# Tree Canopy Assessment 2013-2021

## Boise, ID


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City of Boise & Treasure Valley Canopy Network

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# ACKNOWLEDGEMENTS

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# EXECUTIVE SUMMARY

The Tree Canopy Assessment provides a detailed quantitative analysis of canopy changes in the Boise Area of Impact (BAI) from 2013 to 2021. Canopy cover is the area of land covered by trees, as viewed from above, and serves as a crucial indicator of the extent and health of the region's urban forest. This assessment focuses on understanding the patterns and dynamics of canopy change within the defined study area, based on the Boise Area of Impact boundary defined by the Ada County Assessor's Office. The management of Boise's urban forest is a collaborative effort led by the Boise Parks and Recreation Community Forestry Program in collaboration with other city leadership and departments, multiple public, private and non-profit organizations including the Treasure Valley Canopy Network, and multiple homeowners associations, neighborhood associations and individual residents across the city.

Over the study period, an apparent increase in tree canopy was seen with the average tree canopy rising from 10% in 2013 to 11.7% in 2021, an absolute gain of 1.7%. This equates to a net gain of 1,255 acres of canopy cover across Boise. However, there was still a loss of 1,340 acres of tree canopy over that period, balanced out by 2,595 acres of canopy gain.

In the following report these figures are broken down across Boise Neighborhoods, Land Use Categories, Zoning Areas, and Land Ownership. These examinations provide insight into canopy change at a more granular level. There is also an analysis of canopy on parcels sorted by the year the largest building on the parcel was constructed. This analysis, along with the breakdown across neighborhoods provides an interesting look at the effect of development practices on tree canopy in Boise. For instance, the large tree canopy gains seen in Southeast Boise and Southwest Ada County Alliance show how new developments can incorporate green space. The high overall canopy coverage in older neighborhoods demonstrates the importance of establishing canopy as a goal early in the planning process.

The study found that the majority of Boise's existing and new tree canopy is contributed by trees on private residential properties. This highlights the importance of community in maintaining and growing tree canopy in Boise. If tree canopy is to be treated as a valuable resource, tools should be provided to residents to help preserve existing trees and plant new ones. This could take the form of assistance with planting, pruning, and removals, public education about viable and valuable tree species, and tree protection ordinances in City Code to name a few. Finally, the report provides discussion around potential tree canopy and environmental equity. This provides a look at possible routes and outcomes for increasing tree canopy across Boise.

This study is independent from the previous Treasure Valley Tree Canopy Assessment, funded by USDA Forest Service and Idaho Department of Lands, and conducted by Plan-It Geo and stakeholders across the region in 2013 (link to this report is available here cityofboise.org/media/4256/2013_treasure_valley_utc_project_report-final_-071013.pdf). The 2013 report calculated tree canopy only within Boise City Limits, while this assessment was done for the entirety of the Boise Area of Impact. There are several reasons why the results are not comparable to this assessment. The prior assessment led by Plan-it Geo used a different methodology and a different geographic study area that was based 2011 aerial imagery. This assessment used LiDAR data and imagery to calculate tree canopy for both 2013 and 2021.

# TREE CANOPY SUMMARY

11.7% 2021 Existing Tree Canopy %

10% 2013 Existing Tree Canopy %

**630,000**
Estimated total trees

**1.7%**
Absolute change in tree canopy coverage

**16.7%**
Relative change in tree canopy coverage

**1,255**
Acres
Area change in tree canopy from new plantings and incremental growth.
(2,595 acres of gain - 1,340 acres of loss)

The net amount of tree canopy gain is the equivalent of 950 football fields!

**8**
Neighborhoods have canopy below citywide canopy coverage of 11.7%

**27**
Neighborhoods have canopy above citywide canopy coverage of 11.7%

## Key Terms

**Existing Tree Canopy**: The amount of tree canopy present when viewed from above using aerial or satellite imagery.

**Possible Tree Canopy-Vegetated:** Grass or shrub area that is theoretically available for **the** establishment of tree canopy.

**Possible Tree Canopy - Impervious:** Asphalt, **concrete** or bare soil surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy

## Measuring Tree Canopy Change

**Area Change** - the change in the area of tree canopy between the two time periods.

**Absolute % Change** - the percentage point change between the two time periods.

**Relative % Change** -the magnitude of change in tree canopy based on the amount of tree canopy in 2013.

# MAPPING THE TREE CANOPY FROM ABOVE

Tree canopy assessments rely on remotely sensed data in the form of aerial imagery and light detection and ranging (LiDAR) data. These datasets, which have been acquired for the region, are the foundational information for tree canopy mapping. Imagery provides information that enables features to be distinguished by their spectral (color) properties. As trees and shrubs can appear spectrally similar, or obscured by shadow, LiDAR, which consists of 3D height information, enhances the accuracy of the mapping. Tree canopy mapping is performed using a scientifically rigorous process that integrates cutting-edge automated feature extraction technologies with detailed manual reviews and editing. This combination of sensor and mapping technologies enabled the city's tree canopy to be mapped in greater detail and with better accuracy than ever before. From a single street tree along a roadside to a patch of trees in a park, every tree in the study area was accounted for.

## Tree Canopy Mapping

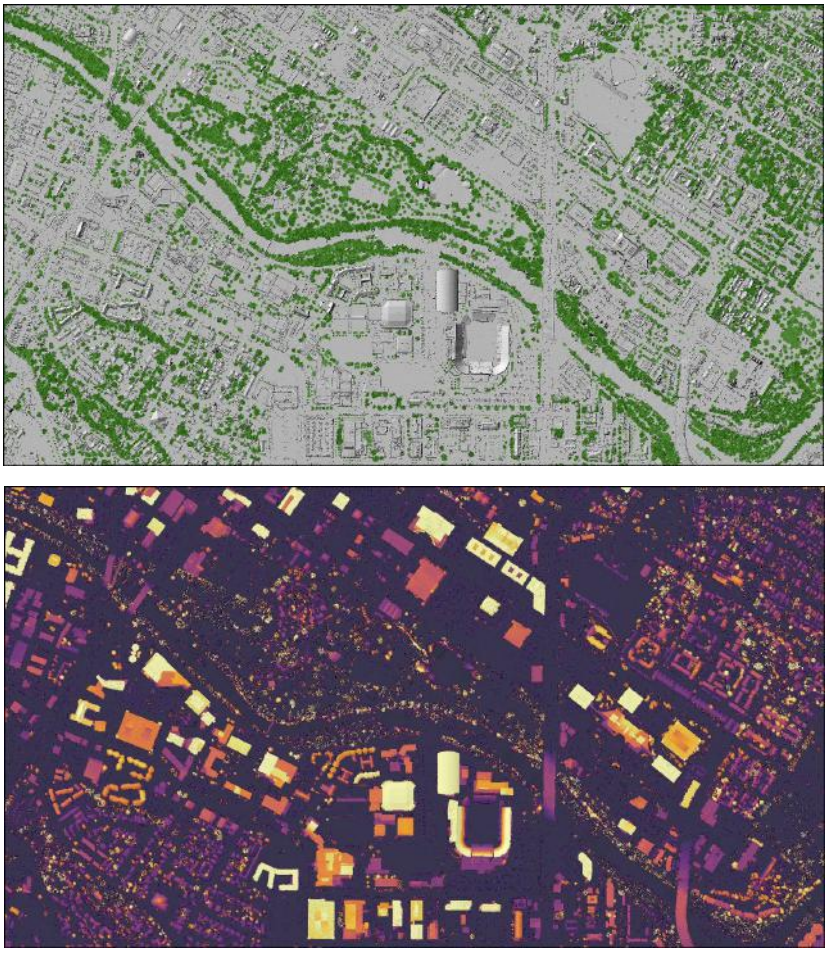


Figure 1. Existing tree canopy map (top) that were derived from the 2019 LiDAR (bottom), zoomed into the downtown Boise area.

Tree canopy is one of seven classifications from the high-resolution land cover map that forms the foundation of this project. Compared to national tree canopy datasets, which map at a resolution of 30-meters, this project generated maps that were over 1,000 times more detailed and better account for all of the region's tree canopy.

## Land Cover Mapping


Figure 2. Map of high-resolution land cover developed for this project, zoomed into the downtown Boise area.

# THE TREE CANOPY ASSESSMENT PROCESS

This project employed the USDA Forest Service's Urban Tree Canopy assessment protocols and made use of federal, state, and local investments in geospatial data. Tree canopy assessments should be completed at regular intervals, every 3-5 years.

Remotely sensed data forms the foundation of the tree canopy assessment. We use high-resolution aerial imagery and LiDAR to map tree canopy and other land cover features.

The land cover data consist of tree canopy, grass/shrub, bare soil, water, buildings, roads/railroads, and other impervious features.

The land cover data are summarized by various geographical units, ranging from the property parcel to the watershed to the municipal boundary.

The report (this document) summarizes the project methods, results, and findings.

The presentation, given to partners and stakeholders in the region, provides the opportunity to ask questions about the assessment.

The tree canopy metrics data analytics provide basic summary statistics in addition to inferences on the relationship between tree canopy and other variables.

These summaries, in the form of tree canopy metrics, are an exhaustive geospatial database that enables the Existing and Possible Tree Canopy to be analyzed.

### The Importance of Good Data

This assessment would not have been possible without Boise's investment in high-quality geospatial data, particularly LiDAR. These investments pay dividends for a variety of uses, from stormwater management to solar potential mapping. Good data supports good governance.

# THE NEED FOR GREEN

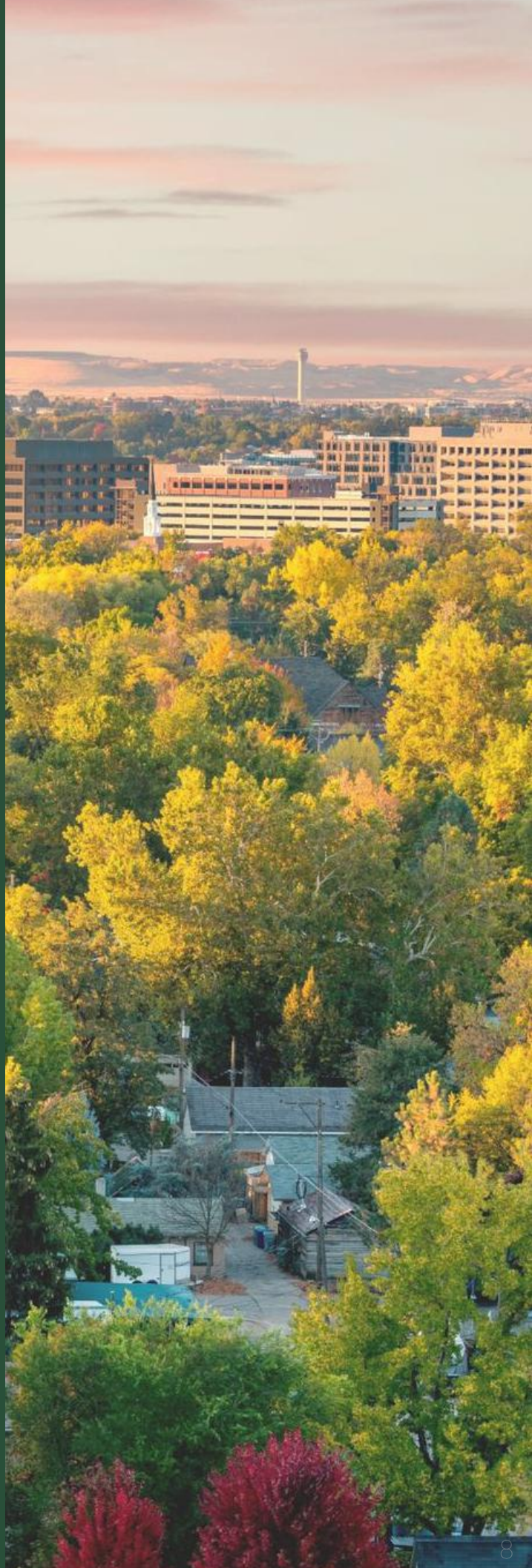
Boise benefits from crucial ecosystem services offered by trees, such as minimizing stormwater runoff, cooling homes and pavement during summer, and creating habitat for wildlife. Trees are an indispensable part of the region's infrastructure, with research showing that these green assets can improve social cohesion, reduce crime, and raise property values. A healthy and robust tree canopy is imperative for building a more livable and prosperous city.

As with any community, Boise faces a host of environmental challenges as it strives to strike a balance between development and conservation. A healthy and robust tree canopy is crucial for maintaining this balance, providing the residents of Boise with a resource that will impact the health and well-being of both current and future generations.

# TREE CANOPY ASSESSMENT

For decades governments have mapped and monitored their infrastructure to support effective management practices. Traditionally, that mapping has primarily focused on gray infrastructure, including features such as roads and buildings. An accounting of the green infrastructure has often been left out of this mapping.

The Tree Canopy Assessment protocols were developed by the USDA Forest Service to help communities better understand their green infrastructure through tree canopy mapping and analytics. ***Tree canopy is the layer of leaves, branches, and stems that provide tree coverage of the ground when viewed from above***. A Tree Canopy Assessment can provide vital information to help governments and residents chart a greener future by helping them understand the tree canopy they have, how it has changed, and where there is room to plant trees. Tree Canopy Assessments have been carried out for over 90 communities in North America. This study assessed tree canopy for Boise over the 2013-2021 period. This study is not related to previous tree canopy assessments.



# FINDINGS

Boise's tree canopy increased from 2013 to 2021, with an absolute gain of 1.7%.

There were 2,595 acres of tree canopy gained and 1,340 acres of tree canopy lost from 2013 to 2021.

To enhance urban resilience, Boise can improve access to trees and the benefits that they provide.

Tree canopy loss is neither evenly distributed nor similar. It varies from removal of individual trees in backyards to clearing of patches of trees for new construction.

Boise can improve environmental equity by prioritizing tree plantings in neighborhoods most susceptible to environmental risk.

Tree canopy in the Southwest Ada Alliance expanded by about 3.5%, reflecting that the investment in that neighborhood is paying off.

Land use history, urban forestry initiatives, natural factors, and landowner decisions, all play a role in influencing the current state of tree canopy in the region.

Gain in tree canopy coverage were possible through preservation and planting initiatives.

# BOISE'S LANDSCAPE CONTEXT

Boise, Idaho is located in the Intermountain West along the eastern edge of the Treasure Valley and is characterized by a high-desert environment. This environment predominantly features sagebrush steppe and scrub shrub vegetation. In this semi-arid landscape, small trees and shrubs occur in upland habitats with cottonwoods and willows inhabiting the riparian areas where there is more water present periodically throughout the year. In developed areas of Boise, where irrigation is available, larger trees have been planted and will thrive under the care and management of the city's parks department and individual residents and landowners.

### Canopy definition & the importance of native trees & shrubs

This assessment captures tree canopies with a height threshold of 8 feet (approximately 2.4 meters) or taller. The term "canopy" refers to the layer of leaves, branches, and stems that cover the ground when viewed from above. In urban settings, larger trees typically offer more significant benefits to people and the environment. Given the region's  landscape, smaller native trees and shrubs, which are also valuable for providing ecological benefits, may not be captured by the larger canopy threshold of this assessment.

### Contextual interpretation & nature access

While tree canopy cover in urban areas provides numerous benefits, it is crucial to distinguish between access to tree canopy and nature access. Tree canopy offers urban residents with benefits like cooling, stormwater management, clean air and aesthetic values. However, access to nature encompasses a broader range of natural environments, including parks, natural reserves, and open spaces that feature a diversity of plant life, wildlife, and ecological systems.

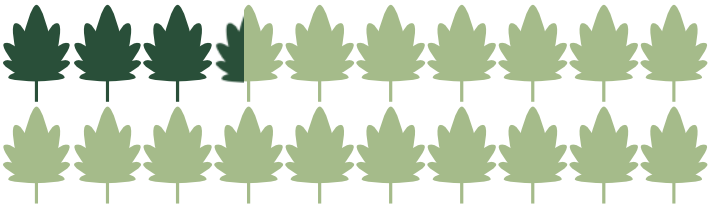
When interpreting the findings of this tree canopy assessment, it is important to consider the unique environmental context of Boise's different neighborhoods. Urban and more developed areas may exhibit higher tree canopy cover, which reflects the presence of larger, managed trees. However, this does not negate the necessity to maintain and enhance natural areas, where a diverse range of native plants and shrubs contribute to the overall ecological health but fall below the height threshold of this assessment.

### Recommendations for increasing canopy

To enhance tree canopy coverage, it is recommended to plant the right trees, in the right locations and for the right reasons. This strategy aligns with the priorities outlined in the City of Boise's various management plans, including: Boise Community Forest Management Plan, Boise Reserves Management Plan and others. These plans emphasize the importance of integrating native vegetation to preserve the local ecosystem while also adding ornamental species for urban beautification, and expanding canopy cover.

# TREE CANOPY METRICS

**11.7%** *of land in Boise is covered by tree canopy*



Tree canopy and tree canopy change were summarized at various geographical units of analysis, such as neighborhood boundaries, property parcels and land ownership types. These tree canopy metrics provide information on the area of Existing and Possible Tree Canopy for each geographical unit.

## Existing Tree Canopy

Cities commonly have uneven distribution of tree canopy, a pattern that applies to Boise. Existing tree canopy percentage for 2021 conditions are summarized using 308- acre hexagons in Figure 3. For each of the hexagons, the percent tree canopy was calculated by dividing the amount of tree canopy by the land area. Using hexagons as the unit of analysis provides a standard mechanism for visualizing the distribution of tree canopy without the constraints of other geographies that have unequal area (e.g., zip codes).There are some hexagons with no tree canopy and others with 40% tree canopy. This unequal distribution can be traced back to Boise's history of development patterns, open space planning, and landscape characteristics such as hydrology, terrain and climate conditions of the high desert. Residents who live and work in areas with more trees (darker green hexagons) benefit disproportionately from the ecosystem services that trees provide. In contrast, the outskirts of the city exhibit lower amounts of tree canopy due to the arid nature of these environments when not irrigated.

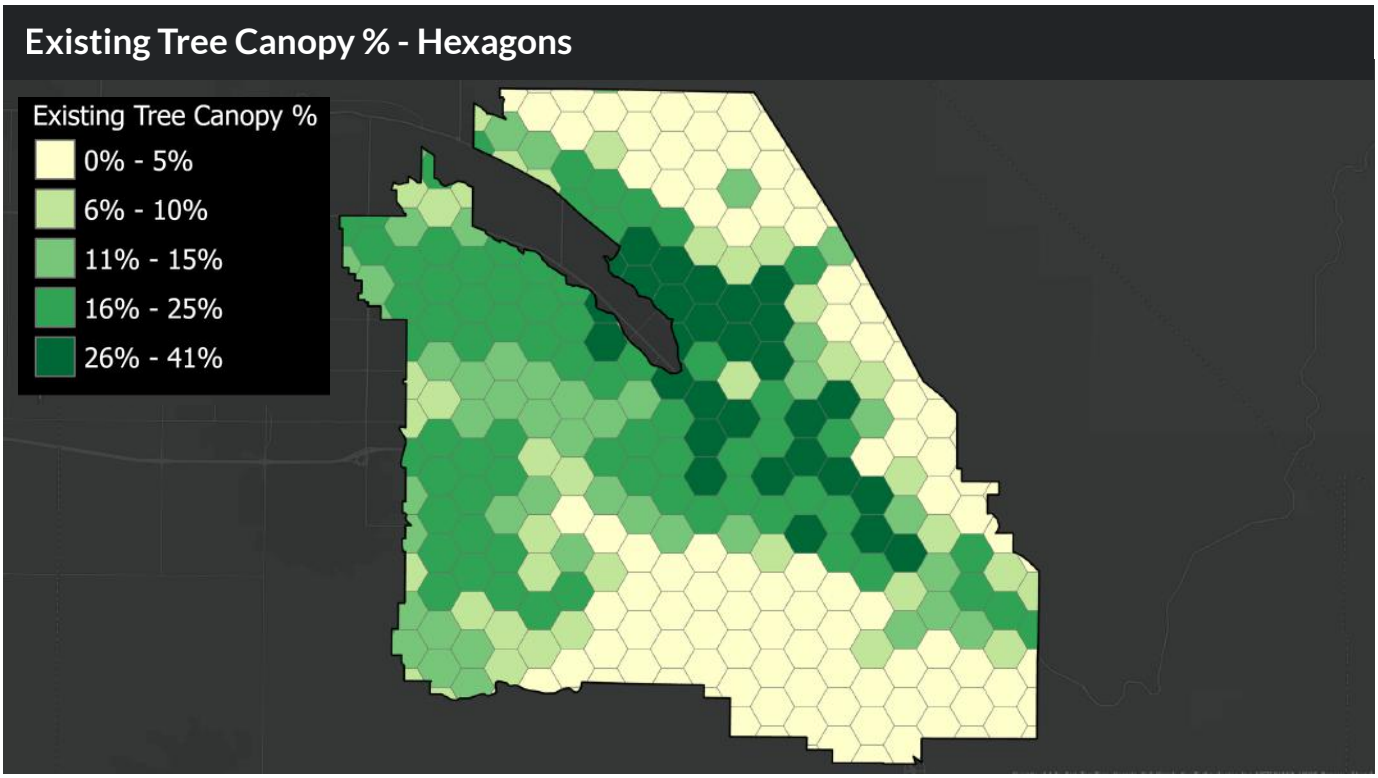



Figure3. Existing tree canopy percentage for 2021 conditions summarized using 308-acre hexagons.

## Possible New Tree Canopy

There is available space in Boise to plant more trees (Figure 4), although ensuring their survival in the semi-arid environment will require irrigation and other forms of management. With more than 39,000 acres of land (comprising approximately 52% of the city's land base) falling into the Possible-Vegetation category, there remain opportunities for planting trees that will improve the community's total tree canopy in the long term.

In this assessment, any areas with no trees, buildings, roads, or bodies of water are considered Possible-Vegetation and represent locations in which trees could theoretically be established without having to remove hardscape. Many factors go into deciding where a tree can be planted with the necessary conditions to flourish, including land use, climate, landscape conditions, social attitudes towards trees, and financial considerations. Despite the ample space depicted in the Possible Vegetation Map for tree planting in the foothills of the region, the arid climate poses challenges to tree survival and wildland fire hazard is also an important consideration for land managers, city planners and residents. Nevertheless, it remains important to plant and adequately irrigate trees in areas where people live and work to foster walkable, livable, safe, and clean environments. Maintaining natural vegetation in the shrub-steppe landscape surrounding the city is equally vital for environmental health and biodiversity. Areas such as golf courses and recreational fields, while offering open space for tree planting, present conflicts in land usage, rendering them unsuitable for tree cultivation.

Maps of the Possible Tree Canopy can assist in strategic planning, but decisions on where to plant trees should be made based on field verification. Underground and above surface factors such as sidewalks, utilities and irrigation should also be considered when evaluating sites suitable for tree planting. In Boise's most densely urbanized areas, significantly increasing the tree canopy will be difficult; nevertheless, it remains vitally important to strive for canopy gain. In the city's residential areas, maintaining the health of of the existing tree canopy and planting new trees will be important.

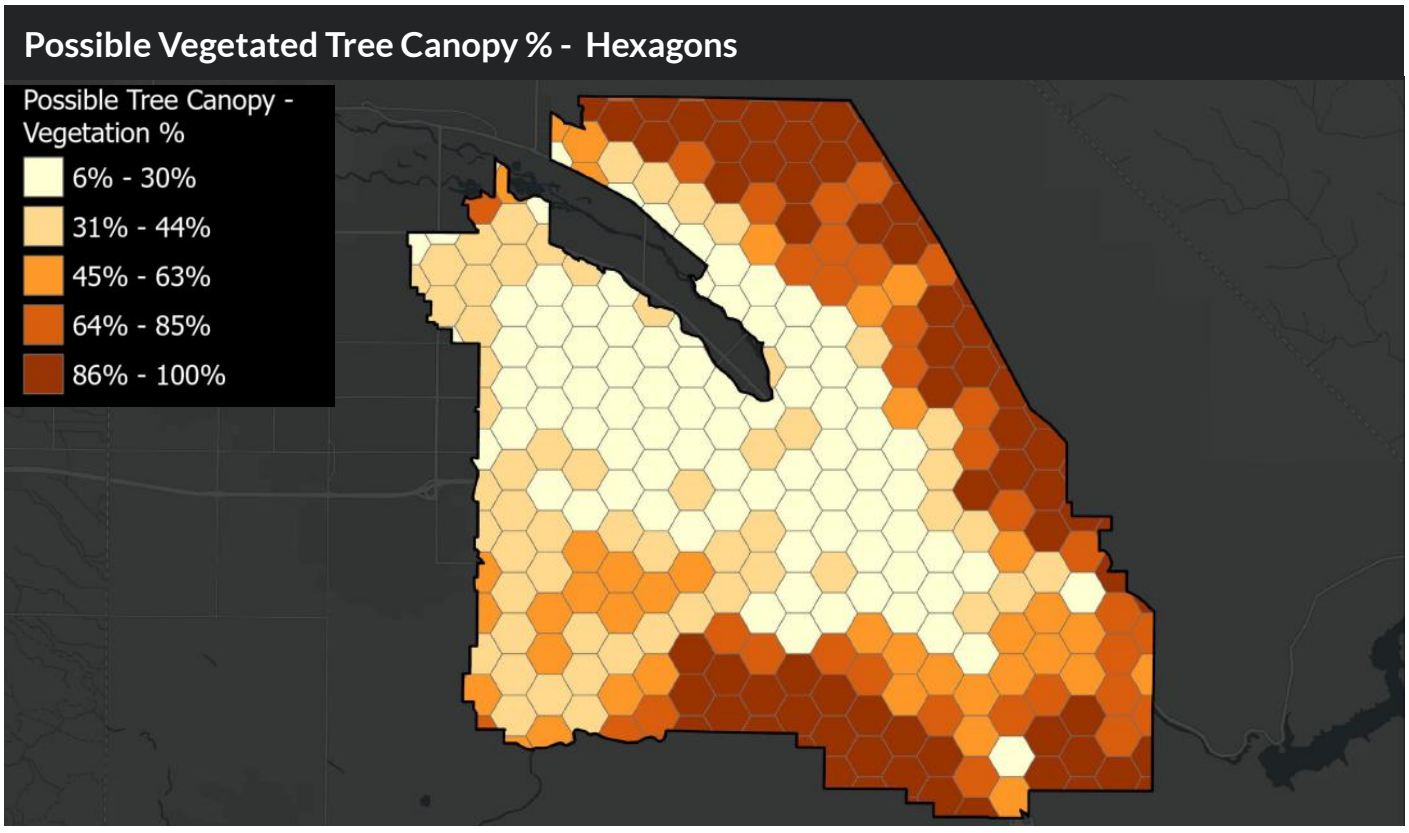



Figure 4. Possible Tree Canopy consisting of non-treed vegetated surfaces summarized by 308-acre hexagons.

## Canopy Change Distribution

The magnitude of tree canopy change across Boise can be measured by the relative tree canopy change over the 2013-2021 period. The relative change is calculated by taking the tree canopy area in 2013, subtracting the tree canopy area in 2021, then dividing this number by the area of tree canopy in 2013. Areas with the greatest change indicate that the canopy is markedly different in 2021 as compared to 2013. In some of the new developments on the less densely populated parts of the city's edge with little tree canopy in 2013, the growth of residential trees resulted in a sizeable relative gain (dark green hexagons in Figure 5). Natural regeneration of canopy and tree plantings also contributed to relative gain in the city's periphery. Conversely, the removal of trees due to development, storm damage, and other factors resulted in substantial relative reductions in tree canopy (purple hexagons in Figure 5).

The future trajectory of Boise's tree canopy is uncertain. There are both environmental and human-induced risks facing canopy cover. Invasive species could pose a serious threat, if not identified and controlled early. For instance, the arrival of the Emerald Ash Borer, an invasive beetle, could significantly impact all ash trees across the city. Some precautions have been taken to address this threat. In riparian zones, invasive plants such as Russian olive and Siberian elm have the capacity to outcompete other established vegetation leading to disruptions to the existing habitat. Timely detection and implementation of efficient control strategies are imperative to address these risks effectively. Natural events such as storms and wildfires can have an impact on the canopy. In open space and conservation areas, tree canopy may return through natural growth, but in urbanized areas, trees lost to storms will need to be replanted. Climate change may cause trees to grow more quickly but could also result in inhospitable conditions for some species that are currently suited to the local climate. Community forest management policies and practices include preservation and conservation efforts and the strength of tree ordinances. Managing these risks will be key to achieving canopy growth.

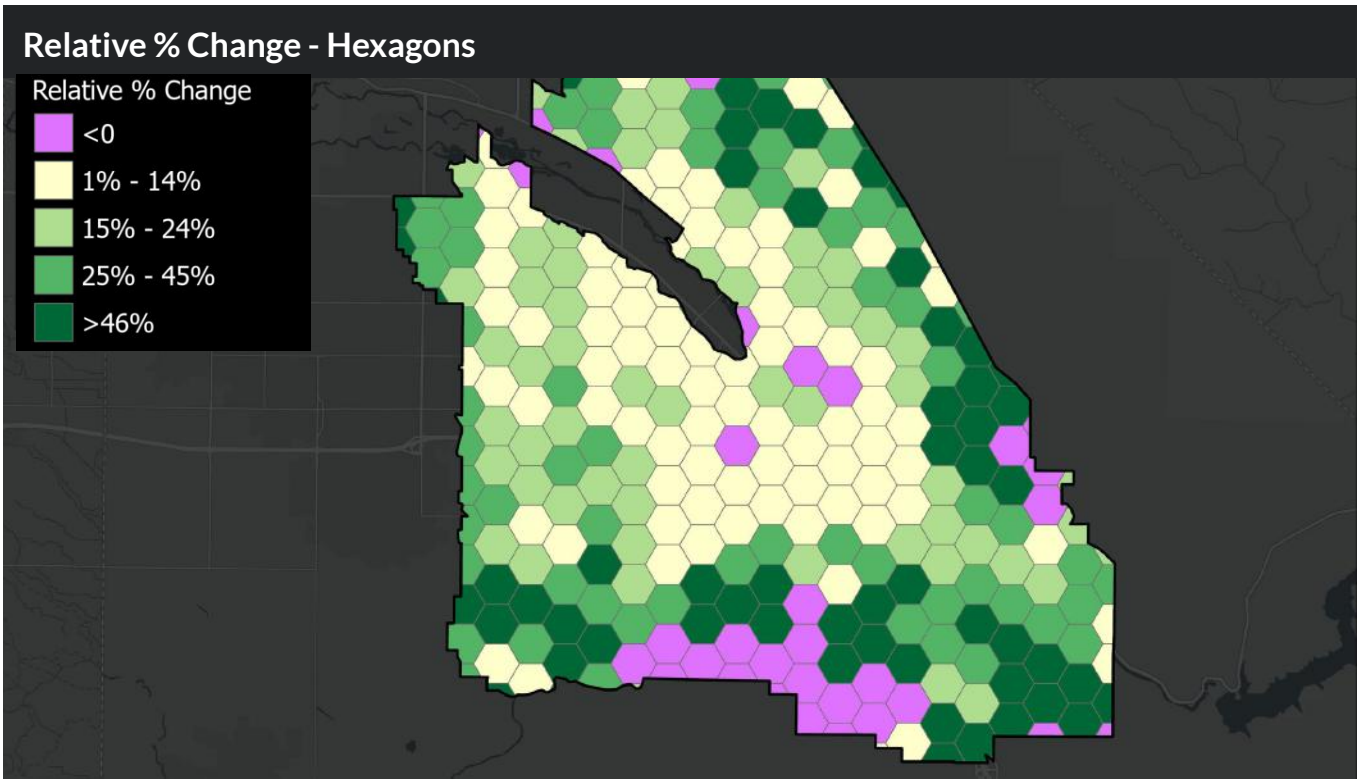



Figure 5. Tree canopy change metrics summarized by 308-acre hexagons. Relative tree canopy is calculated by using the formula (2013-2021)/2021. Colors are categorized by data quantiles. Darker greens indicate greater relative gain, while darker purple reflects a higher magnitude of loss.

## Neighborhood Associations

Neighborhood association geographic boundaries are a useful way to summarize tree canopy in Boise and draw comparisons. South Eisenman, one of the most recently developed neighborhoods in Boise, experienced the most relative change in canopy, surpassing 45%, but has one of the lowest existing tree canopies, measuring at less than 1%. This notable increase can be attributed primarily to the growth of tree canopies and the implementation of new plantings within several large parking lots in the area. The Centennial neighborhood had the greatest absolute change with nearly 5% gain and an existing canopy of approximately 17%. The majority of this increase is credited to trees planted before 2013 that have since developed significantly larger canopies, particularly within parks. By area, Southwest Ada County Alliance and Southeast Boise experienced both the greatest gain and loss of tree canopy (Figure 6). Southwest Ada has been a target neighborhood for the Elaine Clegg City of Trees challenge, with recent investments dedicated to tree planting initiatives. This investment could potentially mitigate canopy loss in the long term.

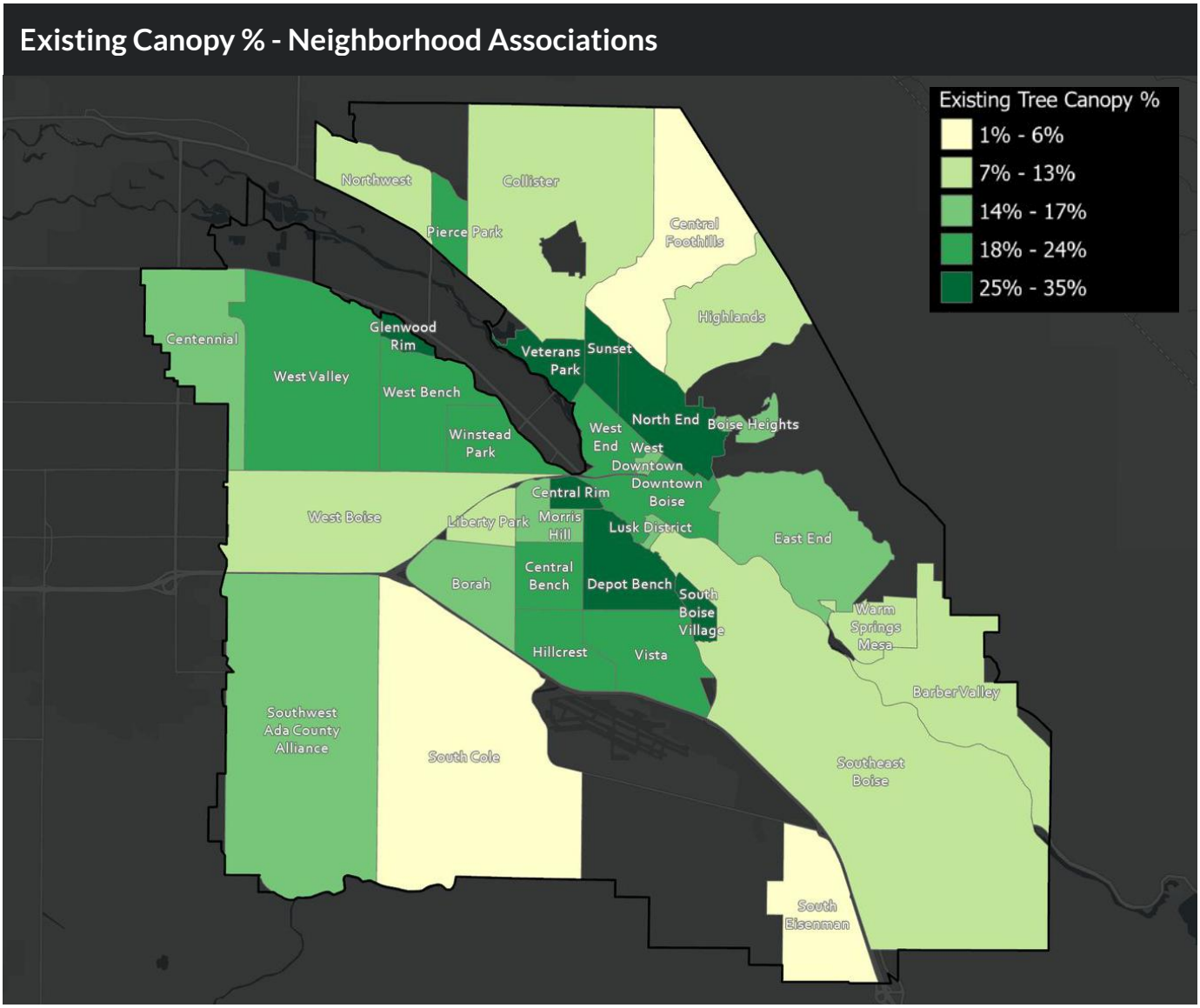



Figure 6: Existing tree canopy percentage for 2021 conditions summarized by neighborhood associations.

## Neighborhood Associations (Continued)

The differences in canopy are the result of land use history, changes to the built environment, and natural factors. Neighborhoods with large parks and open space, those in close proximity to the Boise River, and those in older developments where priority has been placed on planting and caring for trees over a longer period of time tend to exhibit higher tree canopy. There are six neighborhoods that have below the citywide canopy coverage of 11.6%: Warm Springs Mesa (10.8%), Liberty Park (10.7%), Collister (8.5%), Barber Valley (8.0), South Cole (5.8%), Central Foothills (5.0%), and South Eisenman (0.7%). With the exception of Liberty Park and Warm Springs Mesa, these neighborhoods encompass large land areas and are bringing the citywide canopy coverage down. All neighborhoods experienced both gain and loss within their boundaries, but overall gain outpaced loss across Boise, amounting to net gain in canopy from 2013 to 2021 in every neighborhood.

### Tree Canopy Change Metrics - Neighborhood Associations

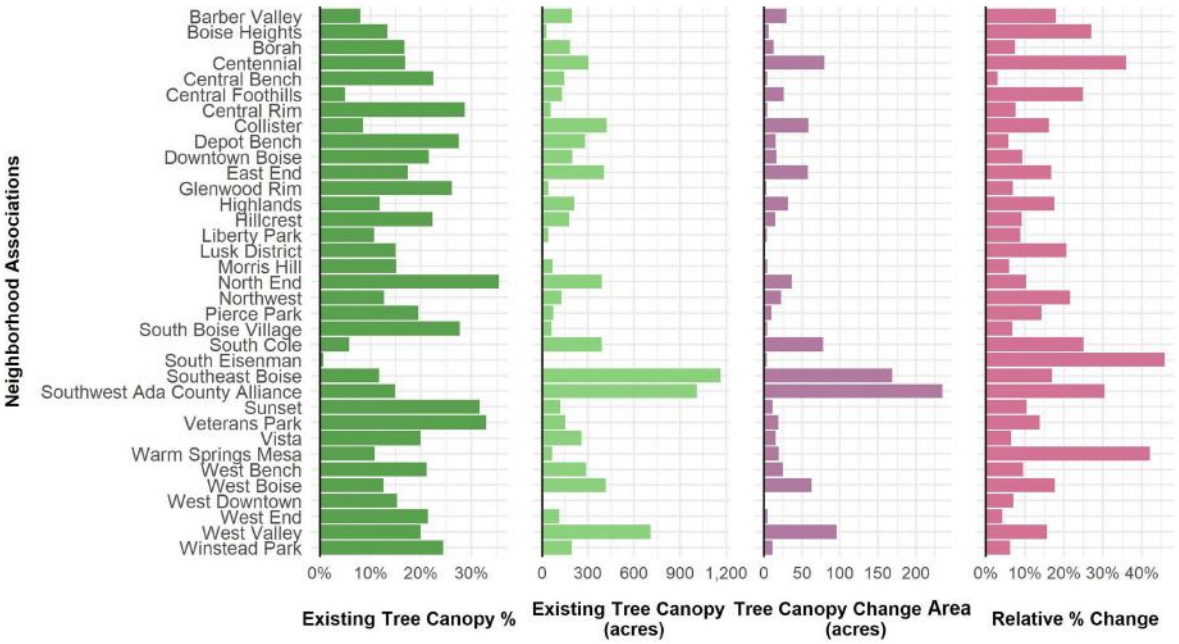



Figure 7. Tree canopy neighborhood associations metrics summarized by existing tree canopy (%), existing tree canopy (acres), tree canopy change area (acres), and relative change (%).

### Tree Canopy Gain/Loss (Acres) - Neighborhood Associations

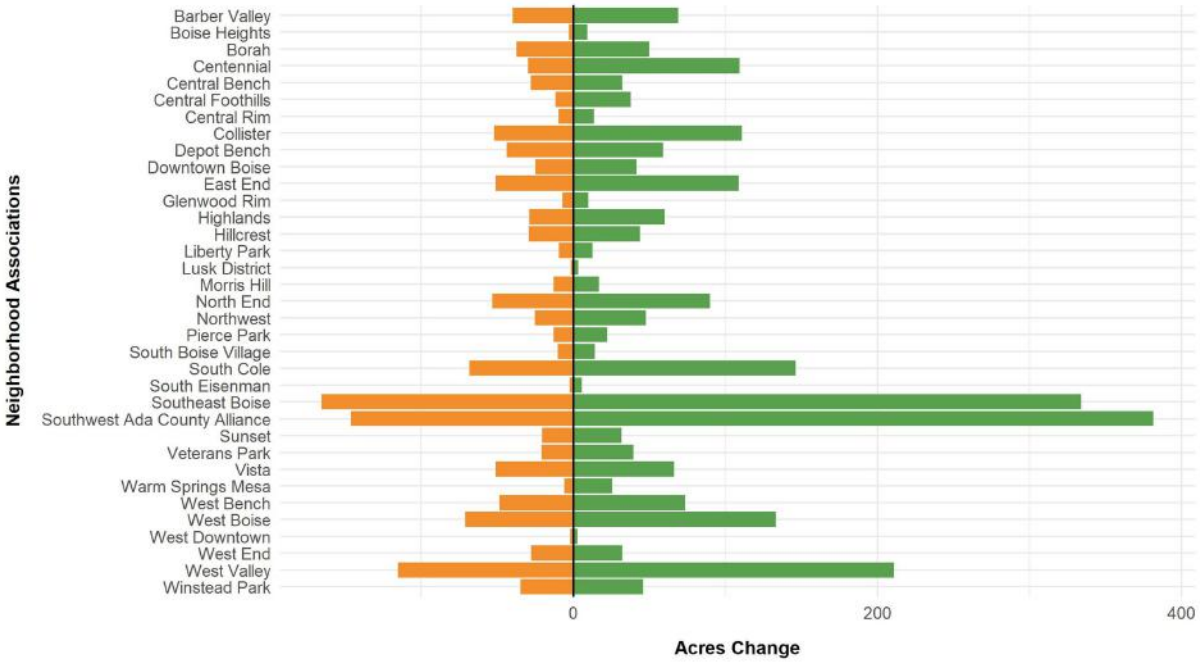



Figure 8. Tree canopy gain and loss (acres) metrics for 2013-2021 conditions summarized by neighborhood associations.

# Future Land Use

Land use involves the utilization of land by humans, encompassing various economic and cultural activities such as agriculture, residential living, and commercial endeavors. The distinction between land use from land cover is important, the latter referring to landscape features like trees, buildings, water, and other classes depicted in this study. Residential land use, for instance, may encompass trees, buildings, impervious ground cover, grass, and other features associated with land cover. Land use can significantly influence the amount of tree canopy and the space available for establishing new tree canopy. For this study tree canopy was summarized by the boundaries of the future land use from the Blueprint Boise (the city's comprehensive plan).

Suburban land controls the majority of tree canopy (approximately 4,000 acres), followed by compact owned land (approximately 2,000 acres), and parks/open space (approximately 1,000 acres). Compact owned land is intended to provide a flexible mix of compact detached, attached, and Multi-Family housing as well as civic, community, and limited commercial uses. The amount of loss on residential land is cause for further monitoring. Over 500 acres of tree canopy were lost in the 8 year period of this assessment. The loss was offset by gain of over 1,500 acres of canopy, ultimately resulting in a net increase of more than 6,000 acres. The loss is cause for strategies such as neighborhood tree planting events, public education about the benefits of trees, and consideration of tree protection policies. Gain outpaced loss on most land use categories. The downtown mixed use land had a net loss of -.5%. PC (Planned Community) land also experienced loss of -.04%.

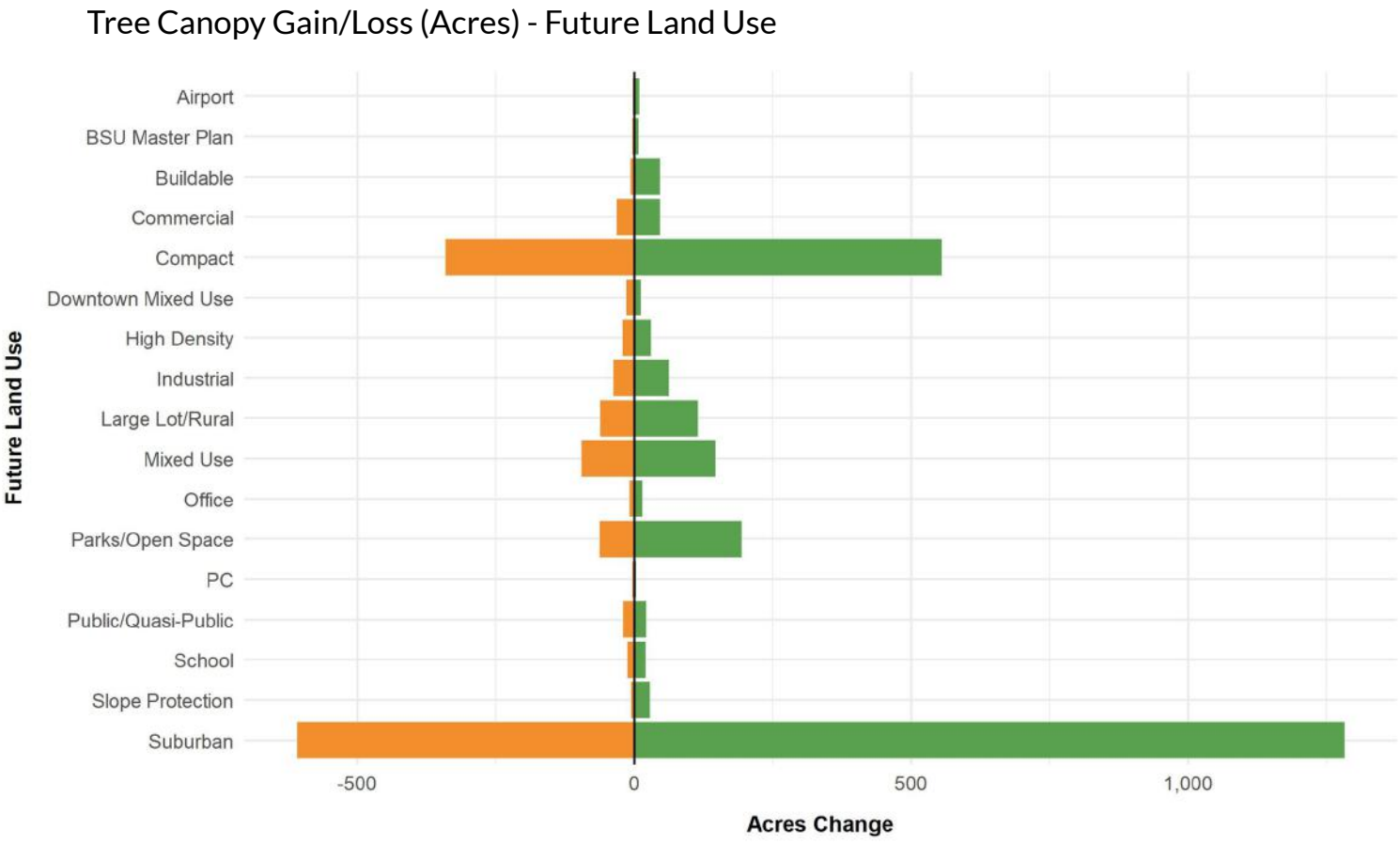



Figure 9: Tree canopy gain and loss (acres) metrics for 2013-2021 conditions summarized by future land use categories.

Vegetated surfaces that are not currently covered by tree canopy represent areas where it is biophysically feasible to establish new tree canopy. As previously described in the possible tree canopy, it may be financially challenging or undesirable to establish new tree canopy on much of this land.

The most opportunity to establish new canopy (possible-vegetation %) is on slope protection land, but there is space in every land use category. Establishing new canopy in highly urbanized areas will be costly due to potential hardscape modifications needed, but are worthwhile investments given the critical ecosystem services that trees along downtown and commercial corridors provide.

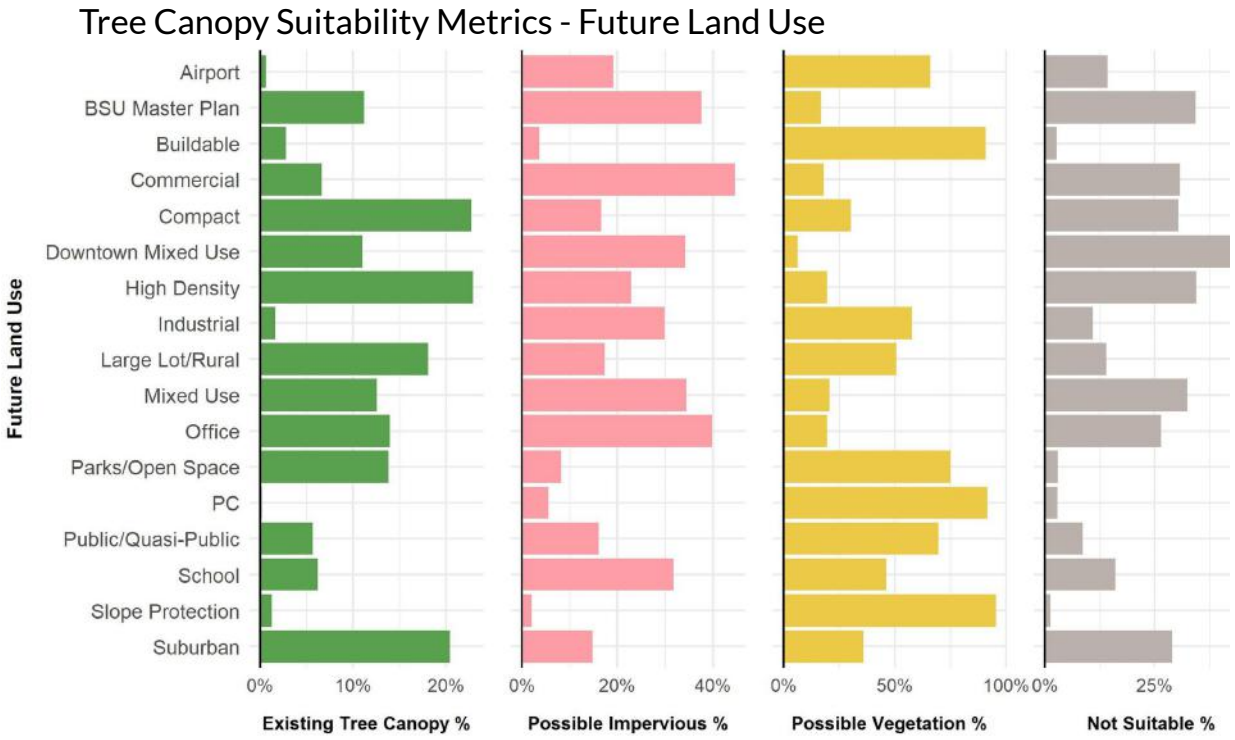



Figure 10. Tree canopy suitability metrics (%) are summarized for future land use categories.

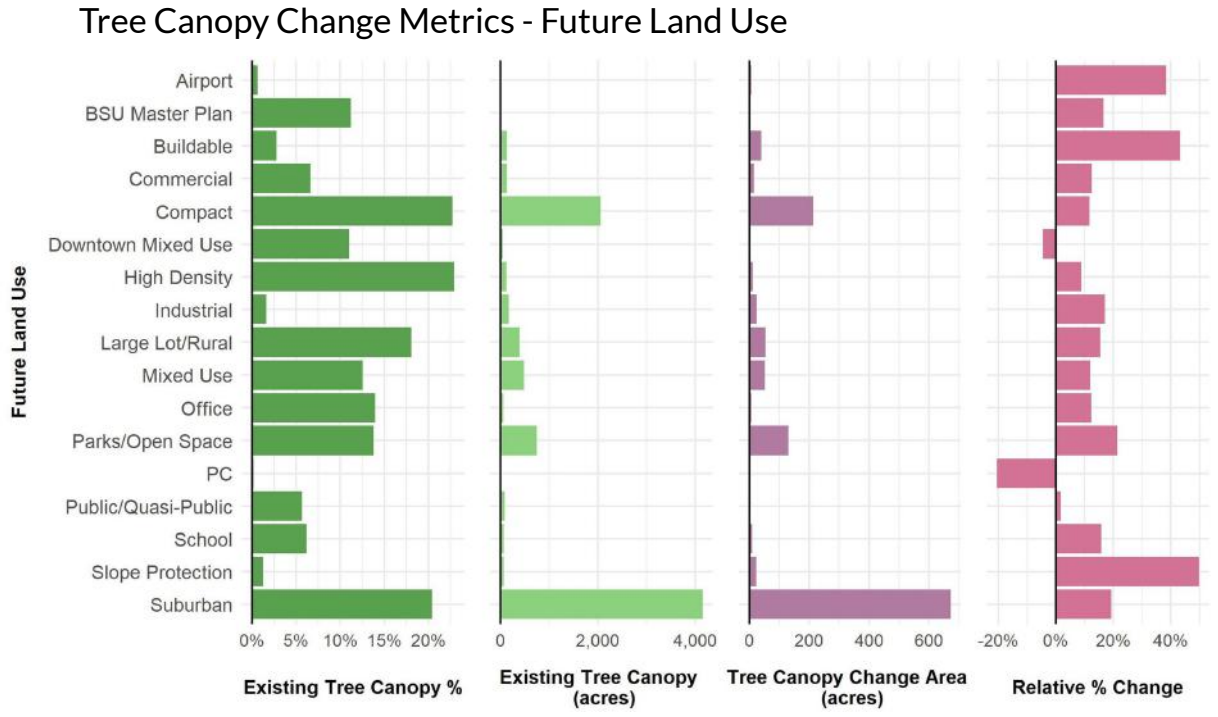



Figure 11. Tree canopy and change metrics summarized for future land use categories.

## Current Zoning Code

Zoning refers to the division of land into different categories, each with its own set of regulations and permitted land uses. In Boise the current zoning code was adopted on December 1 2023. Zoning and trees are interconnected through the regulatory framework that governs the types of activities allowed. For simplicity, the City's 20 zoning districts are consolidated into 4 categories here. Note that Specific Plan Districts are included here as Residential. The most space to establish canopy is in the open lands category with over 70% of possible vegetated land. However, open land also has the least amount of land by area (Open Lands is green, Mixed Use is purple in Figure 13), and except for certain riparian areas it is largely unsuitable for tree planting, thus it will be important to consider establishing canopy in other zoning categories as well.

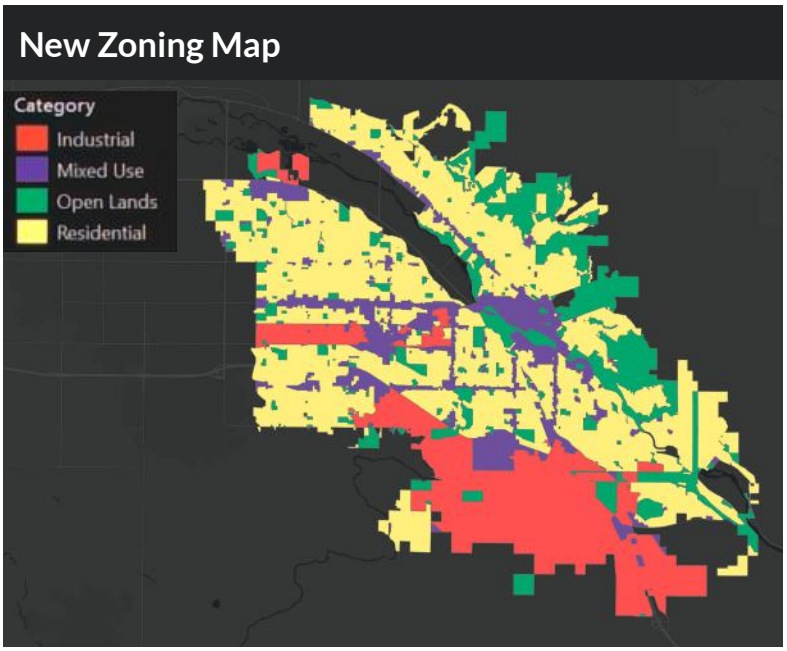


Figure 12. Boise current zoning map.

The majority of Boise's canopy is in the residential category with over 20% of this land covered by canopy. To maintain and enhance green spaces, zoning codes can require the protection of trees in residential areas. In the industrial category there might be regulations about green buffers to mitigate the impact of development on the natural or residential surroundings. In Boise nearly 60% of industrial land is possible vegetated land, but the zoning regulations may oppose planting in the industrial category, and permit the removal of trees for specific development purposes or infrastructure projects. Balancing the needs of urban development with the preservation of trees is a crucial aspect of effective zoning practices aiming to create sustainable and environmentally friendly communities.

### Tree Canopy Suitability Metrics - New Zoning

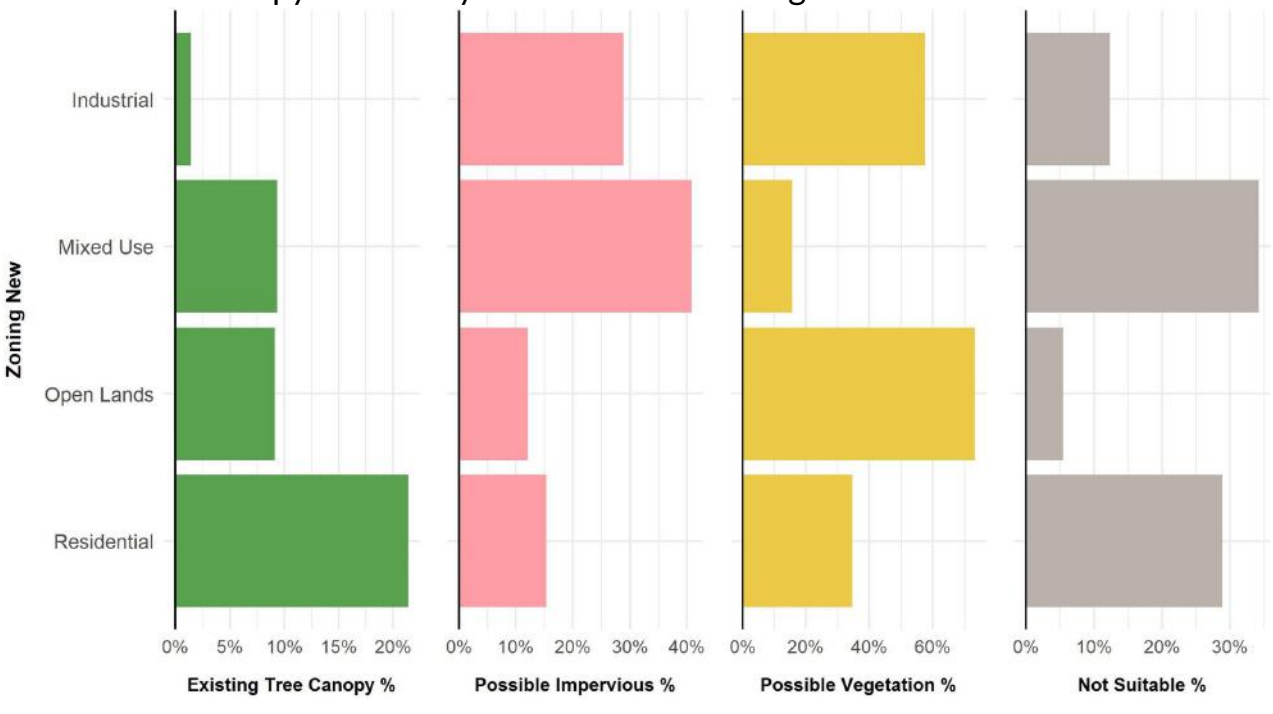


Figure 13. Tree canopy suitability metrics (%) are summarized for new zoning categories.

## Public vs Private Land Ownership

The urban forest serves as a public resource, delivering benefits that extend beyond public-private boundaries. Notably, the majority of canopy exists on private land with approximately 7,000 acres of canopy (Figure 15), reflecting over 80% of total canopy. County owned land has about 11% of the total canopy while the City holds just under 6%. Given that the majority canopy is on private property, it is crucial to educate, engage, and empower private property owners to maintain their trees for the collective benefit.

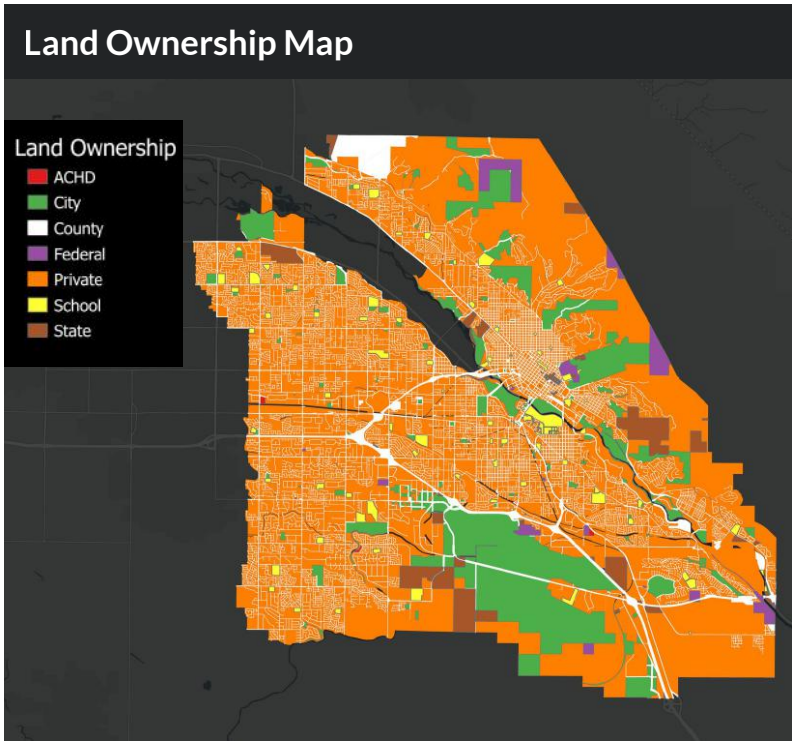


Figure 14. Land ownership map.

In parallel, the majority of both canopy gain and loss is observed on private land (Figure 16). While the City may not have direct jurisdiction over privately held land, establishing trees on these lands can be accomplished through collaboration with industry, homeowners, and developers. To ensure the continuous growth and maintenance of Boise's tree canopy in the future, active participation and recognition of the value of this vital green asset is needed from government, institutions, businesses, and residents alike.

Land owned by the City of Boise has seen a substantial relative gain of over 30%, indicating the success of policies and efforts. This positive outcome suggests an opportunity to further enhance greenery on city land.

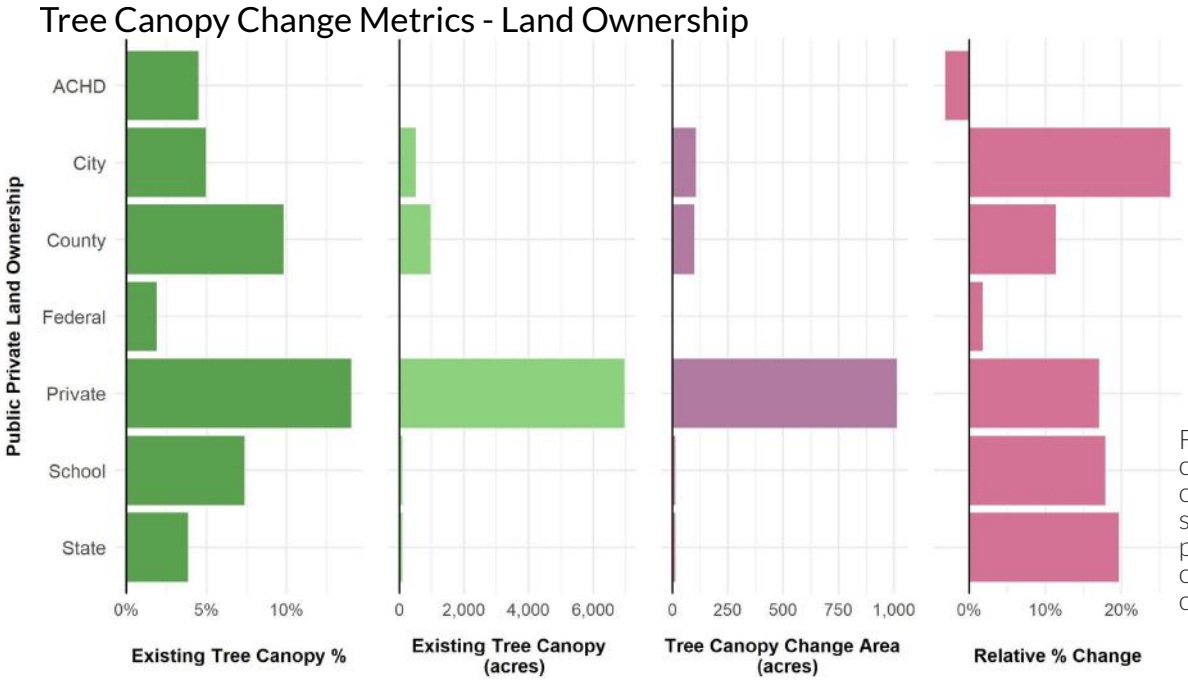


Figure 15. Tree canopy and change metrics summarized by public-private ownership categories.

## Public vs Private Land Ownership (Continued)

Land owned by Ada County has 10% existing canopy coverage. There is approximately 20% possible-vegetated county land with over 50% unsuitable for trees. The canopy is primarily on county transportation right-of-ways. Trees lining roadways not only enhance aesthetics but also serve vital functions such as mitigating stormwater runoff, alleviating the urban heat island effect, and enhancing air quality through the removal of particulate matter and volatile organic compounds. Additionally, they contribute to sound pollution regulation. However, trees in the right-of-ways contend with challenging conditions due to their proximity to roads. Factors like regular salting, soil compaction, vehicular collisions, limited space, and clearance pruning pose obstacles to the establishment and growth of the canopy in these harsh environments. Working closely with transportation authorities and the county to incorporate space for tree planting in updated designs, and implement tree-friendly policies and practices, such as adjusting road salt usage and planning road construction projects with tree preservation in mind, can be beneficial.

### Tree Canopy Gain/Loss (Acres) - Land Ownership

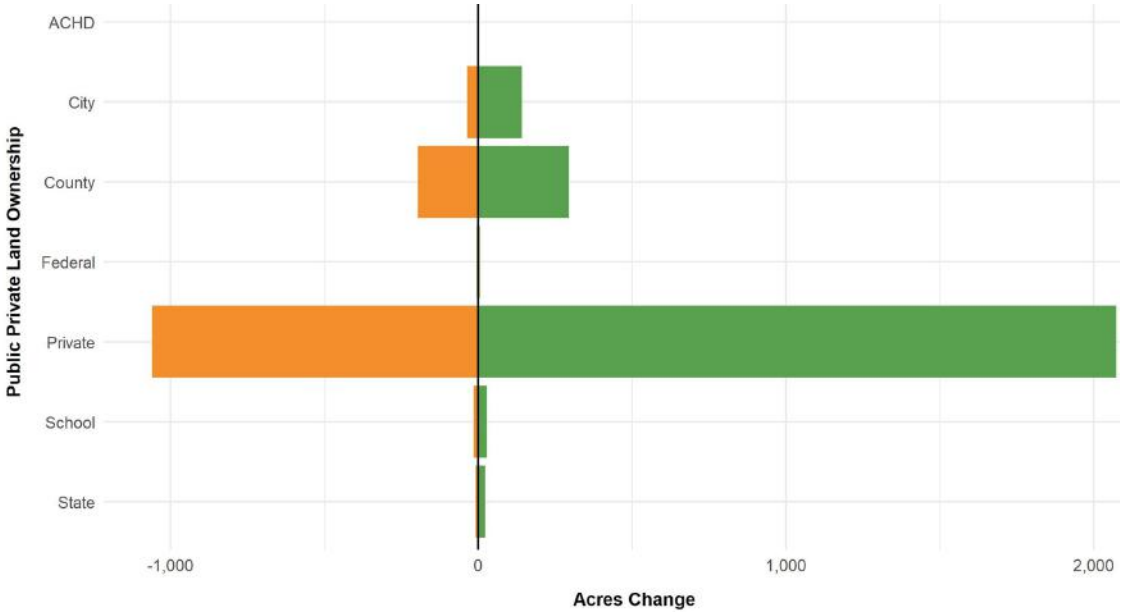



Figure 16. Tree canopy gain and loss (acres) metrics for 2013-2021 conditions summarized by land ownership.

### Tree Canopy Suitability Metrics - Land Ownership

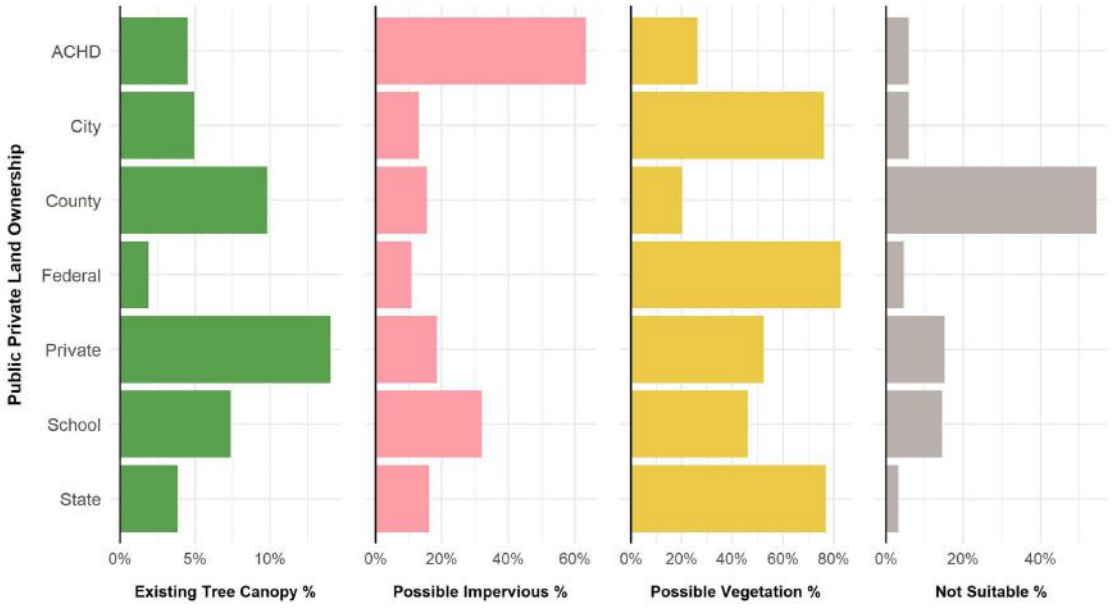



Figure 17. Tree canopy and change metrics summarized by ownership types.

## Parcels Year Built

The year a property was developed* is a factor that can influence the composition, maturity, and overall health of the urban forest in a particular area. Understanding the historical context of development practices and landscaping trends can provide insights into the existing urban forest and guide future efforts in maintaining or enhancing it.

Older properties may have mature trees that were planted when the property was originally developed that require different maintenance practices compared to younger trees. Older trees contribute significantly to the urban canopy. In contrast, newer properties may have younger trees that will take time to grow and contribute to the overall canopy cover. In residential areas, there is sometimes a "plant and forget" cycle, where trees are initially planted during home construction, but there is a lack of subsequent efforts to replace declining trees and ensure the continuity of the next generation of canopy.

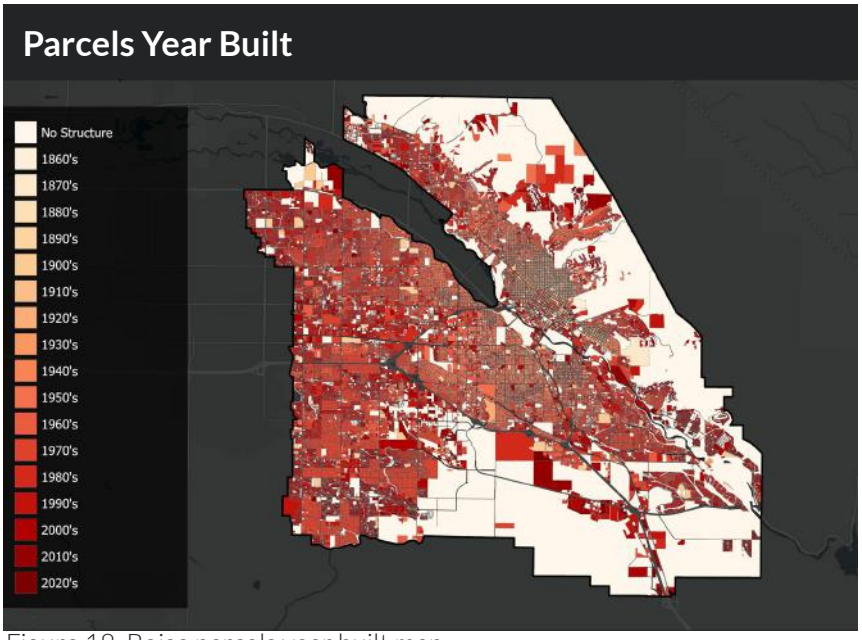


Figure 18. Boise parcels year built map.

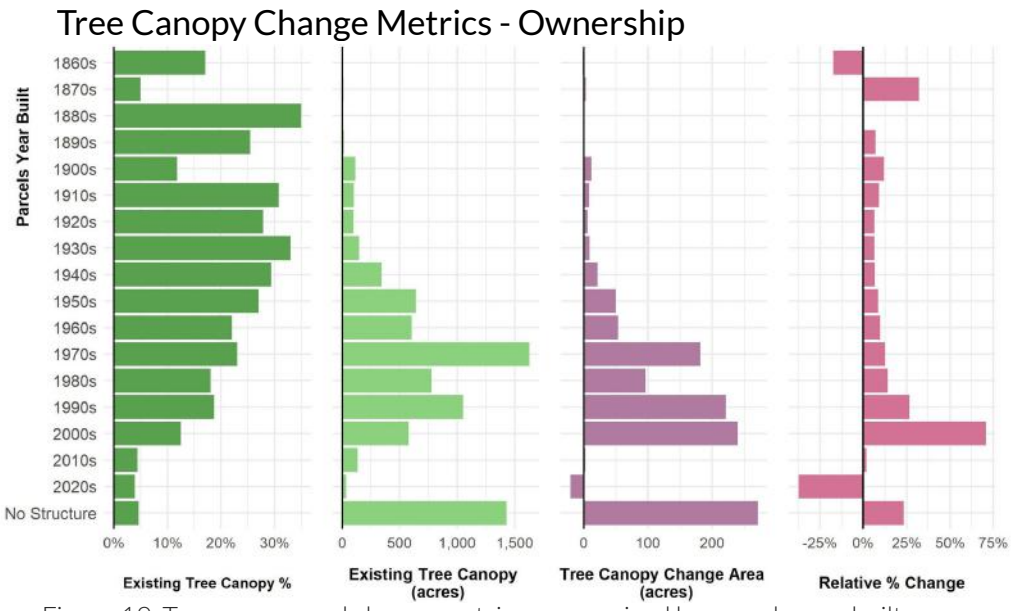


Figure 19. Tree canopy and change metrics summarized by parcels year built.

In Boise, the majority of canopy is on parcels developed in the 1970's and 1990's. The parcels from the 1860s and 2020s, representing the oldest and newest developments, respectively, have seen the highest relative loss. The reason for canopy loss on the 1860's parcels is not clear without further investigation. However, in the case of parcels developed in the 2020's, the loss is attributed to recent development, with insufficient time for new trees to grow large canopies. Removing trees before they reach maturity hampers the possibility for a city to receive its full canopy potential. The best way to increase tree canopy is to retain mature trees that are already providing benefits today, versus replacing mature trees with young trees that will take decades to provide the same benefits and canopy cover. Canopy loss is often the result of an event, but gain is a process. Preservation of trees during development can be creatively integrated to balance multiple goals. Opportunities vary from one situation to another.

*Year built for each parcel was determined using Ada County Assessor's Office data. Each parcel was assigned the year in which the largest structure on that parcel was built.

## Examples of Tree Canopy Change

Numerous factors contribute to the wide range of tree canopy change patterns of Boise as shown in previous sections of this assessment. The examples that follow illustrate canopy change on the ground and how they are captured by the LiDAR and imagery data used for this assessment. Examining patterns and processes over the past decade can provide insights into how the canopy may change in the future.

### New Construction

Construction can have mixed effects on canopy. Trees are often removed to provide space for new purposes such as commerce, despite their potential to mitigate urban heat and manage stormwater runoff in areas dominated by impervious surfaces. An example is the large patch of trees removed for downtown development around the Grove Plaza (orange color in Figure 20). The maps also show newly planted trees (small green circles) in the plaza to the southwest. With proper care, these trees may grow and contribute more canopy over decades. Redevelopment projects that prioritize trees can dramatically increase tree canopy.

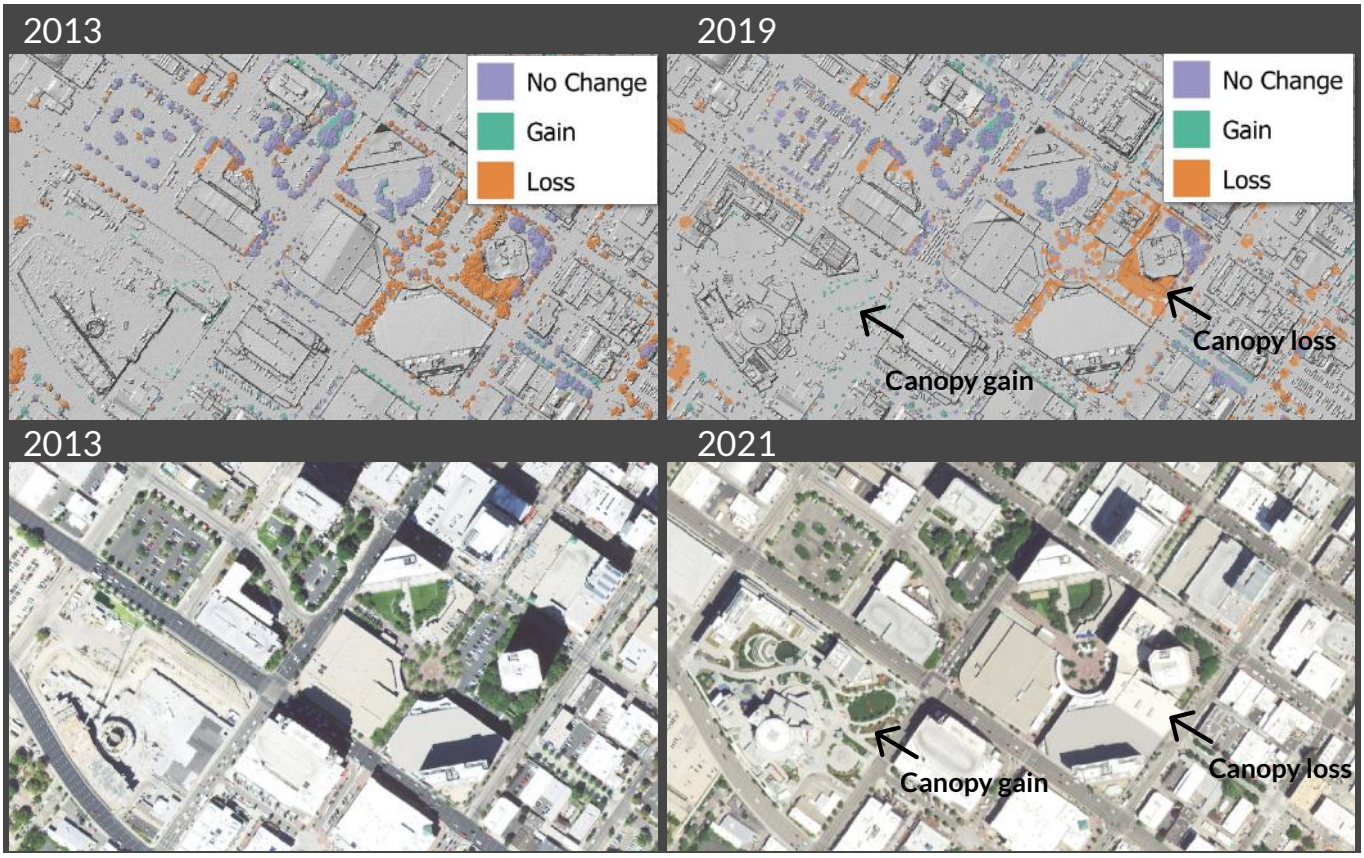




Figure 20. Canopy loss (orange), gain (green), and no change (purple) from downtown development near Grove Plaza. Canopy change is overlaid on LiDAR from 2013 and 2019 (top) and imagery from 2013 and 2021 (bottom).

## Examples of Tree Canopy Change (Continued)

The infrastructure improvements at the Grove Plaza project and the trees planted are an excellent example of how Boise is prioritizing healthier tree canopy and clean stormwater in downtown redevelopment projects. In this project, while they had to remove tree canopy to support the redevelopment, the new infrastructure installed suspended pavement systems that greatly increase soil volume for healthy tree growth and clean stormwater on-site. This practice is prioritized in all new redevelopment projects across Boise.



Figure 21: Photographs of Grove Plaza during the installation of a suspended pavement system to support tree growth, and the same plaza five years later.

## Examples of Tree Canopy Change (Continued)

### Residential Change

Residential land has the majority of tree canopy in Boise, and experienced the most canopy loss by acreage. Trees continue to grow and contribute canopy in more established neighborhoods, but age, disease, invasive species, storms, and changing landowner preferences all contribute to tree removals. As a result, losses may outpace gains over time if replacement trees are not routinely planted.

A mix of canopy gain and loss is shown in Figure 22 for the Highlands neighborhood. The addition of a residential parking garage resulted in the removal of several trees with large canopies. Conversely, in different parts of the same neighborhood, trees planted prior to 2013 are now displaying much larger canopies, evident from the green rings (canopy gain) surrounding purple spots (no change in canopy).

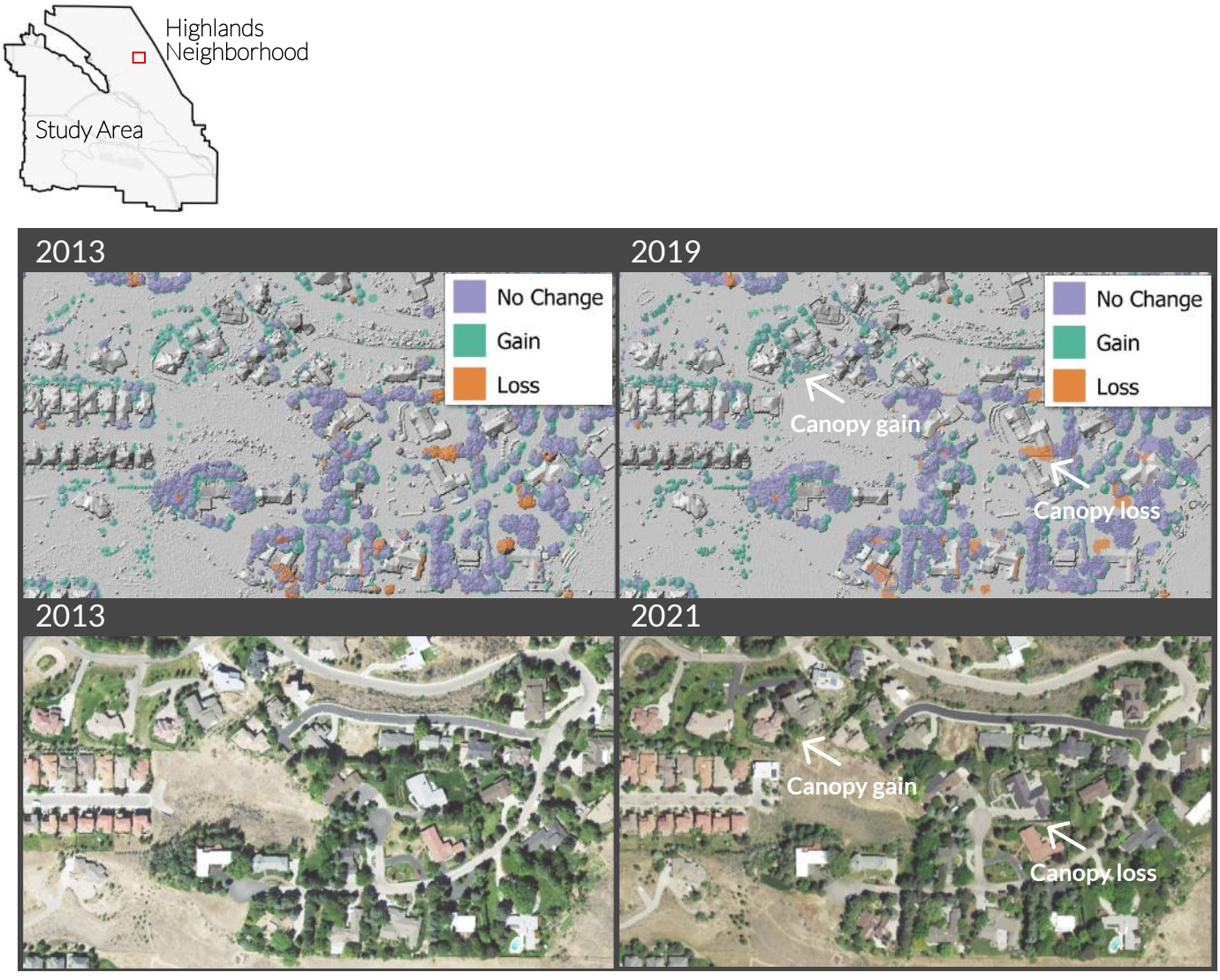



Figure 22. Canopy loss (orange), gain (green), and no change (purple) in the Highlands neighborhood. Canopy change is overlaid on LiDAR from 2013 and 2019 (top) and imagery from 2013 and 2021 (bottom).

## Examples of Tree Canopy Change (Continued)

Boise is prioritizing tree canopy in residential areas through the Elaine Clegg City of Trees Challenge, an ongoing initiative to combat climate change. The Challenge aims to plant one urban tree for every household in Boise, to increase the canopy coverage. Additionally, it seeks to plant one forest seedling for every resident by 2030. This initiative will result in approximately 100,000 trees within the city and 235,000 seedlings in forests across the state of Idaho (www.CityOfTreesChallenge.org).

Figure 23: Volunteers planting trees together for the Elaine Clegg City of Trees Challenge.

# NATURE FOR URBAN RESILIENCE

## Case Study: It's Getting Hot! In the City of Trees

The urban heat island effect refers to the phenomenon where urban areas experience significantly higher temperatures compared to surrounding rural areas. This occurs due to the modification of the natural landscape by human activities such as the construction of buildings, roads, and infrastructure, which replace vegetation with impervious surfaces like concrete and asphalt.

The City of Boise partnered with the Treasure Valley Canopy Network to address the urban heat island effect, a major challenge that can be mitigated through strategic tree planting. The Treasure Valley Urban Heat Watch report, created through the CAPA (Climate, Adaptation, Planning, Analytics) Heat Watch Program, was published in 2019. It utilized urban heat data collected by sensors mounted on volunteer cars traveling designated routes during a one-day urban heat campaign.

This community science initiative revealed that Boise neighborhoods with the least vegetation experience significantly higher summer temperatures compared to those with more vegetation. Conversely, areas with more vegetation benefit from lower energy costs and improved living, working, and recreational conditions. The Treasure Valley Urban Heat Watch Report underscores the link between vegetation and neighborhood heat. Planting trees in Boise's urban heat islands can directly combat the adverse effects of climate change.

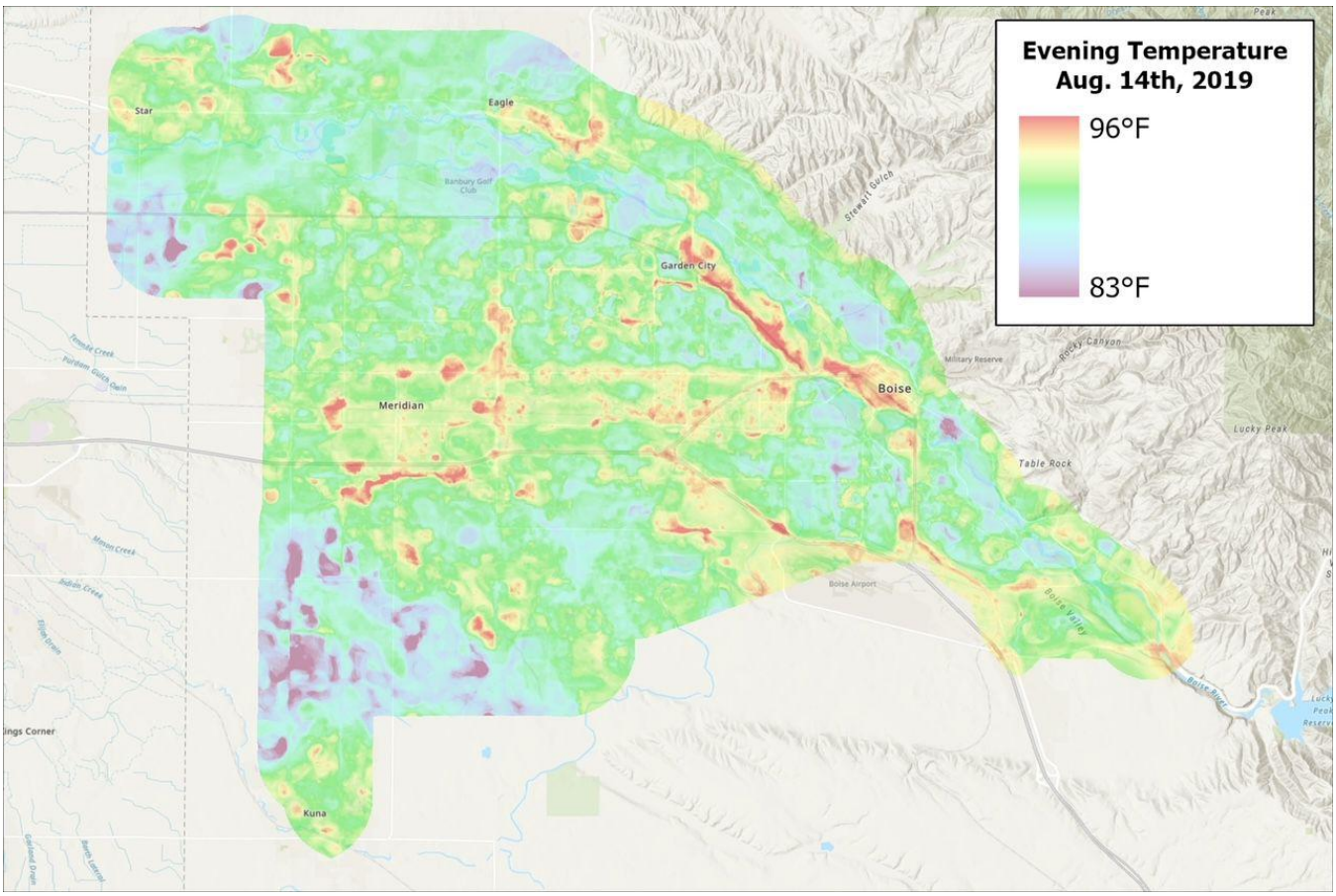
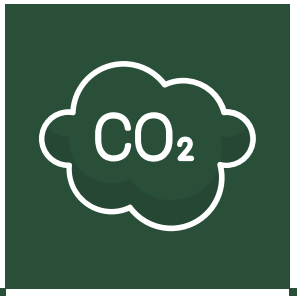



Figure 24. Surface area temperature for the City of Boise as captured by the Treasure Valley Heat Map from the Treasure Valley Urban Heat Watch Report.

## Nature Access

Trees and vegetated spaces in cities combat the urban heat island effect by providing shade, reducing solar radiation reaching the ground, and releasing water vapor that cools the surrounding air. Beyond aesthetic appeal and heat mitigation, these urban green spaces offer a wealth of additional benefits or ecosystem services. They store carbon, reduce flash flooding, and remove pollutants from water runoff, playing a crucial role in enhancing urban quality of life. These ecosystem services are vital for increasing a city's resilience to climate change and environmental challenges. By recognizing and enhancing these services, cities can promote sustainability, foster biodiversity, and create healthier, more livable environments for their residents.

**Heat Mitigation:** Urban vegetation combats the heat island effect by providing shade and cover that reduces the amount of solar radiation reaching the ground, and by releasing water vapor that cools the air.




**Carbon Storage:** Urban vegetation captures and stores atmospheric carbon dioxide through photosynthesis, removing carbon from the atmosphere and storing it in their biomass and in the soil.

**Stormwater Filtration:** Urban vegetation captures, stores and removes pollutants and excess nutrients from stormwater runoff before it is able to reach nearby water bodies.

**Flash Flood Prevention:** Urban vegetation prevents flooding by reducing the volume of water impacting stormwater infrastructure through canopy interception and root absorption.

While ornamental trees in urban settings often offer significant benefits through their large canopies, they may not fully represent Boise's native landscapes. Boise's natural landscape is characterized by smaller trees and shrubs, which also provide essential health-promoting benefits, particularly for residents on the city's outskirts.

To fully harness nature's benefits in cities, it is essential to understand and utilize the ecological capacities of all types of urban vegetation, not just large canopy trees. Promoting equitable access to vegetation must include both urban trees and smaller native species to ensure all community members can enjoy their associated benefits.

Policymakers and urban planners should prioritize areas with vegetation deficits by considering all types of vegetation. Implementing targeted strategies, such as planting native trees and shrubs, can enhance access to nature and improve ecological benefits for all residents. This comprehensive approach ensures that the health and environmental advantages of urban vegetation are equitably distributed, fostering a more sustainable and livable urban environment for everyone.

The Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) software provides valuable insights into the distribution and ecological benefits of urban trees and other vegetation in Boise. The "Nature Access" model within InVEST processes land cover data, setting a benchmark that each Boise resident should have access to a minimum of 9 square meters of vegetation, with an ideal target of 50 square meters per capita, as recommended by the World Health Organization. This model identifies communities with either a surplus or a deficit of vegetation. The top two maps on the right depict Tree Canopy Access and Nature Access, respectively. Per their names, the first one depicts access to trees alone while the second provides a wider picture of the inequitable distribution of all types of nature.

In addition to the "Nature Access" model, InVEST offers several other models that assess various ecological benefits using land cover data and biophysical parameters from public sources. These models evaluate the contributions of all vegetation in Boise to heat mitigation, carbon storage, flash flood prevention, and stormwater filtration. The map at the bottom right presents a weighted sum of these four ecological benefits, resulting in a 0-1 index that indicates the capacity of Boise's vegetation to provide ecosystem services.

By examining the three figures on the right, we can identify areas requiring interventions to enhance access to all types of urban vegetation and address existing disparities in the availability of nature and its ecological benefits. This comprehensive approach helps ensure that the ecological advantages of urban vegetation are equitably distributed, promoting a healthier and more sustainable urban environment for all residents.

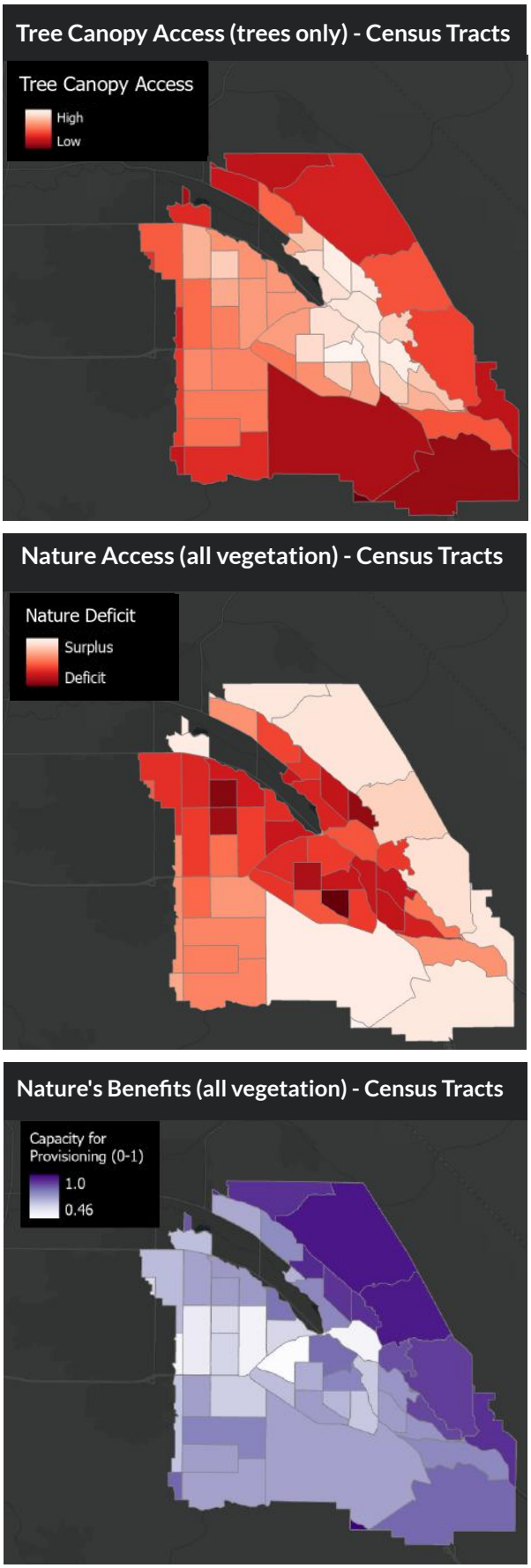



Figure 25. The Nature Deficit map (top) shows the surplus (white) and deficit (red) of all urban vegetation while Tree Canopy Access map (bottom) depicts the availability of tree canopy specifically, with high availability shown in white and low in red.

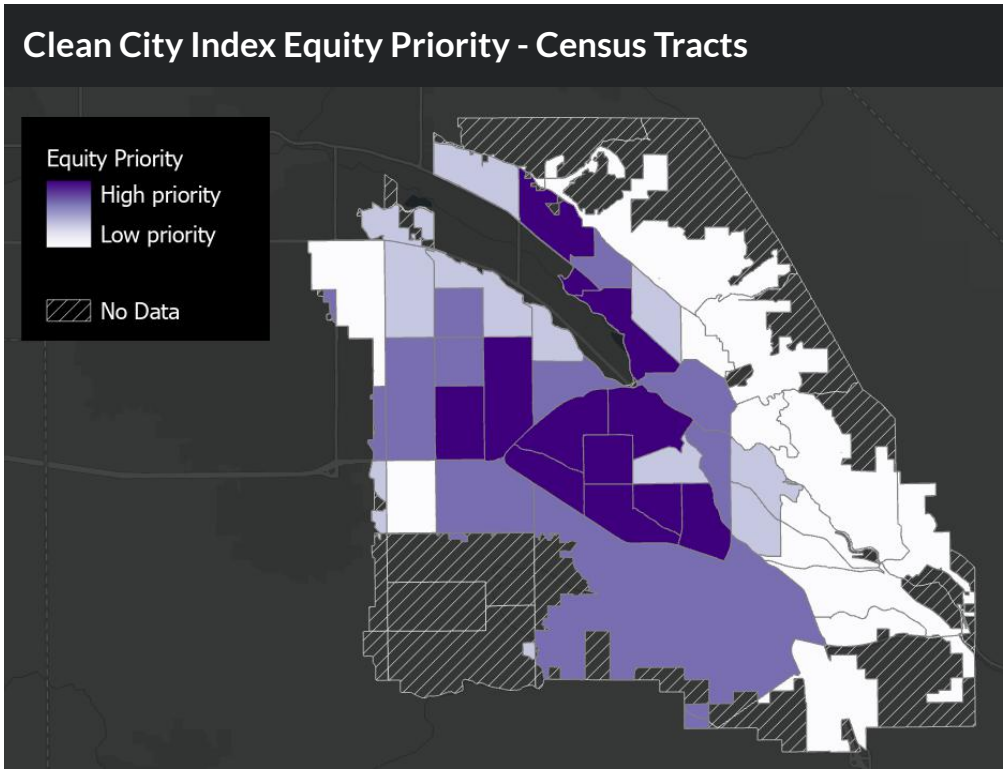
# ENVIRONMENTAL JUSTICE

## The Clean City Index

The City of Boise's Clean City Index is a planning tool that assists city staff and partners in identifying communities with the greatest need for tree canopy based on factors such as high urban heat, low tree canopy coverage, and demographic characteristics.

The index includes a prioritization based on sociodemographic and health indicators associated with communities that are the most vulnerable to environmental degradation and the impacts of climate change. These groups especially include low-income residents and racial and ethnic minorities.

The following figures show the location of the highest priority communities (1 - 4, where 4 is highest priority), as well as their relative distribution in relation to the tree canopy product developed for this report. For the latter, a bivariate legend is used.



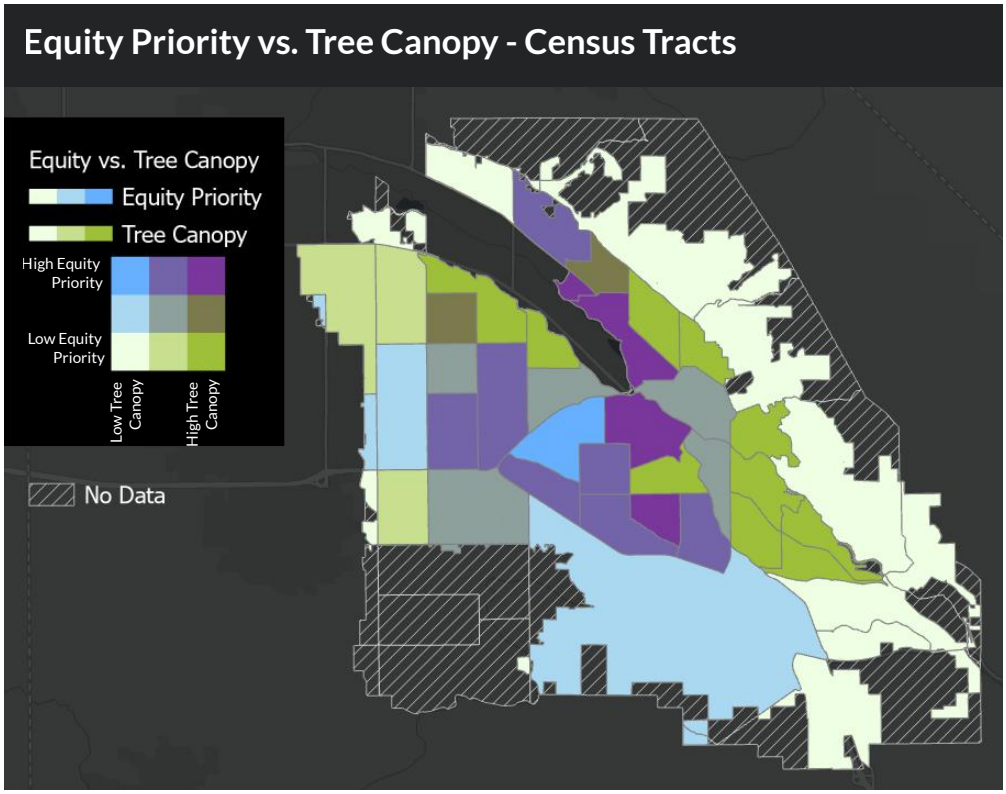




Figure 26. Clean City Index Equity Priority (top) and its distribution in relation to tree canopy (bottom).

# CONCLUSION



The Tree Canopy Assessment for City of Boise (from 2013 to 2021) provides an important snapshot of the current extent of Boise's tree canopy in context with the city's infrastructure, in balance with the surrounding natural environment, and in relation to the neighborhoods and people who benefit from the city's trees. As we move forward, City of Boise and TVCN leadership and staff will use the data and information gathered from this assessment to help enhance our strategic and effective planning, planting and care for the city's trees - which are critical to helping Boise be more healthy and resilient as we grow. Here are just a few of the near-term actions that our team will be implementing using the results of this assessment:

- Through the Elaine Clegg City of Trees Challenge, and using funding resources from the Treasure Valley Equity Project, funded by the Inflation Reduction Act, Boise and TVCN will continue to invest in planning for, planting and growing trees in neighborhoods with low tree canopy and high urban heat.
- TVCN and Boise's Climate Action Division are building on the knowledge gained from our 2019 Urban Heat Mapping project with CAPA Strategies through the Community Forest Corps Project with Center for Regenerative Solutions. This project gathered ground-level heat data in Borah Neighborhood during the summer of 2024. This data will be compiled into a report, released in late 2024 and be used to develop heat reduction strategies (which will include tree planting) in our neighborhoods of greatest need.
- The Boise Community Forestry Division will use data from this assessment to increase strategic planting of trees throughout streetscapes, parks and public spaces.
- This assessment will be used to share the story of impacts of planning and development to tree canopy in context with our rapidly growing urban infrastructure, and help us communicate and partner with planners, developers, transportation agencies and public works to implement and enhance current tree ordinances, policies and tree care/tree preservation/tree planting practices.