover and is at least one acre in size, currently covers approximately 766 million acres, or 34 percent of the total land area in the United States.[1] Initially cleared for agriculture, pastureland, and settlements, the area of forestland in the United States has been relatively stable for over 100 years. Forest regeneration, improved management practices, and timber harvesting (where the carbon is stored in harvested wood

[1] U.S. Forest Service (2010), U.S. Forest Resources Facts and Historical Trends. Retrieved July 15 from: https://www.fia.fs.fed.us/library/brochures/docs/2012/ForestFacts_1952-2012_English.pdf.

products) have resulted in a net sequestration of carbon each year since 1990, which currently offsets approximately 11 percent of the total US emissions.[2]

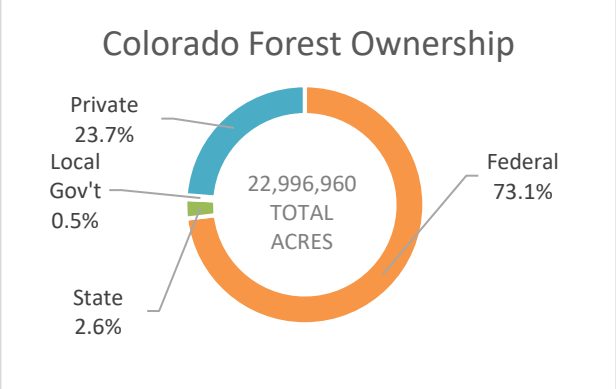
National and sub-national greenhouse gas (GHG) inventories account for forest carbon stocks and stock changes as part of the land use, land-use change, and forestry sector. Carbon sequestered from the atmosphere is stored in different 'pools,' including trees (living and dead), roots, understory vegetation, litter on the forest floor, and soils.[3] Based on draft results from Colorado's 2019 GHG inventory, prepared by the Colorado Department of Public Health and Environment, forests sequestered 6.3 million metric tons of carbon dioxide equivalent (MMT CO_2e) in 2015, offsetting 5 percent of Colorado's total GHG emissions (127 MMT CO_2e).

Colorado's Forest Resources

In Colorado, forests provide a wide array of benefits (i.e., ecosystem services) to residents, from clean water supply and air purification to the provisioning of wood products and space for recreation. In recent decades, however, the growth in population, particularly in wildland urban interface (WUI) areas, combined with changes in temperature and precipitation patterns has compromised the health of Colorado's forests, leading to increased pest outbreaks and more intense wildland fires. Concerns about changes in the climate are raising interest in managing forests for increased carbon sequestration and storage, and a number of programs and policies have been initiated to encourage tree planting and improve stewardship of forest resources.

Forests cover nearly 23 million acres of land in Colorado, comprising over one-third of the total land area in the state. As reflected in Figure 1, a majority (73 percent) of these forests are federally owned. The U.S. Forest Service oversees 49 percent (11.2 million acres), and the Bureau of Land Management oversees 22 percent (5.0 million acres). Private landowners control nearly one quarter (5.4 million acres) of forest land, making them important stewards of Colorado's forest resources. The remainder of forest lands are held by state agencies, local municipalities, and tribal governments.

Figure 1. Colorado Forestland by Ownership Type



Source: USDA Forest Service.

The Colorado State Forest Service (CSFS), a joint administrative relationship between Colorado State University and the Colorado Department of Natural Resources, provides comprehensive support to manage Colorado's forests, including resources, guidance, community planning, wildfire mitigation, and insect disease and detection. In addition, the agency offers professional forestry services for

[2] U.S. Environmental Protection Agency (2019). Inventory of US Greenhouse Emissions and Sinks: 1990-2017. Washington DC: U.S. EPA.
[3] Harvested wood products also constitute a carbon pool, as the wood stored in these products, or deposited in landfills, stores carbon for years to centuries.

community and urban areas, and serves as the primary provider of tree seedlings for restoration efforts.

Each year, the CSFS produces a forest health report that outlines the current conditions of forests across the state.[4] In 2018, Colorado experienced severe disease outbreaks and some of the most severe wildfires in recent history, compromising forest ecosystems and the communities surrounding them. Although tree-killing bark beetles are native insects that are always present at endemic levels, and play an important role in regulating forest health, the size and severity of recent outbreaks is unprecedented. Tree-killing bark beetles affected more than 125,000 acres of "new," or previously uninfested, land in 2018. The most widespread and destructive pest, the spruce beetle, has now affected over 1.8 million cumulative acres of forestland since 2000 (approximately 40 percent of spruce-fir forests). Non-native species, such as the emerald ash borer, continue to threaten Colorado's urban and community forests, where 15 percent of trees are ash species vulnerable to the pest. 2018 was a historic wildfire year in Colorado, with more acres burned than any other year except 2002. The population living in areas at risk of wildfires, referred to as wildland urban interface (WUI) areas, increased by roughly 50 percent from 2012 to 2017, and now includes 2.9 million residents.

Management History

The causes of more intense disease outbreaks and damaging wildfires are complex and include a number of factors. Warmer weather and lower than average precipitation prevent over-winter beetle and larvae die-off, and reduce a tree's ability to produce insect-fighting sap.[5] Decades of fire suppression have resulted in overly dense forests which, combined with warmer, drier climate conditions increase the intensity of wildland fires.

The CSFS addresses wildfire risk mitigation factors associated with overly dense and unhealthy forest conditions, particularly in WUI areas, by engaging with landowners to implement effective treatments to reduce fuels and mitigation wildfires (e.g., through fuel breaks). It provides guidance in developing Community Wildfire Protection Plans, targeting fuel breaks, updating the Wildfire Risk Assessment portal, and supporting the Firewise USA program in Colorado.[6]

Pest and disease outbreaks have left thousands of acres of Colorado's forests with dead or dying trees, dramatically altering the landscape. According to the recent Forest Inventory and Analysis data, 1 in every 14 trees on Colorado's forest land is standing dead. Unlike wildfires, which can destroy all types of vegetation and leave the barren land susceptible to soil erosion and landslides, forest areas affected by bark beetles can often times thrive in the aftermath of an outbreak. Healthy understory unaffected by the beetle benefits from increased availability of water, sun, and nutrients, and can accelerate stand recovery and promote biodiversity. The standing dead or dying trees, however, can

[4] The full report can be found here: https://csfs.colostate.edu/media/sites/22/2019/03/FINAL-307714_ForestRpt-2018-www.pdf
[5] According to the National Oceanic and Atmospheric Administration, Colorado experienced the warmest temperatures on record in 124 years, and the second lowest precipitation levels dating back to 1895.
[6] The National Fire Protection Association's Firewise USA program assists communities in preparing for and mitigating the risks of wildfires. There are over 100 sites in Colorado participating in the Firewise USA Program.

increase the fuel load of a landscape and thus the ignitability, causing concern related to wildfire danger.[7]

Management responses following beetle infestation are thus complex, and limited by a number of factors. The vast majority of areas impacted by beetles are inaccessible, and therefore limit treatment options such as salvage harvests. In addition, in recent decades Colorado has experienced a decline in businesses that harvest and manufacture wood products. This decline in demand has led to increased forest management costs for landowners and reduced revenues from forest resources. According to Colorado's Forest Action Plan, promoting and maintaining viable markets for wood products could have a positive effect on landowners' ability to effectively manage forest resources and build resilient forest systems.[8] Based on a study conducted in 2001, of the $4 billion in wood products (e.g. sawtimber, firewood, and woody biomass for renewable heating and energy) Colorado consumes each year, only 8 percent are sourced from Colorado's forests.[9] Based on a 2009 forest resource assessment, nearly 16 million acres of forest land are available for the management of wood products, including biomass.

Forest Restoration Programs

A number of federal, state, and local programs promote tree planting and improved forest management, particularly on private landowners and urban areas, as summarized below.

Federally Administered Programs

The USDA's Natural Resources Conservation Service (NRCS) operates a number of voluntary conservation programs that provide technical and financial assistance to improve natural resource management on private lands.[10]

Emergency Watershed Protection Program. The NRCS provides federal assistance to private and nonfederal landowners following natural disasters through the Emergency Watershed Protection Program. Programs must have a local sponsor and be partially funded through state legislatures. Financial and technical assistance are provided for debris removal, streambank restoration, drainage facility restoration, landscape (vegetative cover) restoration, levee repairs, and the repair of field conservation practices (e.g., water quality monitoring). The Colorado Water Conservation Board manages the program on behalf of the state. A number of watershed recovery projects have been implemented in Colorado following the 2013 flooding that include sediment removal and tree

[7] A full summary of research conducted by the USFS Rocky Mountain Research Station on the effects of beetle-stricken landscapes can be found here: https://www.fs.fed.us/rmrs/death-comes-life-recovery-and-revolution-wake-epidemic-outbreaks-mountain-pine-beetle-1.
[8] Colorado Statewide Forest Resource Strategy. Colorado State Forest Service. June, 2010.
[9] See the Colorado Statewide Forest Resource Assessment 2009 at https://static.colostate.edu/client-files/csfs/pdfs/SFRA09_csfs-forestassess-web-bkmrks.pdf.
[10] The USDA's Farm Service Agency implements a number of conservation programs authorized by the Farm Bill, including the Emergency Forest Restoration Program and the Tree Assistance Program to provide financial assistance to replant or rehabilitate trees following natural disasters. Specific information on program implementation in Colorado, however, was not found.

planting along riparian zones. A full list of projects can be found here: https://coloradoewp.com/places.

Conservation Stewardship Program. The Conservation Stewardship Program is the largest conservation program in the United States, with over 70 million acres of agricultural and forest lands enrolled. Landowners receive performance-based payments for management activities that enhance the conservation status of working lands. Conservation measures address soil erosion, water quality, plant condition, and wildlife habitat on nonindustrial private forests in Colorado. Colorado landowners receive between $19 million and $25 million annually in financial assistance obligations through the program (including agricultural and nonindustrial private forest lands).[11]

Environmental Quality Incentive Program. The Environmental Quality Incentive Program provides technical and financial assistance to share the cost of adding, maintaining, or improving conservation practices on agricultural land. Priority areas in Colorado include water quality and quantity, grazing management, nutrient management, soil health, wildlife habitat enhancement, and forest health (including timber removal and woody residue treatment). Colorado landowners receive between $28 million and $42 million annually in financial assistance obligations through the program (including agricultural and nonindustrial private forest lands).

State Administered Programs

The CSFS is the lead agency providing technical assistance for forest stewardship and management, fuels reduction, and wildfire mitigation. The agency administers a number of programs to promote forest health and incentivize improved forest management, listed below.

Forest Agricultural Program. Enacted in 1990, the program offers landowners with 40 acres or more of forest land to voluntarily participate in the program and qualify for tax incentives by developing a forest management plan to produce wood products such as firewood, logs, and Christmas trees. The program not only incentivizes wood production, but also promotes improved forest stewardship and resilience towards insects, disease, and wildfires, and prevents forest fragmentation.

Forest Stewardship Program. Over 5 million acres of Colorado's forests are privately owned. The Forest Stewardship Program implemented by the CSFS offers technical and financial assistance to landowners to improve forest management practices to maintain productive, healthy forests.

Forest Legacy Program. The Forest Legacy Program is a conservation program administered by the U.S. Forest Service, in partnership with state agencies, to incentivize the protection of private forest lands through conservation easements or land purchases. The aim of the program is to prevent lands from being converted to non-forest uses by restricting development, requiring sustainable forestry practices, and protecting other values such as recreation and watershed protection. The program has conserved over 2.6 million acres of forest land in the United States since its creation in 1990. Seven projects have been completed in Colorado through the Forest Legacy Program, covering 21,000 acres.

[11] NRCS conservation program reports, including technical and financial assistance obligations are available at: https://www.nrcs.usda.gov/Internet/NRCS_RCA/reports/fb08_cp_cstp.html

Forest Restoration and Wildfire Risk Mitigation Grant Program. This program, established through Senate Bill 17-050 and funded in 2018 by House Bill 18-1338, provides state financial support in the form of competitive grants to enable local community groups, local government entities, public and private utilities, state agencies, and nonprofit groups to:

- reduce wildfire risk in wildland-urban interface (WUI) areas;
- promote forest health and restoration; and
- incentivize the use of woody materials for forest products and biomass energy.

During the 2019 legislative session, House Bill 19-1006 appropriated $1 million from the General Fund for distribution through the program.

Restoring Colorado's Forests Fund. The CSFS collects tax-deductible donations, which are directed to the Restoring Colorado's Forests Fund to cover the costs of producing and planting seedlings on state and private land in the aftermath of destructive wildfires. Forest restoration is targeted on lands most critical to water protection, wildlife habitat, and those areas that provide the most public benefit.

CSFS Nursery. The CSFS operates a tree nursery and produces a variety of locally grown, drought-tolerant conservation species. The nursery provides seedlings for a range of conservation efforts in Colorado, including:

- reforestation in areas damaged by flood and fire;
- soil and erosion control;
- clean air and water conservation;
- pollinator and wildlife habitats;
- edible landscapes;
- agroforestry practices; and
- shelterbelts and wind rows for livestock, crop, and home protection.

Agroforestry. In addition to forestland, trees provide valuable conservation services in the plains of Colorado. Trees strategically planted along roads and cropland boundaries can produce windbreaks and shelterbelts to keep snow from drifting onto roads and fields. Trees planted along rivers and streams stabilize riverbanks and provide wildlife habitat. These nature-based solutions provide an array of benefits and are eligible activities under a number of federal conservation programs. CSFS offers technical support to landowners, and seedlings for trees and shrubs are available through the tree nursery.

Municipal Programs

Urban areas with tall buildings, narrow streets, and limited vegetative cover can cause temperatures to rise relative to their surrounding rural areas. This "urban heat island effect" is caused by the heat-absorbing nature of asphalt, concrete, and other manmade materials, along with waste heat from vehicles, appliances and machinery. This heat effect is exacerbated by limited vegetative cover in urban areas that would otherwise provide a cooling effect from shading and evaporation. In fact,

Denver was recently ranked as having the third highest urban heat island index, with temperatures in the city nearly 5 degrees warmer than the surrounding rural areas.[12] Many urban areas are implementing tree-planting programs to counter this heat island effect, improve air quality, manage storm water runoff, conserve energy, and beautify downtown areas.

A number of municipalities in Colorado are addressing urban forestry through tree surveys, assessments, and the development of forestry plans. A few of these ongoing efforts are listed below.

- **Denver.** Denver Parks and Recreation's Forestry Office is the city agency responsible or trees in public parks, parkways, and other public property. Through a partnership with The Park People (www.theparkpeople.org), residents are eligible to receive free and low-cost trees for planting on private and public property. Over the past 30 years, this program has provided more than 52,000 trees to Denver residents, providing tree shade to cool homes, lower utility costs, improve air and water quality, and enhance property values.

- **Colorado Springs.** Colorado Springs recently completed its first urban forest tree canopy assessment of all public and private trees within the city. The assessment will enable the city to identify trends in canopy cover and how tree cover can be expanded in the future.

- **Lonetree.** Lonetree completed its first tree survey in 2017, and developed an urban forestry plan in 2018. The plan identified current threats to trees (e.g., inappropriate tree selection, improper planting and maintenance, and snow removal practices), and sets goals to promote urban forest education and proper tree planting, manage urban forests to ensure long term tree health, and protect trees from threats caused by pests and disease.

Not-for-profit Programs

There are a number of other nongovernmental organizations that operate tree-planting programs throughout Colorado. Several examples are listed below.

- **One Tree Planted**. One Tree Planted is a donation-based nonprofit organization focused on global reforestation. For Earth Day 2018, the organization planted 7,000 trees in Fourmile Canyon on private land affected by the 2010 fire. Seedlings came from the Colorado State Seedling Nursery. www.onetreeplanted.org

- **ReForest Colorado.** The ReForest Colorado program grew out of efforts to replant more than 41,000 trees in 2003 in the aftermath of the Hayman fire.[13] The fund helps communities recover from natural disasters including wildfires, storms, floods, drought, and insect/disease epidemics. Recently, the fund helped the town of Lyons recover from the 2013 floods and Cañon City following the 3,800 acre Royal Gorge fire. Eligible applicants include state and local governments,

[12] Climate Central (2014). Hot and Getting Hotter: Heat Islands Cooking U.S. Cities. Available at: https://www.climatecentral.org/news/urban-heat-islands-threaten-us-health-17919

[13] Funding came from the Colorado Department of Natural Resources, the Colorado State Forest Service, and Shell Oil Company. The Fund is managed by the Colorado Tree Coalition and receives contributions from individuals, corporations, and philanthropic organizations.

school districts, community and neighborhood associations, and private nonprofit groups that can provide 100 percent matching funds. www.coloradotrees.org

- **Colorado Tree Farm Program**. The American Forest Foundation operates a national tree-growing program (American Tree Farm System) that incentivizes improved forest management on private lands. The certification program promotes the production of sustainable, renewable forest products and provides education and resources to landowners. www.treefarmsystem.org

Voluntary Carbon Markets

Voluntary carbon markets provide market incentives to generate and sell carbon credits to voluntarily "offset" carbon emissions. Offsets are reductions or absorptions of GHG emissions in one place that can be used to compensate for emissions in another place. Offsets in the forestry sector include afforestation (i.e., planting on previously barren land), reforestation (i.e., planting on land that was previously forest), improved forest management, and avoided deforestation. In the United States, two regulated cap-and-trade programs allow entities to substitute offsets for emissions reductions up to a certain percent of total allowable emissions. For instance, California's program allows regulated entities to offset up to 8 percent of total allowable emissions. In addition, corporations, governments, and individuals can also voluntarily offset carbon emissions through the purchase of carbon credits.[14]

Three main registries exist in the United States that cover forest carbon credits: American Carbon Registry (ACR), Climate Action Reserve (CAR), and Verified Carbon Standard (VCS). To date, only one forest carbon project in Colorado has been registered with the ACR, a forest carbon demonstration project in the San Juan National Forest.[15] The National Forest Foundation is the project developer, overseeing the restoration of Engelmann Spruce forest on approximately 760 acres of San Juan National Forest in Colorado that was severely burned in the Missionary Ridge Fire in 2002. This project will generate offset credits over 40 years, and will be immediately retired on behalf of the purchaser, Walt Disney Company.[16]

[14] For more information on forest carbon policies and incentives, including carbon offsets, see: http://www.ncsl.org/research/environment-and-natural-resources/state-forest-carbon-incentives-and-policies.aspx
[15] The CAR has six listed or registered projects in Colorado under the project type 'avoided grassland conversion'. Access to the project registry database can be found here: https://thereserve2.apx.com/myModule/rpt/myrpt.asp?r=111
[16] Project Documents and Validation Statements can be found here: https://acr2.apx.com/mymodule/reg/TabDocuments.asp?r=111&ad=Prpt&act=update&type=PRO&aProj=pub&tablename=doc&id1=197