

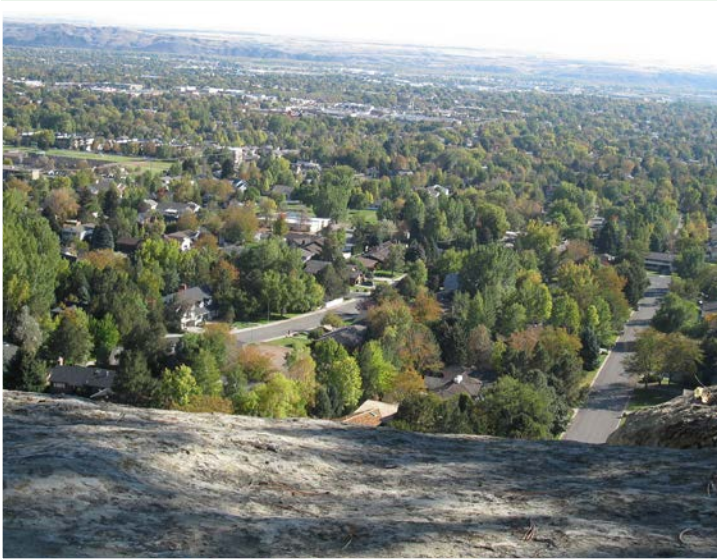
STATE OF COMMUNITY TREES IN MONTANA 2017



Montana's Statewide Community Tree Assessment

Trees are vital to Montana communities. They provide critical environmental benefits and soften the urban hardscape by providing a green sanctuary, ensuring that Montana's urban areas are more enjoyable places to live, work and play. The Montana Department of Natural Resources and Conservation (DNRC) Urban and Community Forestry Program considers trees as one of the greatest assets of a community. The program empowers communities to improve the management and care of trees, promoting community health.

To better understand Montana's community forests, the DNRC compiled public tree inventory information from 61 communities. These inventories include 138,420 trees located within street rights-of-way and in city parks. The statewide information was analyzed to determine tree composition, condition and overall benefits provided.



Tree inventory findings provide baseline data that will:

- Quantify the values and benefits of public trees in Montana communities
- Assist managers and residents in making informed decisions about public trees
- Inform communities that would be most affected by species-specific insect or disease outbreaks
- Help set future management goals, such as prioritizing planting areas and writing maintenance and management plans

Montana Communities with Tree Inventories



Public trees were inventoried across Montana between 2008 and 2015. Many cities funded their own inventories and others were included in a DNRC-led inventory that was partially funded by the U.S. Forest Service. In several communities, volunteers and city employees assisted by measuring tree diameters, assessing tree conditions and recommending pruning and other maintenance tasks. The information is used to help communities determine where to focus available resources, leverage new resources and achieve or maintain Tree City USA status through the Arbor Day Foundation.



Tree Benefits

Urban and community forests constantly work to mitigate the effects of urbanization and development and to enhance livability within the communities. Trees provide numerous benefits in three categories: public health, environmental and social/economic. Montana's tree inventory makes quantification of these benefits possible.

PUBLIC HEALTH BENEFITS

AESTHETICS

- Beautify neighborhoods
- Provide shade, privacy
- Increase wildlife habitat
- Soften urban hardscapes
- Create a sense of place



Urban trees have year-round ornamental value - beautiful spring floral displays, soothing deep green shades in summer, bright autumn colors, interesting bark patterns and evergreen branches holding winter snow. Trees beautify surroundings while serving in functional ways such as providing visual screens and cool resting places. The presence of trees even helps to slow traffic speeds, and may contribute to reduced crime rates (Donovan and Prestemon 2012). People maintain a deep appreciation for trees. The actions of planting and maintaining trees contribute to a culture of community involvement and improvement.



HUMAN HEALTH

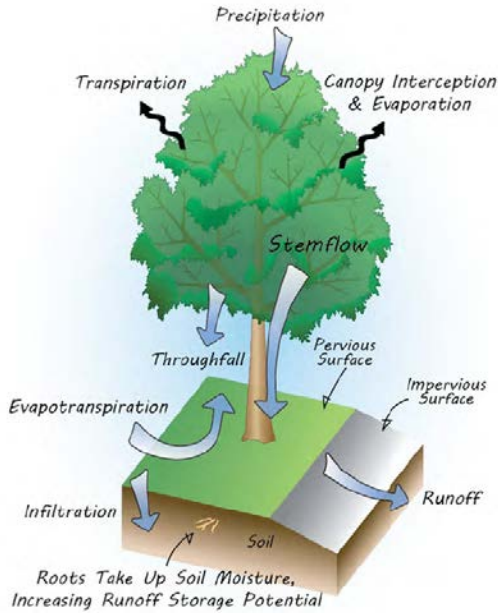
- Increase livability of area
- Reduce stress and fatigue
- Decrease hospital patient recovery time
- Improve respiratory health



Trees provide opportunities for recreation, inviting people to engage in outdoor physical activity. Treed walkways and bike paths contribute to Montana's low adult obesity rate, which is the fourth lowest in the nation at 23.6% (TAH 2016). Studies show that patients recovering from surgery have less reliance on medication and recover more quickly when their room has a view of trees (Ulrich 1986). A study of children with attention deficit disorder who spent time in nature had significantly less severe symptoms than those who played in windowless indoor settings (Wolf et al. 2014). Other studies have found that spending time in treed settings improves short-term memory, restores mental energy and relieves stress.



ENVIRONMENTAL BENEFITS



WATER QUALITY

- Intercept stormwater
- Filter pollutants
- Reduce soil erosion



During heavy rain events, trees intercept rainfall in their canopies, which reduces stormwater runoff and lessens the impact of raindrops on bare soils. Tree roots also increase the capacity and rate of water entering the soil. Trees filter out sediments and other pollutants from stormwater, easing the burden of water treatment facilities.

Urban trees in Montana intercept more than 122.4 million gallons of stormwater annually, or an average of 884 gallons per tree. The value of this benefit is \$1,321,925, an average of \$9.55 per tree each year.



AIR QUALITY

- Reduce particulate matter
- Absorb air pollutants
- Decrease power plant emissions
- Increase oxygen levels



Urban trees improve air quality by removing large amounts of air pollution. Each year urban trees in Montana remove 47,513 pounds (21.6 metric tons) of pollutants including nitrogen dioxide (NO₂), sulfur dioxide (SO₂), small particulate matter (PM₁₀) and ozone (O₃). Air quality is of special importance to Montana communities due to localized inversions, wind, dust and smoke from wildland fires.



CARBON

- Remove atmospheric carbon
- Lower demand for energy



Inventoried trees in Montana annually sequester 9.5 million pounds of CO₂. Trees reduce atmospheric carbon by pulling CO₂ from the air and storing it in leaves, branches, trunks, roots and the soil. Additionally, Montana's urban forests also indirectly reduce CO₂ by lowering the demand for heating and cooling energy (through shading and wind protection), thus avoiding CO₂ emissions from the consumption of natural gas and electricity. The reduced energy consumption avoids the release of 11.7 million pounds of CO₂ per year. Annual total carbon benefits, including CO₂ sequestered and avoided, are valued at \$147,635.

Tree Benefits

SOCIAL & ECONOMIC BENEFITS

COMMERCIAL/BUSINESS

- Increase property values of homes and businesses
- Stimulate business
- Increase safety by lowering crime rates and slowing traffic
- Community fruit tree projects contribute toward healthy, affordable local produce and benefit nurseries and related businesses



In commercial areas, well-designed landscapes with trees create welcoming sites for customers. There is documented evidence that trees promote better business by stimulating more frequent and extended shopping and a willingness to pay 9 to 12% more for goods and services in business districts having an urban forest (Wolf 2007). Homes with trees generally have a 5 to 20% higher property value than homes without a treed landscape. Fruit trees planted for community use can provide a locally-sourced healthy food choice for consumers.



ENERGY

- Lower surrounding temperatures by shading and transpiration
- Reduce energy costs
- Protect dwellings and hardscape



Through shade and transpiration, trees and vegetation help moderate temperatures in urban settings. Shade from trees reduces radiant heat, thereby regulating the heat-island effect caused by paved surfaces and buildings. In addition to providing cooling shade in summer, trees give protection from wind in winter, saving on energy demand for homes. By reducing energy needs, trees reduce emissions from the generation of power.

Montana's urban trees annually save 12,456 Megawatt hours (MWh) and 1,160,647 therms, for a total retail savings of \$1,844,435 or \$13.32 per tree. The electricity savings is equivalent to running 2,490 home central air conditioning units for 1,000 hours each. The natural gas savings is equivalent to heating 8,000 houses (2,500 square feet each) for a month.

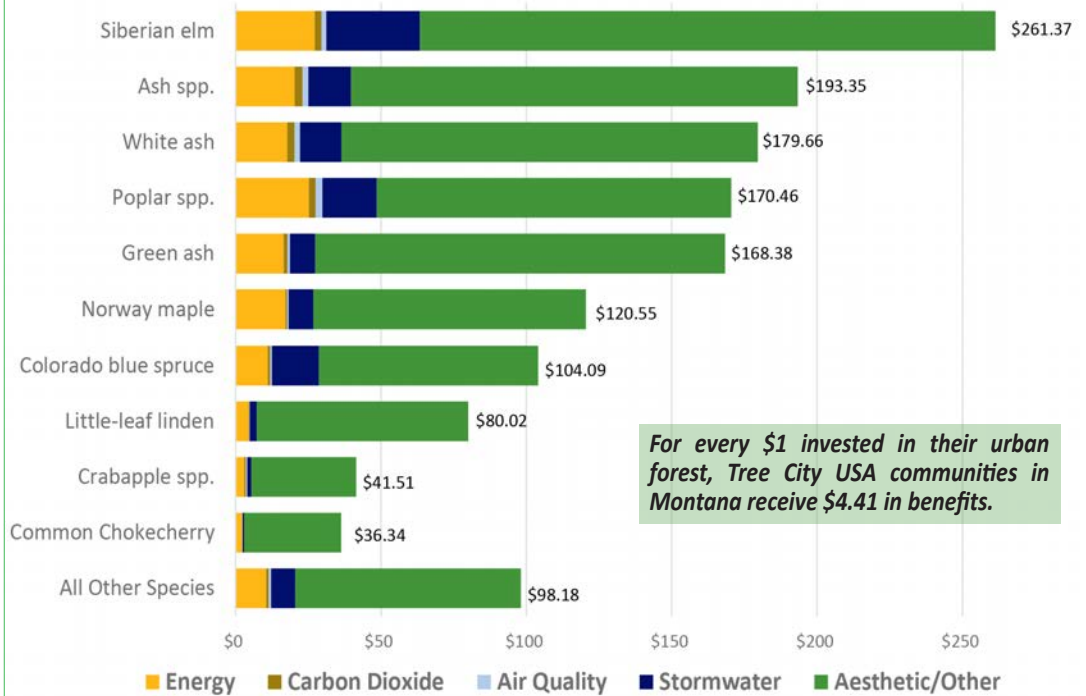


Inventoried community trees in Montana provide over **\$17 million** per year in environmental, economic and health benefits. They contribute cumulative benefits to the community at an average value of **\$124 per tree**. The larger the tree, the more benefits it provides. Many of Montana's inventoried Siberian elms are large, old trees, which accounts for their high benefits per tree value compared to other species. These and other species currently providing the highest benefits have characteristics making them less than desirable street trees (i.e. weak wood and high maintenance needs in poplars; insect problems in ash, messy fruit in maples).

The replacement value for the entire population of trees in these communities is **\$185.5 million**; an average of \$1,340 per tree.

ANNUAL BENEFITS PER TREE

Per-Tree Values



For every \$1 invested in their urban forest, Tree City USA communities in Montana receive \$4.41 in benefits.



Energy Savings

\$1,844,435

Electrical kWh Saved

12,455,849

Natural Gas (Therms) Saved

1,160,647



Air Quality Improvements

\$123,273

Pounds of Pollutants Intercepted

47,512



Stormwater Runoff Reduction

\$1,321,925

Gallons of Water Reduced

122,400,482



Carbon Dioxide Reduction

\$147,635

Pounds of CO₂ Avoided

11,748,263



Property Value Increased

\$13,747,443

STATEWIDE ANNUAL BENEFITS



West of Continental Divide

Sixteen inventoried communities are west of the Continental Divide. This mountainous area experiences more precipitation, cooler summer temperatures and lighter winds than the area east of the Divide. In general, the communities inventoried in the western region are more populated than communities in the east.



SPECIES COMPOSITION

Western urban forests have a tree composition high in broadleaf deciduous trees (86%) and low in conifers (14%). The ten most common species inventoried were Norway maple, ash (green and white ash, and ash spp.), crabapple, ponderosa pine, chokecherry, Colorado blue spruce, Siberian elm, red maple, aspen and poplar species.

Some urban foresters use a 10-20-30 target as a guideline to reduce the possibility of catastrophic tree loss due to insects and disease. This recommendation suggests an urban tree population include no more than 10% of any one species, 20% of one genus or 30% of one family. For some western Montana communities, Norway maples greatly exceed the maximum 10% recommendation. Many of these maples were planted in the early 1900s and are declining due to urban stresses and old age. Replacement trees should include a diverse mix of species, favoring large-stature species where appropriate.

PEST ALERT

Trees in western Montana are vulnerable to emerging insects and diseases:

- Norway maple – verticillium wilt, anthracnose, tar spot, wetwood
- Ash – emerald ash borer
- Conifers – bark beetles
- Maple, birch, buckeye, elm and willow – Asian longhorned beetle

1: Avoided Carbon: Avoided carbon is a result of reducing energy consumption. The avoided value represents carbon that would have been created from the production of additional energy.

The 2016 analysis was conducted using iTree Streets, a street tree management and analysis tool for urban forest managers. Tree inventory data was analysed to quantify the dollar value of annual environmental and aesthetic benefits. The iTree Suite is free, peer-reviewed software from the USDA Forest Service. www.itreetool.org. Grant funding for this project provided by the US Forest Service.

Quick Facts

53,342 Trees

165 Unique Species

\$5.6 Million Total Benefits

\$103 Benefits Per Tree

\$64.6 Mil. Replacement Value

43% in Good Condition

36 Mil. gallons Stormwater
Runoff Reduced Annually

10,639 lbs Air Pollutants
Removed Annually

4,300 MWh & **403,123 therms**
Energy Saved Annually

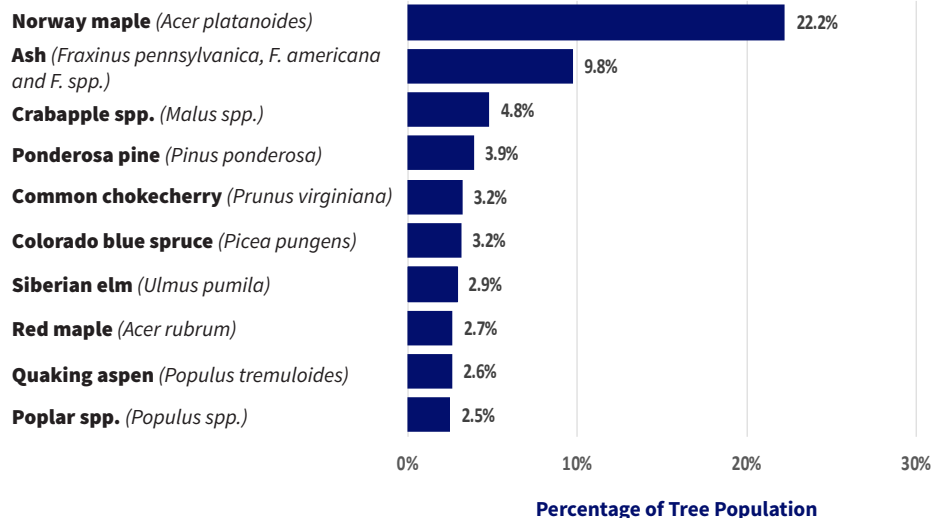
\$4.5 Mil. Property Values

941 tons Carbon Dioxide
Sequestered Annually

1,204 tons Carbon Dioxide
Avoided Annually₁

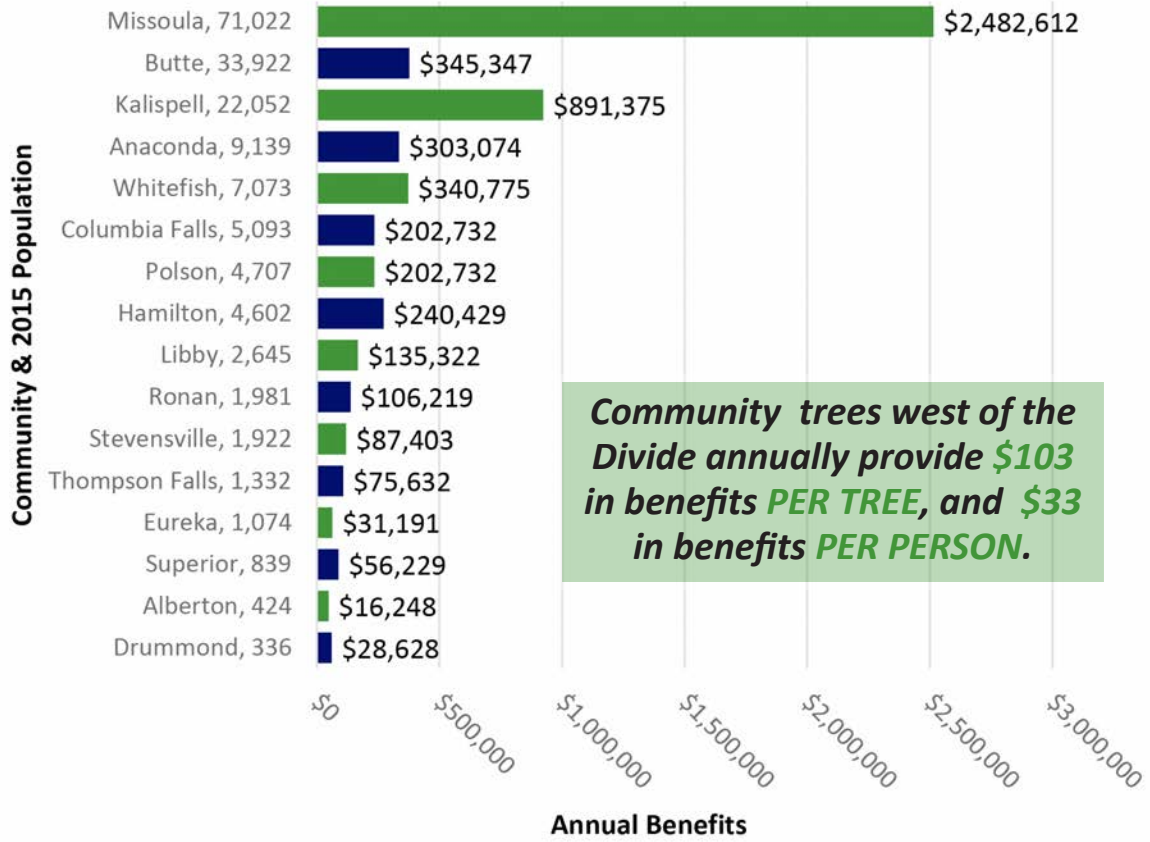
*It would cost almost **\$65 MILLION** to replace every inventoried tree west of the Divide with one of a similar size, stature, species and condition.*

Top 10 Most Common Species





ANNUAL BENEFITS (\$) BY COMMUNITY SIZE - WEST OF THE DIVIDE



East of Continental Divide

Forty-five of the inventoried communities are located east of the Continental Divide. The region is mostly open prairie, sagebrush, crop land or badlands with scattered mountainous, forested areas. Eastern Montana communities experience a more severe climate than those of the western region, with hotter summers, colder winters, more wind and a higher likelihood of precipitation extremes. Consequently, some tree species that grow well west of the Divide may need additional attention in eastern Montana.



Quick Facts

85,078 Trees
147 Unique Species
\$11.6 Million Total Benefits
\$137 Benefits Per Tree
\$121 Mil. Replacement Value
63% in Good Condition
86 Mil. gallons Stormwater
 Runoff Reduced Annually
36,872 lbs Air Pollutants
 Removed Annually
8,156 MWH & 757,508 therms
 Energy Saved Annually
\$9.3 Mil. Property Values
3,828 tons Carbon Dioxide
 Sequestered Annually
4,670 tons Carbon Dioxide
 Avoided Annually₁

SPECIES COMPOSITION

Similar to the western region, eastern communities are comprised of mostly broadleaf deciduous trees, which make up over 85% of the composition. The ten most common inventoried trees were ash species (green and white ash, and ash species*), Colorado blue spruce, crabapple, Siberian elm, eastern cottonwood, little-leaf linden, American elm, poplar species, willow species and chokecherry. Ash trees account for nearly 40% of all inventoried trees east of the Divide. Thirty-five communities in the eastern region exceed the suggested 20% maximum for ash species. In comparison, only one community west of the Divide (Anaconda) exceeds the 20% guideline. Siberian elm and cottonwood provide greater benefits per tree than any other species.

*Some communities inventoried only to the genus level.

PEST ALERT

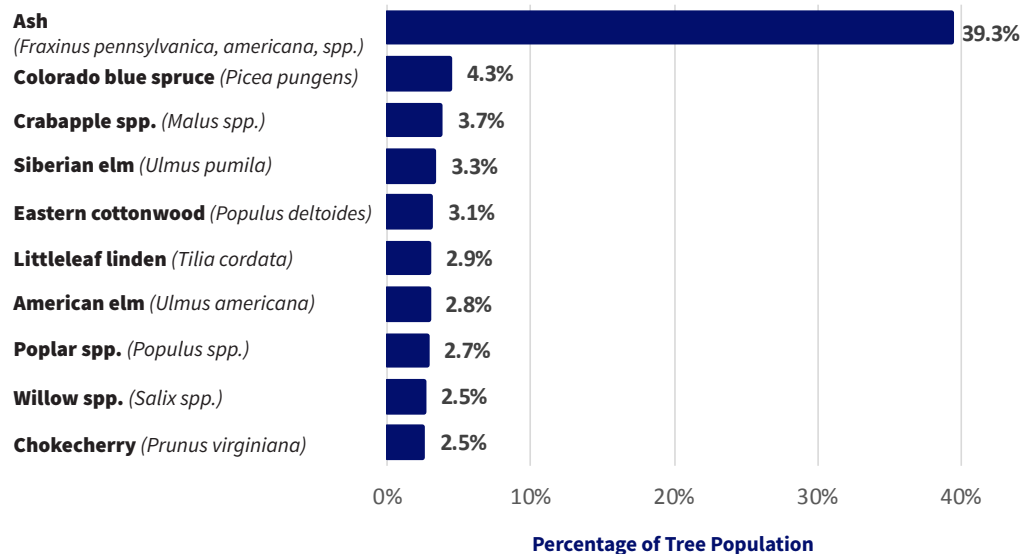
Trees in eastern Montana are vulnerable to emerging insects and diseases:

- Ash – emerald ash borer
- Conifers – bark beetles
- Rosaceae family (crabapple, pear, etc.) – fire blight

1: Avoided Carbon: Avoided carbon is a result of reducing energy consumption. The avoided value represents carbon that would have been created from the production of additional energy.

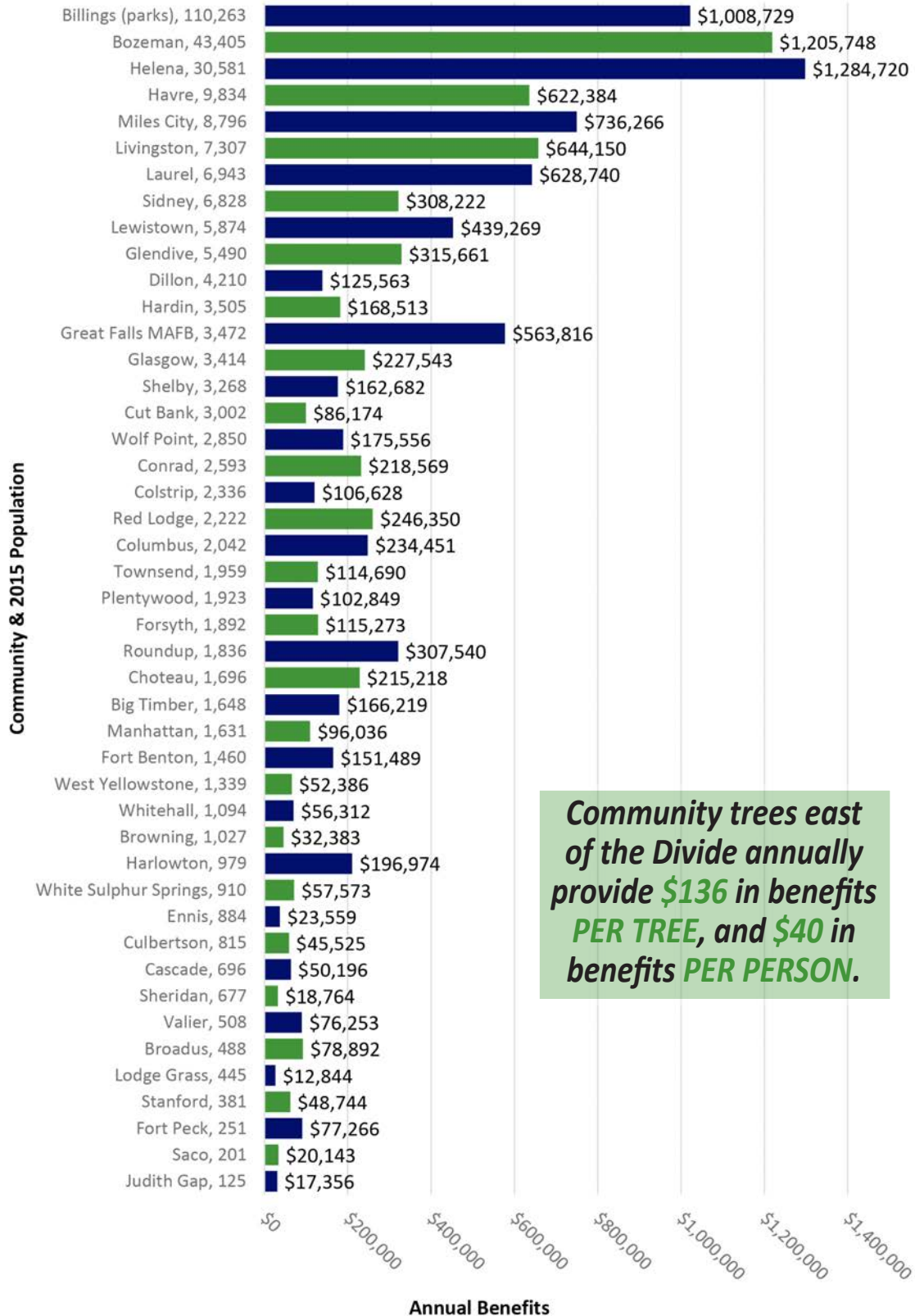
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Top 10 Most Common Species





ANNUAL BENEFITS(\$) BY COMMUNITY SIZE - EAST OF THE DIVIDE



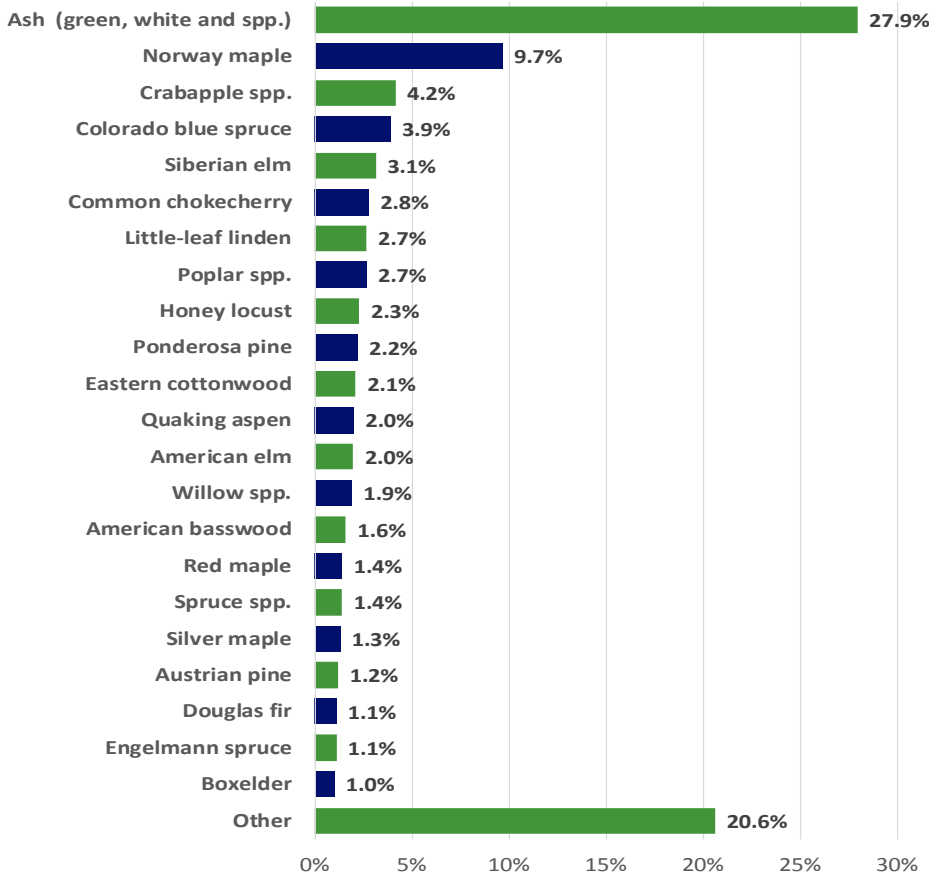
Statewide

URBAN FOREST COMPOSITION

Montana's inventoried urban and community forests include 138,420 public trees and 17,512 available planting sites on streets and in parks.

- More than 180 unique tree species were identified across the state.
- The predominant trees statewide are various ash species (28%, mostly green and white ash), Norway maple (nearly 10%) and crabapple (4%). These species comprise 42% of the total inventoried tree population.
- Almost half of the trees (47%) are under 8" in diameter (DBH), and 11% are over 24".
- The current stocking level is 87.9%, based on a total 157,403 sites, including tree sites, vacant sites and stumps.
- Replacement of Montana's inventoried community trees with trees of similar size, species and condition would cost nearly \$185.5 million.

POPULATION SUMMARY



Quick Facts

138,420 Trees

2,269 Trees (average) Per Community

\$17.2 Million Total Benefits

\$124 Benefits Per Tree

\$185.5 Mil. Replacement Value

180+ Unique Species

55% in Good Condition

122.4 Mil. gallons Stormwater Runoff Reduced Annually

47,513 lbs Air Pollutants Removed Annually

12,456 MWh & 1.2 Mil. therms Energy Saved Annually

\$13.7 Mil. Property Values

4,768 Tons Carbon Dioxide Sequestered Annually

5,874 Tons Carbon Dioxide Avoided Annually

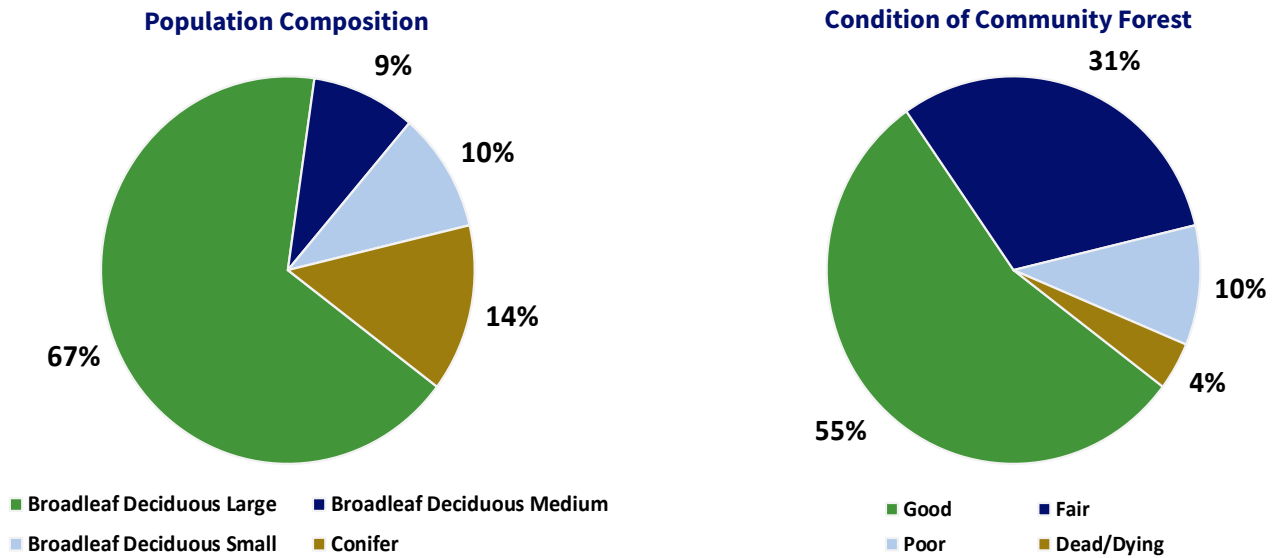
*Inventoried communities have an average of **ONE** tree for every **THREE** people.*

A WORTHY GOAL: **THREE** trees for every person.



CONDITION

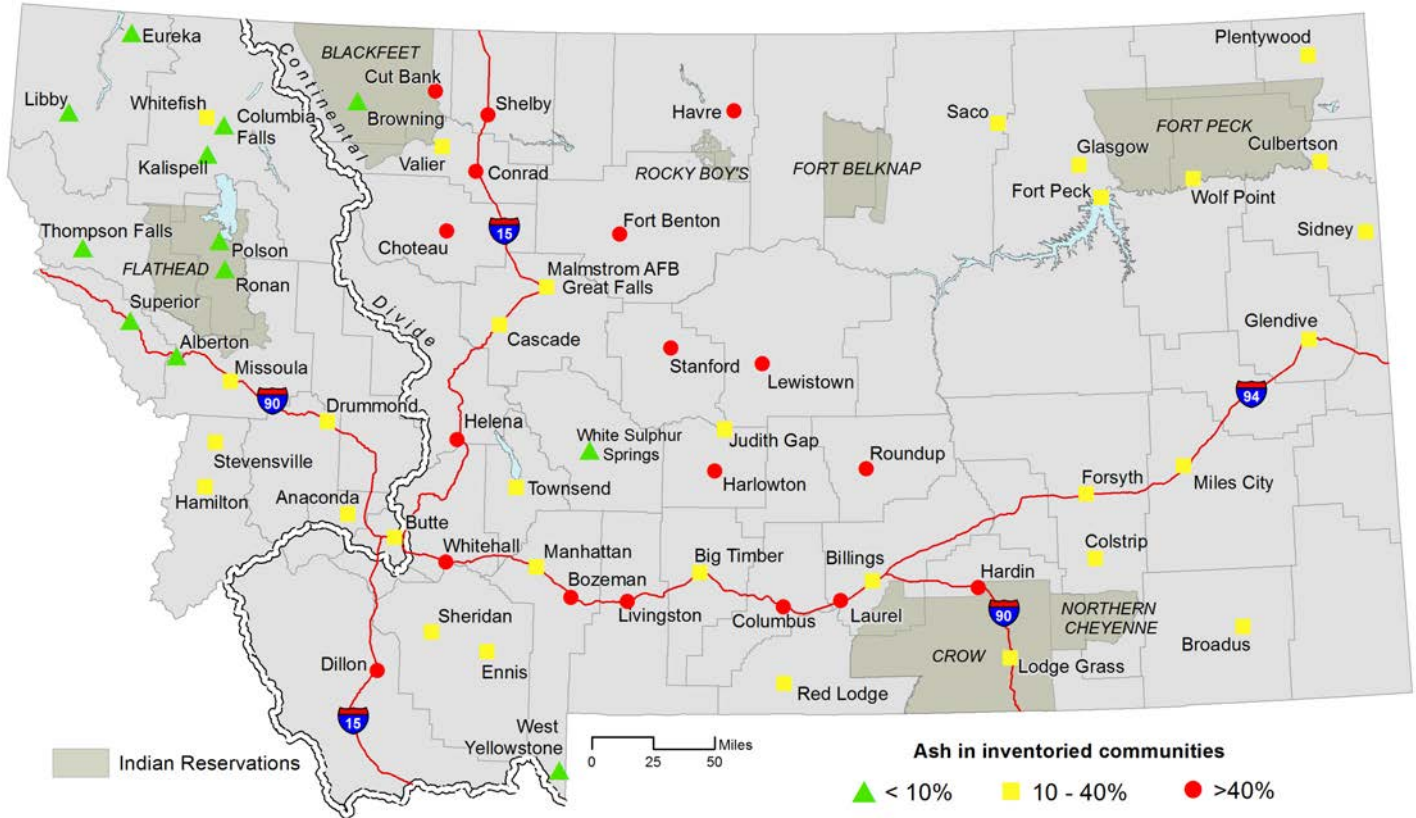
Broadleaf deciduous species comprise nearly 86% of the statewide inventory - 67% of those are large-stature trees, 9% are medium-stature and 10% are small-stature species. Conifers comprise 14% of the overall population. Montana's community forest is generally in good to fair condition with 55% of all trees statewide ranked good and 31% ranked fair. About 14% of Montana's community trees are in poor or dead/dying condition. This baseline information on tree condition gives a reference point upon which to improve.



PEST ALERT

With nearly **30%** of the analyzed community forest comprised of ash, emerald ash borer (EAB) poses a significant risk of widespread tree mortality. Mortality associated with EAB could reduce leaf surface area in the community forest by more than **40%** and result in a loss of nearly **\$6.7 million** in annual environmental benefits. In the case of an EAB outbreak in Montana, the loss of environmental benefits will significantly exceed the direct cost of trees lost. Selecting non-ash species is critical when planting new community trees.

POTENTIAL URBAN TREE MORTALITY FROM EMERALD ASH BORER



Ash are the most commonly planted trees in several Montana communities east of the Continental Divide. Ash species represent more than 40% of all publicly-owned trees in 18 communities: **Havre, Roundup, Laurel, Columbus, Stanford, Conrad, Fort Benton, Dillon, Harlowton, Helena, Lewistown, Hardin, Cut Bank, Bozeman, Livingston, Whitehall, Shelby and Choteau**. These communities have the most to lose if/when emerald ash borer arrives. Communities with higher percentages of ash have higher potential for loss of urban forest benefits provided by those trees. Of all 61 inventoried communities, only 11 have 10% or less of their public tree population as ash and may suffer the fewest consequences if an infestation occurs.



Emerald ash borer larvae tunnel through trees' inner bark and inhibit transport of water and nutrients. Adults can generally fly two miles in search of a suitable tree, but the primary means of long distance dispersal has been by human transport of firewood. To date, there are no regulations in effect that restrict firewood movement into Montana. All infested trees die if not properly treated with insecticides. Preventing EAB introduction requires close monitoring of the potential host material that enters Montana.



Next steps for urban forest inventory in Montana

Montana DNRC Urban and Community Forestry Program inventory goals include:

- Using inventory data, increase public awareness of urban forestry issues by working with communities, agency partners and organizations that support urban forests
- Inventory new communities and assist communities with inventory updates; keep the state's tree data current and useful, recognizing the role that reliable inventories can play in tracking changes in tree species composition over time and helping to plan for a changing environment
- Produce a statewide urban forest management strategy applying inventory results

BEYOND THE NUMBERS.....DNRC will engage with partners to:

- Invest in green infrastructure across the state - **promote tree planting in appropriate places**
- Explore sustainable forestry solutions to urban areas using a **diverse range of tree species**
- Demonstrate **best management practices** in urban forest management via careful design, establishment and care
- Continue to **support the important roles of tree boards and volunteers** in the growth of Montana's urban forests



CONTACT A DNRC REGIONAL OFFICE

For Montana DNRC urban forestry assistance on inventory, planning, grant opportunities, technical advice on tree selection, planting, removal, maintenance costs or becoming a Tree City USA, please contact the regional urban forester in your area:

Northwest - 655 Timberwolf Pkwy, Kalispell, (406) 751-2267

Southwest - 2705 Spurgin Road, Missoula, (406) 542-4288

Northeast - 613 NE Main Street, Lewistown, (406) 538-7789

Southeast - 1371 Rimtop Drive, Billings, (406) 247-4403

City Urban Forestry Departments can provide local forestry information and assistance in Billings, Bozeman, Great Falls, Helena, Kalispell and Missoula.



Montana's public trees are a valuable asset. They provide critical green infrastructure and a multitude of benefits. Understanding the condition and composition of Montana's urban forests allows for better management and planning decisions for the future. It is important to maintain a current inventory of our urban forests in order to grow our investment and maximize our returns.

This assessment suggests there is justification for more attention at both the state and local level towards urban forestry. Future discussions should consider ways to improve and retain a healthy urban forest. By investing in our community-owned forests, the citizens of Montana will see these trees appreciate in value year after year.



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