A Guide to
Urban Forest Plans

By Karen Firehock and Lauren Doran

Is your community ready to create an urban forest plan?

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Writing by Karen Firehock and Lauren Doran. Reviews of this guide were provided by several urban foresters, consulting arborists and ISA and TRAQ arborists including GIC's own staff certified arborists. Additional case study research was conducted by GIC's Planning Associate Paige Werman. Guide edited by Tim Lewis. The Green Infrastructure Center Inc. is a nonprofit organization dedicated to natural resource conservation from wildlands to downtowns. Learn more about the GIC, our expertise and our mission by visiting https://gicinc.org/

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About this Guide

This guide was written to assist local governments and tree advocacy groups in understanding what to request and what should be expected when undertaking a planning process for their urban forest. While this guide was written for South Carolina, it can be applied universally. This guide came about following GIC's review of 100 cities and towns in South Carolina and research into other management plans from multiple U.S. cities. We found plans varied widely in their specificity, purpose, and level of detail. Some plans offered specific goals and strategies along with responsible parties to carry them out, while others were more aspirational. As one urban forester explained, "We couldn't start creating data and canopy maps to inform our work because we needed a plan to justify getting the data and maps." Fortunately, in states such as South Carolina, Georgia, Virginia, Florida, Mississippi and others, there is state forestry agency support for urban forest mapping, inventory, and planning. This means that data can be collected – funded by grants that support gathering the information that forms the basis for why, where, and how to better manage our urban forests.

We no longer need to have plans that lack supporting data. Just as we would not create a transportation plan without knowing road routes, capacities and traffic demands, we should not create urban forest plans that are not based on accurate data. Some cities have created a needs assessment, which can be useful to show what is required to create a robust urban forest program and what should go into an urban forest management or master plan. If that is a necessary first step for your community on its urban forest planning journey; that's perfectly fine. Just be clear that such a listing of needs is not a plan. A plan should describe the assets to be managed, the resources required for such management, responsible parties (to specific staff level), a timetable for implementation, benchmarks for evaluating success, and a budget to carry out the plan (with details for costs such as staffing and equipment).

Before embarking on an urban forestry plan, reference this guide to determine the type of plan to pursue and the steps to get there. This guide is intended to help you as you put out requests for consultants or undertake this process internally (as some cities elect to do) – to have the right steps and expectations clearly spelled out for internal planning processes, contracts, or requests for proposals.

Consider the management of your urban forest as a journey and not an end point. Programs are built over time and management needs change as the environment changes. For example, a new pest or disease could enter your location, decimating trees downtown (e.g., the emerald ash borer, which has killed the stately ash trees in many a city), necessitating widespread tree removal, the planting of new trees, changing your city's recommended tree list, and educating the public and contractors on what not to plant and how to look out for further infestations.

Lastly, do not be discouraged if your community (and your budget) is small. We have found small towns with robust tree care programs and trees in excellent health, due to the dedication of town staff and a supportive and engaged community. Indeed, this guide provides options for smaller communities to create plans that work for them – hybrid plans. Contact your state forestry agency's urban and community forestry program to inquire about grants for planning, inventory mapping and tree care and planting. The GIC also has state programs and technical staff who can be of assistance in many places. So, with all that help, resources, and tree planning and planting funding available, there's no reason not to get going now!

Let us begin by getting the planning started, or if your program has languished, kick-start an existing plan. The journey of 1,000 miles begins with the first step.

Introduction

Why we need to plan for our forests

Many communities recognize the values their trees provide – beauty, wildlife and bird habitat, shade, higher property values, cleaner air and water, and reduced stormwater runoff and urban flooding. Yet, as tree canopy declines, we lose these benefits. Recent data show America's urban tree cover is declining at a rate of about 175,000 acres per year – around 36 million trees annually (Nowak and Greenfield 2018). This has economic consequences, which Nowak and Greenfield estimated as equivalent to losing benefits valued at $96 million. Concerted action is needed to reverse this loss, especially as people continue to move to the southeastern United States in record numbers. South Carolina is the 10th fastest growing state in the U.S. – and with growth comes more development. As we grow, we need better planning to ensure that we retain the beneficial trees that cleanse the air, shade our communities, reduce urban flooding, provide habitats for wildlife and people, and contribute to community character and sense of place.

Why are we losing our urban trees? Causes for this decline arise from many sources, including land conversion for development, storm damage, hurricanes, and lack of replacement as older trees die. However, unless there is a dramatic storm, we may not notice the losses that are happening daily. While many people and communities care about city trees, they often lack data about their extent (how much tree canopy do we have?) or detailed strategies to conserve or restore them (requiring tree canopy retention or replanting following development). Furthermore, when disasters strike, communities often have plans for tree debris removal, but not for tree replanting.

Cities often have plans in place to remove storm debris but not for replacing trees lost from storms.

In order to have a sustained tree canopy cover long term, communities need to create and implement strategies to stem tree loss and regrow canopy that has been lost. Trees, like all living things, get old and die. Although trees usually seed the next generation — which is how forests regenerate — in urban areas, the constant mowing and manicuring of the landscape, along with the loss of urban forests to new development, mean that trees cannot repopulate the landscape as they would in a wild setting. Tree regrowth in cities requires intentional planning.

Most communities in South Carolina do not have an urban forest management plan. This does not mean that forests aren't being managed. But, without adopted plans in place, urban forestry programs are often underfunded, have high employee turnover, or vary widely in public support year-to-year, depending on political factors, such as whether the current mayor has an affinity for trees or whether there is an active citizen advocacy group. Planning for trees and a healthy urban forest requires taking the long view. Just like other city plans — comprehensive plans, strategic plans, or capital improvement plans — urban forest plans need to be created and informed by sound data, built upon existing community support, and have clearly identified responsible parties and funding streams to carry them out.

When making the argument for urban forest planning, also keep in mind that urban forest plans relate to many other city plans. They can also inform sustainability plans, resiliency plans, stormwater management plans, comprehensive plans, and neighborhood master plans.

> **Urban Forest Plans— like other city plans— need to be created and informed by sound data, built upon existing community support, and have clearly identified responsible parties and funding streams to carry them out.**

This guide was created to ease the confusion between the many options for urban forest plans. Master plans, management plans, or urban forest studies are names often used interchangeably. In this short guide, we explain the differences, along with what type of plan is needed first, second, third, and so on.

Some of the content for this guide is excerpted from a longer guide *Tree Planning and Planting Campaigns: A Guide for Reforesting Cities and Towns*, which also covers how to engage the community and build support for tree planting. Download the guide here: https://gicinc.org/books/tree-planning-and-planting-campaigns

Urban and Community Forests

What is an urban forest?

All the trees growing within a city or town boundary comprise its urban or community forest. The urban forest is made up of publicly and privately owned trees, trees in parks and natural areas, street trees, trees on commercial properties, and trees in residential yards. These trees provide many benefits and should be managed as part of the community's green infrastructure. The health of urban forests depends on proactive tree protection, proper tree maintenance, and tree planting to replace tree loss. An Urban Forest Plan serves as a guide to communities working to establish a vision, goals, or management practices for their urban forest.

Urban trees provide a chance for respite and recreation. Trees encourage people to walk and bicycle, which is beneficial to heart and lung health.

Why does an urban forest need to be managed?

Urban forests provide many benefits to the community from cleaning the air and regulating flooding to increasing shade and supporting recreation and fitness. Trees also improve home values and increase the success for commercial areas by making them more attractive to shoppers, renters, and businesses. These ecological, cultural, and economic benefits are referred to as ecosystem services. Some of these services can be measured and quantified while others are more difficult to assign a specific value, but all these services improve the quality of life for community residents. To maintain the urban forest as a valuable part of a city's infrastructure, management is required to prevent loss and to promote tree health. It's also important to have plans in place to care for, clean up and mitigate impacts to trees from natural disasters such as hurricanes, tornadoes, or floods.

Ecosystem Services
Provided by the Urban Forest*

Cleans the Air
reduces air pollution by capturing particulates, absorbing harmful pollutants

Sequesters Carbon
decreases climate impacts by capturing and storing carbon

Reduces Energy Consumption
shades buildings lowering energy use and costs for an average household about 20% in summer

Lowers City Temperatures
evapotranspiration and shade decrease city temperatures making air feel about 15°F cooler

Raises Real Estate Values
increases property values on developed lots – up to 18% more real estate value

Regulates Flooding
trees soak up rainfall, reduce stormwater volume, and help recharge groundwater

Supports Recreation and Fitness
provides urban green spaces for people to walk and motivates them to walk farther and for longer

* For more examples of these benefits, including citations, see GIC's guide, *Tree Planning and Planting Campaigns, A Guide for Reforesting Cities and Towns* https://gicinc.org/books/tree-planning-and-planting-campaigns

Cleans the Water
trees filter nitrogen, phosphorus, and sediments from stormwater

Provides Wildlife Habitat
many birds, small mammals, and beneficial insects use trees for shelter and food

Reduces Stress
people with cancer live longer in greener places, and residents in greener communities have lower levels of depression and stress

Decreases Crime
crime rates are lower in well-treed neighborhoods

Beautification
people value the beauty of trees (another reason well-treed lots sell faster and for higher prices)

Decreases Car Accidents
street trees reduce speeding by providing visual stimuli that cause people to drive more slowly, thereby calming traffic and reducing accidents

Increases Economic Revenue
people shop longer and spend more per item in well-treed shoppping areas

Risks to the Urban Forest

Lack of Funding for
Tree Care and Management

Development/
Urban Sprawl

Fire

Pests and Diseases

Drought

Urban forests face many risks such as development, disease, invasive species, and sea level rise that impact their health and ability to provide ecosystem services. By understanding these risks, a community can plan to manage, protect, conserve, and restore the urban forest for a sustainable and healthy future. Management of the urban forest should entail active planning, tree care, robust protection ordinances and enforcement, education, and tree planting and replacement to account for losses, along with setting goals to retain, or even grow the urban forest. Planning for and managing trees today ensures the urban forest will continue to provide benefits to citizens in the decades to come.

Invasive Species

Flooding

Extreme Heat

Storm Damage

Sea Level Rise

What are some common obstacles to urban forest management and planning?

GIC interviewed communities across SC about their urban forestry programs. We found that forestry programs vary widely, from communities just starting to manage their urban forest to communities with robust programs in place. Obstacles for communities just starting an urban forestry program include lack of data with which to create a plan and lack of staff to create and implement the plan. Across all types of communities, we found confusion about what type of plan should be created and how to create it. Education of both urban foresters, city staff, community leaders and elected officials on the value of an urban forest plan and guidance for creating a plan were desired by these communities, and this guide is intended to fill that need.

> Across all types of communities, we found confusion about what type of plan should be created and how to create it.

Types of Urban Forest Plans

There are several types of urban forest plans that have been created for cities and towns in the U.S. These plans have various names and overlapping elements. A large city may have several different plans for their urban forest, such as: a master plan outlining its vision and planting goals for the urban forest; a management plan providing 5-year actions; annual work plans for management of public trees; and a storm plan for emergency preparedness of the urban forest. (*See text box on preparing for storms and extreme weather on page 14.*)

A small city, town, or county may decide to create one plan encompassing all these elements. For simplicity, we break these plans into three categories: Urban Forest Master Plans, Urban Forest Management Plans, and Urban Forest Small Community/Hybrid Plans.

Urban trees encourage people to stay longer and spend more in cities and towns.

Urban Forest Master Plan

An Urban Forest Master Plan is a vision and plan for the entire urban forest, encompassing both public and private trees. The plan should be created using data assessing the current state of the urban forest, such as tree canopy maps showing the extent of forest coverage, tree equity analysis, and codes and policy assessments to ensure trees are planted and protected properly. The vision should be developed through engagement with the city staff and the community. This vision and the corresponding goals should underpin and inform all other city plans such as an urban forest management plan, a comprehensive plan, other master plans or revitalization plans in the city. The master plan should ideally also show trends in canopy gains and losses and where new planting is intended to ensure canopy can be expanded to meet established goals. A Forest Master Plan Checklist is available in Appendix 2.

Urban Forest Management Plan

An Urban Forest Management Plan guides management and care of existing public trees and planting of new public trees for a government-based urban forestry program. This plan should be based on an inventory of public trees to know their conditions and needs for care and maintenance, as well as an assessment of the urban forestry program's needs including staff qualifications, training, equipment, funding, and current management practices. It should include a budget with both short term (annual) and longer term (5-year, 10 year) spending needs. The goals and actions in a management plan should be based on the vision for the urban forest created in the Urban Forest Master Plan. It is also possible to combine the master and management plan into one plan as long as the master plan elements are completed first to inform why, where, and how to manage the forest resource.

Note that we earlier referenced that some communities need to first have a plan for what to include in their master or management plan and they may need a community education campaign to gain support for the idea of urban forest management. Most people don't think of city trees as an "urban forest" so marketing, education and key messages may be a first pre-step to embarking on a master or management plan. Community support is also built during the planning process by engaging key stakeholders and the public in reviewing maps, data, strategies and even tree planting. A Forest Management Plan Checklist is available in the Appendix 2.

Types of Urban Forest Plans

	Urban Forest Master Plan	Urban Forest Management Plan	Small Communities Hybrid Plan
Description	Vision plan for the entire urban forest- public and private trees- that underpins all other urban forestry plans.	Guides tree care and planting of public trees for a government-based urban forestry program.	Master and management plan elements are combined.
Purpose	Plans for the spatial distribution of urban tree canopy. Evaluates the many benefits trees provide, and ideally, whether trees are equitably distributed (tree equity). Establishes a goal for canopy extent (no net loss, increase canopy by X%). Used to inform other plans such as comp plans, neighborhood plans, future land use plans, park and open space plans.	Plans for the active care of the urban forest based on vision set forth in Urban Forest Master Plan, primarily for public trees. Ensures that the city has adequate resources to care for current and future trees. Informs master planning with respect to avoiding unnecessary tree losses from storm damage or disease and ability to care for newly planted trees and to enforce tree ordinances.	Combines tree canopy extent, goal setting and tree planting and care capacity under one plan. Appropriate for smaller cities and towns that may outsource tree care or with limited capacity to add more trees.
Timeline	10-20 years	3-5 years	Variable- 5-20 years
Team & Stakeholders	**Plan leaders**-2-3 people from city and/or nonprofit partner to guide the process. **Public Stakeholder group**- large group representing diversity and range of views of the public **Advisory Committee**- include nonprofit partners and city departments such as urban forestry, planning, parks and rec, public works/utilities (stormwater, sewer, water), transportation, budget, emergency management, fire, police	**Plan leaders**-2-3 people from city and/or non-profit partner to guide the process **Tree-focused Stakeholder group**- tree advisory board or group of tree focused stakeholders and partners **Internal Advisory Committee**- city staff including urban forestry, parks and rec, public works/utilities (stormwater, sewer, water), transportation, budget, emergency management, fire, police (may include consultant firms used for urban tree care)	**Plan leaders**-1-2 people from city and/or nonprofit partner to guide the process **Stakeholder groups**- may include two groups- a public group for vision and goals and a tree-focused group for tree care actions **Advisory Committee**- include nonprofit partners and city departments involved in tree care, planning, parks and rec, public works/utilities (stormwater, sewer, water), transportation, budget, emergency management, fire, police (may include consultant firms used for urban tree care)
Vision and Goals	Develop vision and goals with community based on an understanding of the existing conditions/ assessment data- Where are we currently? Where do we want to go? (Based on spatial data/maps)	Vision and goals come out of urban forest master planning process	Develop vision and goals with community based on an understanding of the existing conditions/ assessment data- Where are we currently? Where do we want to go? (Based on spatial data/maps)
Actions	• Broad- focused on all trees- actions (rooted in -vision and goals) for government, nonprofits, private sector, neighborhood groups, and citizens to take to work toward vision • Policies- ordinances, specifications, and standards • Strategic plans- ensure budget funds	• Focused- actions (rooted in vision and goals from UF master plan) that government will take to care for existing public trees and plant new public trees • Practices and procedure- pruning cycles, budget planning, staffing, risk assessment	• Both broad and focused actions • Practices and procedure- pruning cycles, budget planning • Policies- ordinances, specifications, and standards • Strategic plans- ensure budget funds
Implementation Plan	Prioritized list of recommended actions- short term and long term. A map showing priorities for where to plant trees (and possibly where to prioritize tree retention).	3-5-year action plan with funding required and responsible agency, annual work plan must include time and costs for manhours, equipment, training	Both- recommended actions and 3-5-year action plan with funding required and responsible agency, annual work plan. May also include locations for where to retain/plant trees.

Small Communities Hybrid Plan

A Small Communities Hybrid Forest Plan combines elements of master and management plans into a single plan for communities that do not need or cannot implement all the elements of a plan for a larger locality. For example, a small community may contract its tree care to an outside firm and thus does not need to allocate staffing to tree care, or it may not have an in-house arborist, but instead have a consulting arborist. Even in this case, however, there still needs to be a budget to support consulting arborists and a team to evaluate their work, assign remedies to problems such as failing limbs or to determine where new trees are needed if aging or diseased trees are removed.

Community needs vary so, for many small communities, a plan combining a vision and goals with tree care guidance and actions may be the best option. This plan, like the others, should utilize such data as a tree canopy assessment or a tree inventory to inform vision, goals, and actions.

Preparing the Urban Forest for Storms And Extreme Weather

A Community Forest Storm Mitigation Plan can be made part of the community's existing emergency plan, an urban forest management or master plan, or can be a standalone plan. Such a plan should focus specifically on ways to avoid or mitigate the damage trees may cause during a storm or other catastrophic event.

After a large event, which may result in a major federal disaster declaration, debris hauling and monitoring represent an enormous cost to impacted communities. There were six times more billion-dollar severe storms during 2001–2022 (142 events) than the prior 2 decades (25 events/1980–2000), so storms are increasing in frequency, as well as in the amount of damage they cause. If a community isn't ready, then response and recovery will be much slower and less effective, not to mention more damaging and more costly. Furthermore, if FEMA rules are not followed, the community may not qualify for reimbursement of their costs.

GIC offers several tools to help communities get ready for storms and a link for more training resources. To learn more, see, https://gicinc.org/projects/resiliency/storm-mitigation-planning/

Starting the Process: What Type of Plan Does Your Community Need?

An assessment of the state of tree care in your community will determine if your community is ready to create an urban forest plan, and what kind of plan would be most beneficial. Following is a self-assessment tool based on GIC's five tiers of urban tree care. Filling in this chart will indicate where a community is in the process of building a robust urban forestry program and indicate next steps for success.

For communities further along in the process, the next step might be an urban forest master plan, whereas for communities just beginning, an urban tree canopy assessment might be the first step. If you already know what you need, skip to the section on **Creating an Urban Forest Plan** on page 36.

Self-Assessment

GIC has created a self-assessment tool/questionnaire based on tree care standards in six categories:

1. Data and Tracking

2. Staffing

3. Tree Codes

4. Plans

5. Community Engagement

6. Funding

We have created five corresponding tiers (*see graphic at right*): The "tree" tier represents the most robust program. While, a small town may remain at the "roots" or "sapling" stage because of resource constraints, it could go all the way to the "tree" level by investing in its urban forest and establishing partnerships to make the urban forest plan work.

By answering the questions in the table on the following pages and tallying up the points, each community can determine which tier they fall into, then see what next steps can be taken. An interactive version of this Urban Forestry Program Self-Assessment Tool can be found on our website here: https://gicinc.org/resources/tools/

Self-Assessment Tool — State of Urban Tree Care

Mark each "Yes" answer to earn 1 point. Add up the all the points to get a score that will correspond to a "Tier"

	QUESTIONS: Does your community have…	YES	POINTS
DATA to track and manage trees	1. A map locating the public places where trees are planted and managed? (not individual trees)		1
	2. Documented tree maintenance records or expense reports?		1
	3. An estimation of tree canopy using the i-Tree Canopy tool?		1
	4. High resolution spatially-based (GIS) tree canopy data and maps including both existing canopy and open space locations for potential planting?		1
	5. A tree inventory locating individual public trees on streets, downtown, in parks, citywide, or by another planning geography?		1
	6. A tree risk management program for public trees by planning geography such as along emergency routes and/or around critical facilities?		1
	Subtotal DATA points		

	QUESTIONS: Does your community have…	YES	POINTS
STAFF to track and manage trees	7. A named staff member or contractor for tree care?		1
	8. A process in place or parties identified to remove hazard trees?		1
	9. A landscape architect, horticulturalist, forester, or arborist on staff to manage trees?*		1
	10. A City Arborist position (ISA certified) to manage trees?		1
	11. Opportunities for staff to attend trainings or for staff to earn continuing education credits?		1
	12. A Tree Risk Assessment Qualified (TRAQ) arborist on staff?		1
	13. Staff to review development plans and enforce tree protection and planting regulations?		1
	14. Forestry staff with time and resources for community engagement and education?		1
	Subtotal STAFF points		

	QUESTIONS: Does your community have…	YES	POINTS
CODES AND POLICIES governing tree care, planting, or removal	15. A responsible party for tree care and planting designated in your community's code?		1
	16. A tree care ordinance for the removal or care of public trees?*		1
	17. A code requiring the protection of trees during and after construction through fencing, signage, retention, and/or after care for newly installed trees?		1
	18. Urban tree planting and landscaping standards in your code?		1
	19. A code requiring a tree removal permit for private property?		1
	20. An approved tree species list with appropriate locations for specific species such as street trees, parking lot trees, and parks trees?		1
	21. Standards for street, RoW, parking lot, and plaza plantings including the application of ANSI standards for tree installation and maintenance?		1
	22. Incentives for utilizing structural support such as underground structural support cells?		1
	23. Trees identified as green infrastructure for stormwater management?		1
	Subtotal CODES AND POLICIES points		

* A required component to meet Arbor Day Foundation's Tree City USA standards

	QUESTIONS: Does your community have…	YES	POINTS
PLANNING to track and manage trees	24. Language about the importance of trees and a list of their benefits in your comprehensive plan?		1
	25. An open space plan, parks plan, green infrastructure plan or other plan that mentions the importance of trees?		1
	26. Written instructions/memo to guide tree maintenance and/or tree planting activity?		1
	27. A risk management plan for public trees?		1
	28. An invasive tree species management plan for public land?		1
	29. An urban forest master plan?		1
	30. An urban forest management plan?		1
	31. An emergency management plan that includes a process for assessing, mitigating and managing trees and tree debris?		1
	32. A tree recycling and re-use plan (urban wood utilization plan)?		1
	Subtotal PLANNING points		

	QUESTIONS: Does your community have…	YES	POINTS
COMMUNITY ENGAGEMENT with trees	33. Information on the city/town website or newsletter about the benefits of urban trees and city or town contacts regarding tree care and planting?		1
	34. An annual public education event for tree care and tree planting?		1
	35. Regular engagement and/or education events about trees for residents?		1
	36. An Arbor Day celebration?*		1
	37. A Tree Advisory Group or Tree Board?*		1
	38. A community tree planting program, volunteers, or partnerships?		1
	39. Regular tree giveaway events in the community?		1
	40. A community based tree focused advocacy group?		1
	Subtotal COMMUNITY ENGAGEMENT points		

	QUESTIONS: Does your community have…	YES	POINTS
TREE FUNDING	41. A funded program for tree care and maintenance?		1
	42. Tree care spending of at least $2 per capita annually?*		1
	43. Funding for staff to proactively (not reactively) care for trees?		1
	44. A tree donation program?		1
	45. Stormwater utility fees to help fund tree planting or maintenance?		1
	46. A tree mitigation fund or tree bank established to be used for planting trees on both public and private property?		1
	47. A process for actively seeking out grant opportunities for new tree planting?		
	Subtotal TREE FUNDING points		

Add up your YES points for a Total Community Tree Care Assessment Score. Use the number to determine which "Tier of Tree Care" applies to your community and see recommended next steps on the next page.	**TOTAL POINTS**	

Which Tier is Your Community? And What Are the Next Steps?

After answering the questions on the previous pages add up your points for a tree care total score for your community. Use the Score to determine your current Tier of tree care and see recommended next steps from the categories below.

NASCENT: 0-6 points

The **NASCENT** communities do not have a tree care program and have not incorporated trees into their planning processes. Before embarking on an urban forest master or management plan, these communities should begin with the basic program development tasks listed below. Once these tasks have been accomplished, the community can move on to the second Tier— Seeds— for next steps.

Nascent: Next Steps

- ✔ Identify/map public places where trees are planted and managed.
- ✔ Name a staff member or contractor for tree care.
- ✔ Establish a process for removing hazard trees.
- ✔ Designate a responsible party for tree care and planting in community's code.
- ✔ Incorporate trees, tree benefits, and the importance of planning for trees in comprehensive plans and other community plans such as open space plans, park plans, or pedestrian plans.
- ✔ Provide information about the benefits of trees and contacts for tree care and planting on the community's website.
- ✔ Host an annual public education event about tree care and tree planting.
- ✔ Create a funded program for tree care and maintenance.

SEEDS: 7-12 points

SEED communities are in the beginning stages of establishing an urban forestry program. They have at least one element in each of the six categories. Before embarking on an urban forest master or management plan, these communities should continue program development with the tasks listed below, as well as any unfinished tasks from the Nascent list. Once these tasks have been accomplished, the community can move on to the third Tier—Roots— for next steps.

Seeds: Next Steps

- ✔ Document and track tree maintenance records and/or expense reports.
- ✔ Estimate tree canopy using i-Tree canopy (or invest in spatially-based tree canopy data and maps that include existing canopy and potential planting areas).
- ✔ Hire a staff landscape architect, horticulturalist, forester, or arborist to manage trees.*
- ✔ Create and pass a tree care ordinance for the removal and care of public trees.*
- ✔ Create and pass a tree protection ordinance requiring protection of trees during and after construction.
- ✔ Offer regular engagement or education events about trees for residents.
- ✔ Hold an annual Arbor Day celebration.*
- ✔ Establish a Tree Advisory Group or Tree Board to manage trees.*
- ✔ Spend at least $2 per capita on tree care annually.*

TREE CITY USA®

* Meets requirement for 'Tree City USA' designation with the Arbor Day Foundation. Tree City USA cities are eligible for tree planting grants and other state grant programs.

ROOTS: 13-20 points

The **ROOTS** communities have built upon a basic tree care program and achieved a few more elements in each category qualifying for 'Tree City USA' status through the Arbor Day Foundation. Cities at this stage should apply for 'Tree City USA' status and continue program development with the tasks listed below, as well as any unfinished tasks from the Seeds list. Once these tasks have been accomplished, the community should move on to the fourth Tier— Sapling.

Some communities at this stage may want to start on an urban forest master or management plan. To do so, data (such as tree canopy or tree inventory data) should be collected to guide the plan. An understanding of the type of plan desired will inform which data will be most relevant.

Roots: Next Steps

- ✔ Hire a city arborist with ISA certification to manage trees.
- ✔ Provide staff opportunities to attend tree-related trainings to earn continuing education credits.
- ✔ Incorporate urban planting and landscaping standards into the community's code.
- ✔ Pass a requirement for tree removal permits on private property.
- ✔ Establish an approved tree species list with appropriate locations for specific species such as street trees, parking lot trees, and park trees.
- ✔ Create a written document or memo to guide tree maintenance and tree planting activities.
- ✔ Build a community tree planting program.
- ✔ Establish regular tree giveaway events in the community.
- ✔ Provide enough funding for staff to perform proactive tree care.

SAPLING: 21-30 points

SAPLING communities have continued to grow and invest in their tree care programs in all six categories. These communities should work toward a robust urban forestry program with the tasks listed below, as well as any unfinished tasks from the Roots list. Once these tasks have been accomplished, the community will reach the highest Tier— Tree. Communities are ready to embark on an urban forest master or management plan at this stage. To do so, data (such as tree canopy or tree inventory data) should be collected to guide the plan. An understanding of the plan desired will inform which data will be most relevant.

Sapling: Next Steps

- ✔ Obtain spatially-based tree canopy data and maps including existing tree canopy and open space locations for potential planting.
- ✔ Attain a tree inventory of public trees citywide or in targeted areas such as downtown or in parks- work toward a full inventory of public trees.
- ✔ Assess tree risk for public trees by planning geography such as city streets, along emergency routes and/or around critical facilities.
- ✔ Invest in Tree Risk Assessment Qualified (TRAQ) certification for staff arborist.
- ✔ Assign forestry or aligned staff to review development plans and enforce tree protection and planting regulations.
- ✔ Provide forestry department with enough staff time and resources for community engagement and education.
- ✔ Develop standards for street, ROW, parking lot, and plaza plantings including the application of ANSI standards for tree installation and maintenance.
- ✔ Provide incentives for using underground structural support.
- ✔ Adopt a city policy that recognizes trees' role as green stormwater infrastructure.
- ✔ Create a risk management plan for public trees.
- ✔ Create an invasives management plan for public lands.
- ✔ Create an urban forest master plan.
- ✔ Create an urban forest management plan.
- ✔ Include trees in the community's Emergency Management Plan.
- ✔ Create an Urban Wood Utilization Plan and program for tree recycling and reuse.
- ✔ Facilitate the creation of a tree focused advocacy group.
- ✔ Build a tree donation program to support tree planting.
- ✔ Add a stormwater utility fee to help fund tree planting/maintenance.
- ✔ Establish a tree mitigation fund or tree bank to be used for planting trees on both public and private property.
- ✔ Develop a process for actively seeking grant opportunities for new tree planting.

Tiers continued next page

TREE: 30-47 points

Communities in the **TREE Tier** have the most robust tree care programs and this is the desired outcome for all communities. These communities should work toward any incomplete tasks for the previous **Sapling** list. Communities who have not already done so are ready to embark on an urban forest master or management plan at this stage. To do so, data (such as tree canopy or tree inventory data) should be collected to guide the plan. An understanding of the plan desired will inform which data will be most relevant.

Additional tasks tree communities should undertake include:

- Storm planning for the urban forest, see resources here: https://gicinc.org/projects/resiliency/storm-mitigation-planning/
- Review of codes and ordinances to ensure the robust protection of trees— download GIC's Policy and Practices Audit Tool here: https://gicinc.org/resources/tools/
- Adaptive management of the urban forest by regularly evaluating if canopy cover is stable, declining or expanding and changing approaches to management to mitigate or reverse canopy decline.

Building a community tree donation program, or hosting community planting days are part of a robust urban forestry program.

Working Toward a Plan

Based On Where You Are Now, What Does Your Community Need?

After taking the self-assessment you should have an idea of where your community is in the process of building an urban forestry program, as well as some next steps to advance your program. Most localities don't have data on the extent and health of their urban canopies; nor do they have comprehensive tree inventories. Data are the foundation of effective planning. Although cities inventory sidewalks, roads, buildings, and other public facilities, such as schools, they seldom catalog the condition and extent of natural infrastructure such as their trees. However, since trees are our "green infrastructure," we need to manage them, just as we do our "grey infrastructure," such as roads, sidewalks, or storm drains. Recall that many urban forestry programs provide grants and technical support to obtain these data, so lack of funding should not be the limiting factor to obtaining it.

Data Driven Plans— To Inform Goals And Strategies

A well-informed urban forest program will have:

- **A canopy map** showing the extent of canopy cover for the entire locality to inform city goals for where canopy is needed, lacking, and should be maintained.
- **An inventory of trees** on public lands and along street Right-of-Ways (RoW) to inform basis for long-term health of the trees, determining maintenance plans, flagging trees for further risk assessment, and informing which types of trees to plant in the future to ensure diversity. Trees performing stormwater functions (e.g., in bioswales or as part of planted water buffers) can also be catalogued as "green infrastructure." Inventory is expensive so plan for those streets or tree locations that are most critical, such as trees along evacuation routes or near entries to hospitals or police stations for instance. This can flag trees for further risk assessment.
- **A risk assessment of trees** to determine which trees are at risk of full or partial failure and could interfere with public facilities or emergency RoWs, as well as at public gathering places, such as public parks or plazas. These data can then be used to prioritize city maintenance.

The data from these activities can be used to set goals for a city for how much canopy is desired, where it is planted, and how it will be maintained. Different types of data are needed for master plans and management plans. Following is a description of the data needed. If you are already familiar with canopy maps and tree inventories, skip ahead to the **Creating an Urban Forest Plan** section on page 36.

Planning Without Data

As proponents of science-based approaches to planning, we recommend that best practices entail the use of tree canopy and inventory data to craft urban forestry plans. However, in some cases, it was only after going through the visioning and planning process that a city was able to secure funding to acquire the data recommended for urban forest plans. This guide proposes best practices, while acknowledging that there may be exceptions. However, data are more accessible today than ever before. Forestry departments in many states offer robust technical support and grants to help communities get tree canopy assessments, tree inventories and more.

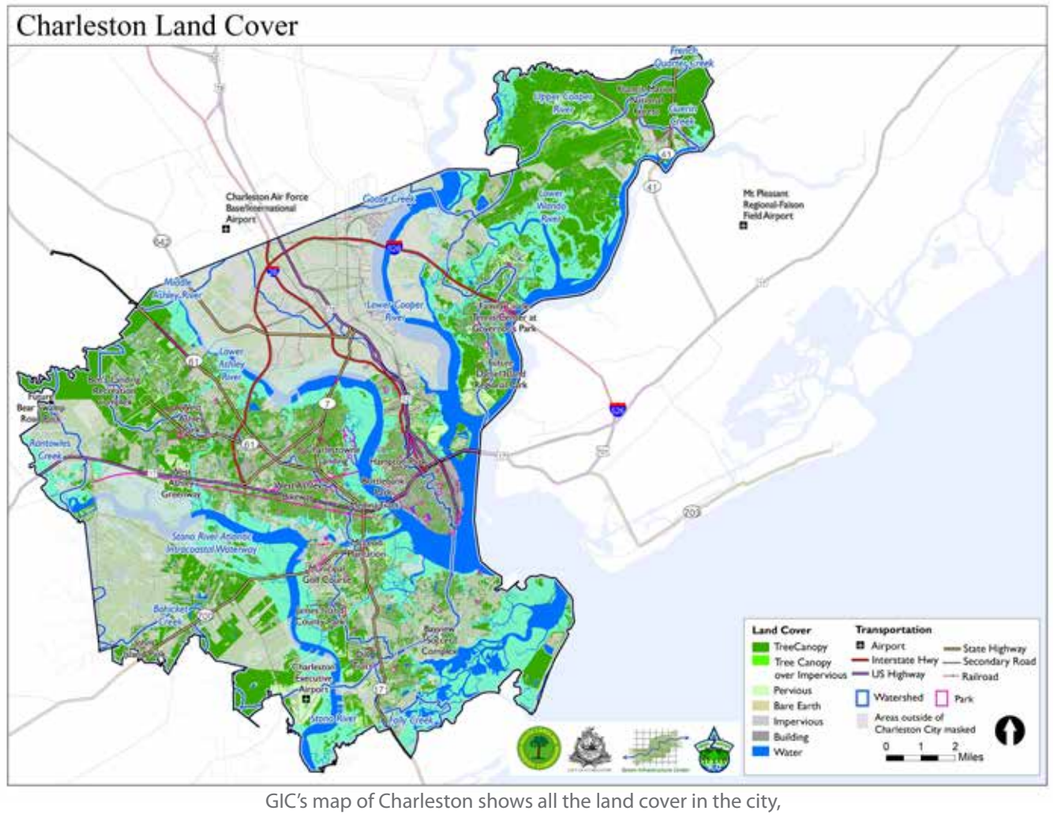
Contact your state's Urban and Community Forestry Department to learn more. Our nonprofit Green Infrastructure Center offers canopy mapping, planning, goal setting and analysis for several states as well. Contact the state urban forestry program for more information on grants to support this work.

Data Needed for Master Plans

Options for Setting Your Goals

Master plans usually involve setting a goal for the city's canopy coverage. Cities often want to choose a standard goal, such as to increase its tree canopy by 5% in 5 years, or something catchy, such as "40% canopy by 2040!" However, setting numbers that sound catchy might not be realistic. One Southern city set a goal to plant 40% canopy. Unfortunately, this percentage coverage was higher than the available land to plant and would have resulted in planting every possible place, including schoolyards, playing fields and cemeteries, as well as the removal of buildings, and would have required 100% participation from all private landowners and neighborhood homeowners' associations in order to achieve it. Furthermore, it would have precluded other community uses, such as vegetable gardens or playing fields, and required the removal of structures to create enough planting spaces. So, it is not recommended to set a goal without understanding whether the open space physically exists in which to achieve it.

When setting a canopy goal, municipalities need to consider strategies for both public and private property because the private sector owns approximately 80% of the land in most cities.



GIC's map of Charleston shows all the land cover in the city, not just tree canopy, so it can be used for many planning applications.

Cities should also consider whether they want to make a canopy goal for the entire city and not just for public lands. In the eastern United States, since only about 20% of city land is publicly owned, a city will not get very far in increasing canopy cover unless it involves the private sector – the other 80% of landowners – in planting and conserving trees on private lands. How much canopy coverage currently exists, as well as determining what is possible, requires a land cover map showing existing canopy and plantable open space (referred to as potential planting area or PPA).

Using Maps and Data to Set a Goal

A map showing where tree canopy and open space are located is critical to establishing a realistic planting goal. The most important map needed is a general land cover map, which should include tree canopy. A land cover map accounts for every area of the Earth, as seen from aerial imagery. A land cover map also includes other 'classes' of land cover including bare earth, grass, shrubs, impervious surfaces, and water. Aerial imagery is analyzed to categorize different types of land cover, such trees, shrubs, grass, bare earth, water, and impervious surfaces. Usually, land cover maps do not distinguish individual trees.

There are many reasons to analyze all major types of land cover – not just trees. Although tree cover locations are important, planting plans also require knowledge of where there is open space to plant new trees. Areas where trees could be planted are referred to as Potential Planting Areas (PPA) and usually include areas that are identified as bare earth or turf. However, impermeable areas that are no longer needed, such as overbuilt mall parking, could also be utilized by removing the hard surface and improving the soil to create new plantable areas.

Canopy Mapping Tools

There are various software tools that can recognize land cover types, based on the feature's physical properties. Commonly used tools apply light reflectance from the feature's surface. More advanced methods, such as object recognition tools, consider a feature's shape and locational context, and can be used for higher accuracy. The results from these applications can be combined with feature-height data derived from LiDAR, which is important if you are to distinguish trees from large shrubs and bushes, or from mangroves and other marsh species.

Analyzing imagery and creating a tree canopy map allows for planning and goal setting based on canopy *location*. This is an important distinction. Some software tools (such as i-Tree Canopy) only apply random sampling to estimate the tree cover. This means a subset of randomly sampled points from known land cover are analyzed and the resulting tree cover percentage is derived using statistical methods to model the *likely canopy cover percentage*, but it does not map individual trees, patches of woodland, or open plantable areas. In other words, while software tools that use randomly sampled points provide a quick, easy, and relatively accurate way to derive a canopy coverage statistic, they do not determine where those trees are located. When canopy location is unknown, plans cannot be made about where to conserve trees, determine the largest clusters of trees, identify plantable open space areas for increasing tree canopy, or for future comparisons concerning tree losses and gains.

In addition, online modeling tools that use randomly sampled, user-defined observation points often produce a higher tree canopy percentage than actually exists. Remote sensing of aerial imagery (based on conducting analysis and comparing that to results generated through i-Tree Canopy) tends to show lower canopy coverage than randomly generated points methods. This is due, in part, to common identification errors that mistake other leafy vegetation, such as bushes, for trees. Research comparing i-Tree and other random sampling tools to remote sensing methods bears this out (*Parmehr et al, 2016*).

The table on the following page shows examples of ways to divide and analyze canopy data. Tree data can be clipped to any area, such as a town planning area or a region; or it can be clipped by political boundaries, such as council, commission, or board districts. Showing tree cover by political boundaries can offer some advantages. For example, some politicians enjoy competing to have the most trees or using the data to point out the need for more tree investment in their districts.

Example Statistics from Canopy Data to Inform Master Plans

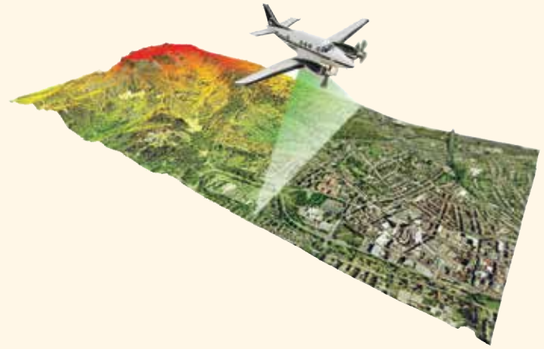
Type of Analysis by Percent	Combine canopy and PPA data to see tree location/ plantable areas in relation to specific areas of concern	Applications to Target Planting (See example maps on pages 26-27.)
% of trees by income/race	Overlay census tracts with canopy data to review canopy distribution.	Compare income or race to canopy cover. Are there social equity issues where some races have less access to canopy? Is canopy less in low-income or areas?
% of trees by neighborhood	Use local neighborhoods shape file (from GIS department) and clip (show) canopy by neighborhood.	Which neighborhoods have more or fewer trees? Which need more trees?
% of trees by watershed	Use local watershed boundaries and clip canopy to each.	Used to set watershed plan goals, using trees as a BMP, buffer coasts from storms, or prevent runoff from uplands.
% of trees by downtown, historic or other important districts, such as economic opportunity zones	Use planning districts or master plan area shape files and clip canopy data to each district.	Beautify/revitalize downtowns, improve property values, and set goals for areas being restored.
% of trees in parks	Use locality park boundaries and clip canopy data by parks.	Which parks have more/fewer trees? Compare to plantable areas – is there room for more trees? Consider reviewing these data with census race/income data.
Trees as buffers (by miles or feet)	Extend a boundary from surface waters (e.g., 100, 50 or 30 feet from stream or lake edges.)	Which areas lack forested buffers for water quality or for wildlife habitat?
Tree canopy over streets	Use local road network and clip canopy from 5 to 15 feet in from edge of RoW (creating a shape file over street corridor). Also calculate canopy within the shape file by block.	Which streets are at least 50% or more tree covered, 25–49% covered, 10 –24%, 15% or less, 0%? Code streets by coverage and target low-canopy streets for planting.

Converting Images into Data

Using remote sensing to map canopy location

The **Normalized Difference Vegetation Index (NDVI)** is a standardized index allowing a GIS analyst to generate an image displaying greenness (relative biomass) based on imagery captured from above the earth. This index imagery can pick out vegetation by using the contrast in the characteristics of two bands from a multispectral raster dataset. Vegetation can be identified through the chlorophyll pigment absorptions in the red (R) band and the high reflectivity of plant materials in the near-infrared (NIR) band. The NDVI image, along with the source imagery from the National Agricultural Imagery Project (NAIP), provide 4 spectral bands (red, blue, green, and infrared), which are used to identify various features where they visually match the imagery most accurately; for example, the green reflected from the leaves of a tree. To learn more about NAIP, see https://www.fsa.usda.gov/Internet/FSA_File/fourband_info_sheet_2011.pdf

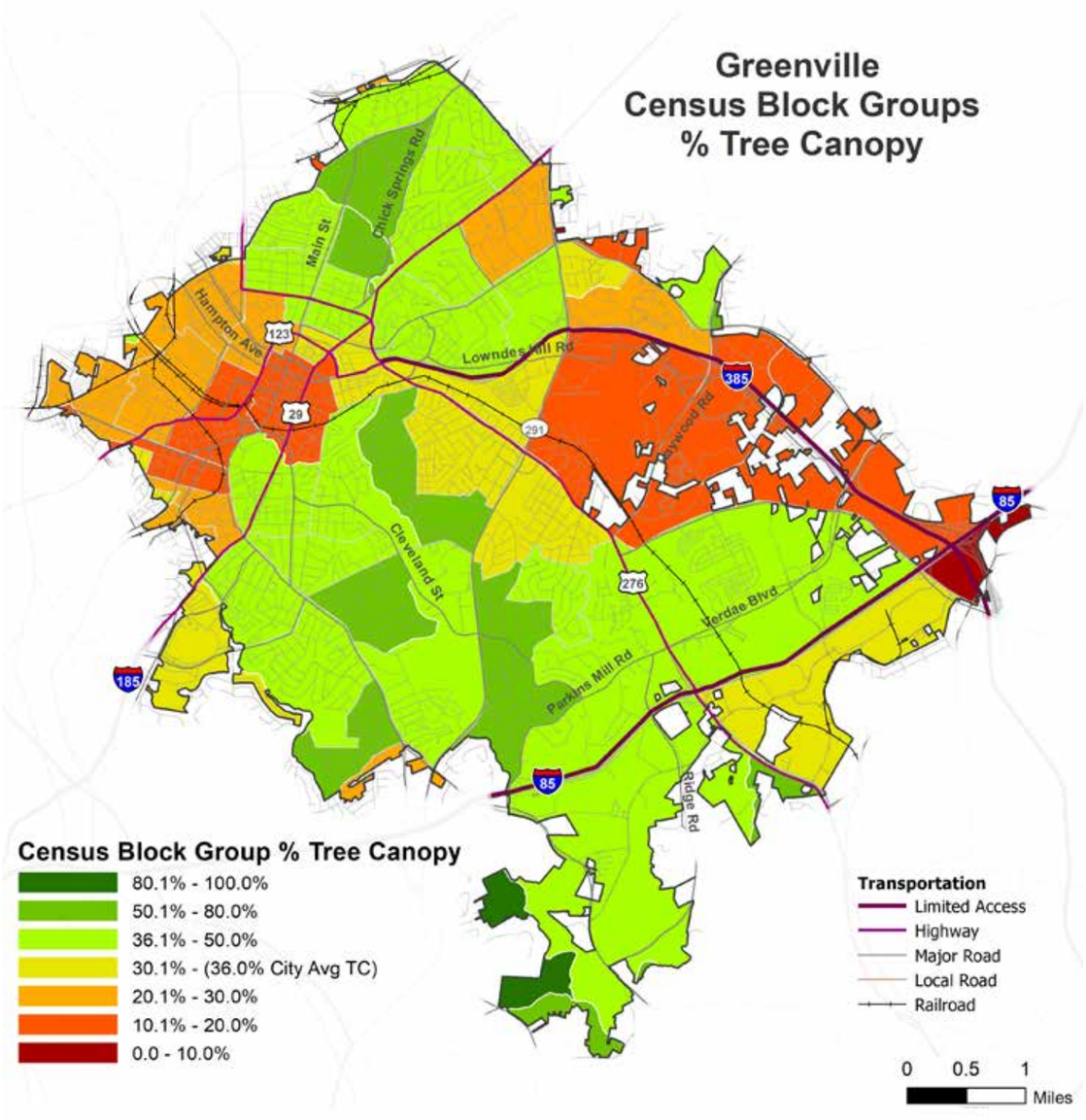
Resolution of the imagery relates to its accuracy. For urban areas, where land type and uses can change dramatically over just a few meters, a fine scale of resolution is needed (1 meter or less). Using NAIP imagery ensures that the right scale of a minimum of 1-meter is used.



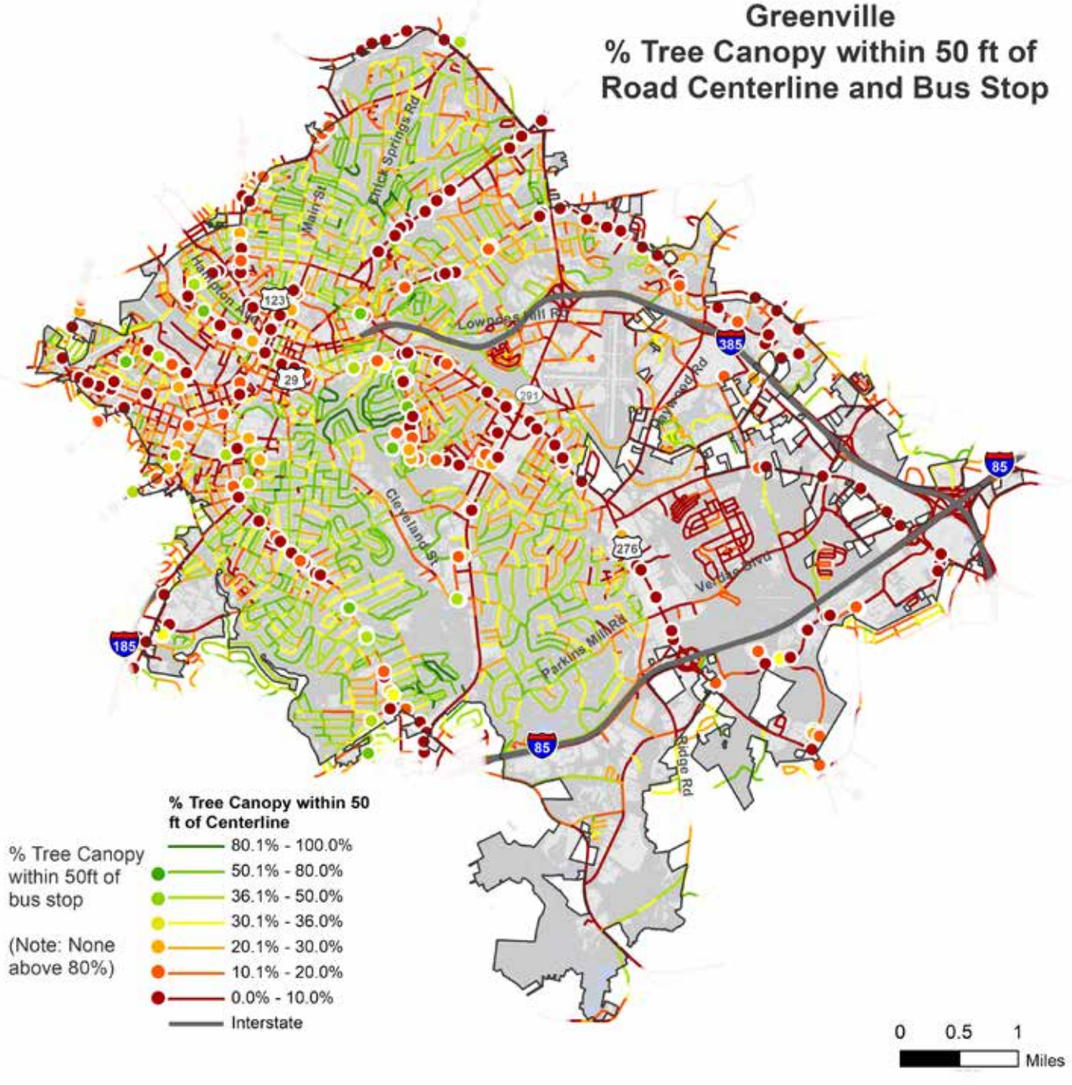
LiDAR—Light Detection and Ranging—is a remote sensing method used to examine the surface of the Earth. LiDAR fires laser beams to the ground and measures the return interval to determine obstacles and their distance. LiDAR beams can be used to determine feature height and thus pick out short vegetation (e.g., bush) from tall vegetation (tree). Other shape recognition software can help with picking out palm trees (a very tall grass) from trees.

To learn more about the data used for mapping see: https://gicinc.org/books/tree-planning-and-planting-campaigns/

Forested buffers are another important feature to prioritize since trees along surface waters cleanse overland runoff before it reaches the river or lake.



These two maps show how canopy can be analyzed in many ways such as by census block groups or by street shade.



Maps created by the Green Infrastructure Center Inc.

Potential Planting Area Data

An open space Potential Planting Area (PPA) assessment will be needed, even if your community's goal is simply to maintain current canopy. This will include creating a PPA map, especially if the intent is to increase the canopy. Plantable spaces need to be mapped and available planting areas calculated. Unless this area has been calculated, your community cannot set a realistic planting goal as it won't know how many new trees could be fitted into the landscape. You can use GIS to digitally fit trees into the landscape (ensuring they are set back from structures, away from utility lines, sports fields, or other uses that would interfere with trees). This allows for modeling how many more trees could be planted. Three key data layers are needed to model how many trees could be planted. They use the landcover layer and other relevant data as their basic sources of digital information:

- **Potential Planting Area** (PPA) – open space available.
- **Potential Planting Spots** (PPS) – locations where planting trees is actually possible.
- **Potential Canopy Area** (PCA) – modeled canopy at maturity (e.g., 25 years).

The Potential Planting Area data should be reviewed by the city's arborist and planners to point out areas that need to be digitally edited to represent city expectations of where planting is or is not allowed, areas already lost to development, or that are already planned for land clearance. Excluding unplantable areas from open space results in a more realistic calculation of plantable areas and potential new trees.

Potential Planting Spots

The Potential Planting Spots (PPS) overlay is created from the PPA. To do this, A GIS analyst uses the PPA, running it through a GIS model to select those spots where a tree can be planted, depending on the desired sizes of the trees when mature. Planting scenarios can be based on a 20ft. or a 40ft. wide mature tree canopy cover, with a 30% overlap. Or, if you are planning for larger trees such as mature live oaks, a 60ft. spread could be used. As a result, planting spots are either 16ft. or 32ft. apart, respectively.

NAIP Image.

Potential Planting Area (PPA).

Potential Planting Spots (PPS).

Potential Canopy Area (PCA).

Potential Canopy Area

The Potential Canopy Area (PCA) is then created from the PPS. The possible planting spots are given a buffer around each point that represents a tree's mature canopy. First, larger canopy trees are digitally added, followed by smaller ones, which are fitted into the remaining spaces. Planting spots are assigned a buffer of 10ft. or 20ft., to result in trees 20ft. and 40ft. apart, with a 30% overlap. This utilizes gaps that would otherwise be found between adjacent circles and reflects the reality that trees overhang and intermingle with each other. By taking the open space data and converting it into circles that represent the mature spread of each tree, the total number of trees that can actually be fitted into an open space is known.

This analysis can determine the total number of large and small trees that could potentially be planted in the open spaces available. These spaces can then be classified as public or private ownership (using city parcel data) to determine if planting spots are on public or private property. As noted earlier, a general rule of thumb is that 80% of land within a city or town is privately owned, and about 20% is in the public domain. So plantable areas can be considered similarly.

The final map of available planting spaces and total number of tree planting spots can then be used to calculate the cost of meeting a specific canopy goal on both public and private lands and to determine whether that goal is realistic or not. GIC uses the available planting space and the number of trees that can be fitted within the PPA to create a tree planting calculator. This makes it far easier for planners to convert plantable area into number of trees when setting goals. Additional cells are added in the calculator to cover the cost of planting trees. (See the following pages for calculator tools to determine the planting numbers and costs.)

The following questions can help establish where to plant trees to achieve your goal(s). A canopy goal should be informed by planting data (how much canopy you have and where), as well as how much space is available to plant. The canopy map (1-meter resolution or finer), once checked over for quality assurance by a GIS analyst and forester/arborist, should provide an accurate measurement of the extent (percentage) of canopy city wide. As noted earlier, LiDAR data should have been used to examine vegetation heights, in order to rule out shrubs and other green vegetation under 10 feet tall. Once you have collected and assembled all the relevant data, consider the following questions to prioritize planting areas:

- Does the community want to beautify neighborhoods with trees?
  - —How evenly are trees distributed across neighborhoods?
- Does the community want to provide shade and mitigate heat with trees?
  - —Are trees lacking in some areas, e.g., downtown or business districts?
- Does the community want to address equity issues with trees?
  - —Is canopy distributed evenly and equitably regardless of race or income?
- Does the community want to improve community health with trees?
  - —Walkability- how well treed are roads/sidewalks and routes to schools or parks?
  - —Air quality- What are the ecosystem services (e.g., air quality or shade) would be provided by new tree canopy?
  - —Access to green space- How well treed are community spaces, such as parks and schools?
- Does the community want to reduce energy costs by shading buildings with trees?
  - —Are trees lacking near school buildings or other municipal buildings?
- Does the community want to improve water quality with trees?
  - —Are trees lacking alongside rivers and lakes?

Tree Planting Cost Calculator

TREE COST (1 to 2 inch caliper)		COST
MATERIALS	Tree purchase price each	$100.00
	Gator Bag*	$40.00
	Stakes/Rope/Mulch	$15.00
	Subtotal Materials per Tree	**$155.00**

INSTALLATION AND MAINTENANCE COSTS		QUANTITY/COST
STAFF HOURS	PLANTING—number of staff hours	1
	PRUNING—number of staff hours	+2
	Subtotal Plant & Prune Hours	3
	WATERING—number of staff hours	0.25
	Multiply by days of watering	X12
	Subtotal Watering Hours	3
	Subtotal staff hours (plant, prune, water)	6
	Multiply by staff hourly rate	x $20.00
	Subtotal Labor Costs, per tree, first 2 years	**$120.00**
	Total Costs Per Tree (materials & labor)	**$275.00**
	Multiply by total number of trees	x 5
	Total Costs All Trees (materials & labor)	**$1,375.00**

*A self watering bag can save on costs https://www.treediaper.com/

Planting Cost Calculator for Increasing Tree Canopy Coverage

POTENTIAL NUMBER OF TREES THAT CAN BE PLANTED IN PPA		
40' Canopy spread	214,826	49.0%
20' Canopy (Understory)	223,696	51.0%
Total trees that can be fitted into available open space	438,522	
Current Tree Canopy Coverage	58.0%	
Current Possible Planting Area	5.7%	
Additional Tree Canopy Possible	5.7%	
Max. Possible Tree Canopy Coverage	63.7%	

SCENARIO TESTING		
Timeframe (in years)	20	
New Tree Canopy Coverage Goal	61%	
Tree Canopy Coverage Increase to Reach Goal	3.0%	
Percent PPA to Plant to Reach Goal	52.6%	
	Number of Scenario Trees	
Percent Canopy Trees	49.0%	117,965
Percent Understory Trees	51.0%	122,836
TOTAL		240,801
Estimated Cost to Install and Maintain Canopy Tree	$275.00	
Estimated Cost to Install and Maintain Understory Tree	$275.00	
Total Cost of Scenario CANOPY Trees	$32,440,424	
Total Cost of Scenario UNDERSTORY Trees	$33,779,864	
TOTAL COST All Trees	$66,220,288	
City Assumed Costs to Plant Canopy Trees*	30%	
City Assumed Costs to Plant Understory Trees*	30%	
TOTAL CITY COST for Achievement of Scenario Goal	$39,732,173	
TOTAL CITY COST PER YEAR for Achievement of Scenario Goal	$1,986,609	

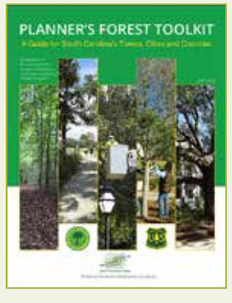
* Assumes the private sector covers the other 70% of costs. This requires a planting campaign, many partners and a process to log where volunteered trees are planted.

No-net-loss and managed loss canopy goals

While expanding tree canopy is laudable, no-net-loss and managed loss goals are still valuable. While not as inspiring as the notion of expanding the urban canopy, goals to avoid tree loss or manage tree loss to limit it to a minimum threshold can be couched as maintaining a city's health and quality of life. Since hundreds or thousands of trees are removed or lost annually in cities due to development, disease, or simply old age, no-net-loss or managed loss goals require active tree planting and management to achieve. Assuming 1,000 trees are lost annually (which can be verified by comparing canopy maps every several years), that many replacement trees or a percentage of those need to be replanted every year just to maintain current canopy cover.

In addition to trees lost from age or storms, no-net-loss and managed loss goals require studying the city's policies to see which of them may lead to a change in coverage. For example, excessive parking requirements for new developments may require paving the landscape beyond what is necessary. Similarly, if land can be cleared (lot line to lot line clearing) before a site plan is approved, then tree conservation is almost impossible, since there is no review of which or how much canopy to retain.

To evaluate city policies that contribute to tree conservation and policies that foster excessive land conversion or pavement, see GIC's Planner's Forest Toolkit and Trees and Stormwater Codes and Policies Audit tool to assess which policies may need to be changed.



See https://gicinc.org/books/planners-forest-toolkit/ and https://gicinc.org/projects/resiliency/trees-and-stormwater/

Data Needed for Management Plans

Management plans entail setting strategies and benchmarks for maintaining and managing public trees. An inventory is necessary for such plans to determine the scope of need (how many trees need pruning, how many trees have incidences of pests or disease, where have trees been removed or damaged, etc.).

Tree Inventories

Tree inventories catalog the location of individual trees and include other information including tree diameter at breast height (DBH), species type, canopy condition (good, fair, poor), estimated height, etc. Inventories are usually done for street trees, or for trees in such public spaces as parks and schools.

There is a great variety of software for counting tees and storing the data, including interactive maps, tools to map diversity, etc. Platforms such as Open Tree Map or Tree Plotter are proprietary software that can store your mapped trees for a fee. GIC can also provide such services. A city that has a publicly viewable GIS portal also could just load the tree planting points into their GIS system and display them for the public to view.

Tree inventories can be performed either by professionals or by trained volunteers. When working with volunteers, good training is essential. Definitions and evaluation criteria will need to be standardized, such as when ranking a tree's condition as good, fair, or poor, or for assessing the condition of the tree canopy. In general tree inventories can be expensive (about $5.00 or more per tree inventoried) so consider carefully which trees to inventory first. An inventory could take place over several years, beginning with priority areas; for example, trees in parks or trees at highly visited sites such as town hall, or emergency response sites such as the police station, along busy roads serving as evacuation routes, or in redevelopment areas where investments in infrastructure are planned for the near future.

Inventory data can be stored or exported to a simple spreadsheet and used to analyze such statistics as the diversity of trees, the numbers of small, medium, and large trees, and other factors. These data can then be used to inform tree planting goals. For example, after a volunteer-conducted street tree inventory, one city found that half of its street trees were crape myrtles. While crapes are pretty, they do not provide the same benefits for shade, pollinators or stormwater uptake as does a traditional native canopy tree, and they can also be subject to pests, such as bark scale. In that case, the city could educate residents about planting other trees instead, and not include crape myrtles in tree giveaway programs.

It is also important to ensure a high level of tree diversity throughout an urban forest. When communities have an overabundance of the same species, there can be dire and dramatic consequences. A whole neighborhood of trees, or a beautiful tree-lined street can die off entirely within a few months. For example, in Pennsylvania and New York, certain species of maple have been attacked, destroying large numbers of trees in several historic downtowns. If a street (or multiple streets) has only one tree species, it may be subject to greater risks if a particular pest or disease enters the community.

Furthermore, some trees, such as the American sycamore (*Platanus occidentalis*), give off irritants that can cause respiratory distress. A few of these trees on a block are not a concern, but an entire neighborhood of this tree (as is the case in some cities) could cause distress for people who suffer from allergies or asthma[1].

Why track pests and disease?

There are many pests that can affect urban tree health and their prevalence may necessitate a locality to take such actions as avoiding planting more of the affected tree species.

The emerald ash borer is responsible for killing tens of millions of ash trees in 30 states and is now found in South Carolina's upstate region, so planting ash trees may be a risky choice in those regions.

The emerald ash borer is killing ash trees in the millions.

Another new pest, crape myrtle bark scale, is a small insect that appears as a white or gray, felt-like encrustation that can stunt the growth and blossoms of crape myrtle trees and has begun to infect them across the Southern U.S.

So, when choosing which species of trees to plant, consider whether there are existing pests that could infect them and also ensure a diversity of tree species, so that, if one tree species is infected, other trees may not be.

Crape myrtle bark scale is a small insect that appears as a white or gray, felt-like encrustation.

[1] Sycamores have trichomes, which are very small, fine hairs on the back of each leaf. They can cause physical irritation to the eyes and nose and bouts of coughing or nausea.

Examples Of Statistics From Tree Inventories That Can Inform Planting Goals And Maintenance Needs:

Diversity
Numbers of different species; numbers of large versus small canopy trees; street by street analysis; neighborhood analysis, etc.)

Location
Miles of streets with or without trees: by neighborhood; by historic district; along walking routes to schools or parks; in central business districts; by council district; by age and income; by linking to census data, etc.

Tree Condition
number of street trees by excellent, good, or fair condition. Trees with defects or at risk of failure are flagged for further follow-up.

Ecosystem services
carbon sequestration; stormwater uptake; particulate uptake; etc. For methods, see the **Tree Campaign Guide** mentioned earlier.

If the inventory has also tracked empty tree pits and stumps, those missing tree locations can also be included in an inventory as future spots that could be planted (assuming the planting spaces are adequate for healthy tree growth or make plans to expand them).

Tree Risk Assessments

Tree risk assessments are evaluations of tree conditions performed by certified professionals and are designed to evaluate tree risk. There are three levels of risk assessment, based on the scope of work. A level-1 assessment is a quick survey of a specific population of trees, such as those along major streets or those in public parks and is intended to detect trees with problems that require attention (e.g., likely to fail) and may need a more thorough level-2 or level-3 assessment. Data concerning these tree risks can guide the removal of risky trees or limbs to increase the safety of urban and community trees. Cities should have someone on staff trained in Tree Risk Assessment Qualification (TRAQ) or hire or contract with a TRAQ professional to evaluate tree risk and make informed decisions on whether trees need to be removed or just mitigated through other best management practices. For more on TRAQ certification, see https://www.isa-arbor.com/certification/becomeQualified/becomeQualified

Risk is determined by whether the tree has the potential to affect people or property. So, when a rotting tree falls in a remote forest, it would have a low-risk assessment ranking versus a tree with a rotten limb overhanging a public sidewalk. Not all cities perform tree risk assessments. Some have urban foresters or trained volunteers collecting these data. A level-1 tree risk assessment should be performed annually to assess the overall condition of public trees and flag specific trees for a more thorough follow up. Mitigation should be prioritized for high-traffic areas (e.g., trees in public plazas) or high-risk areas, such as trees subject to excess wind or wave action, at major road interchanges, overhanging pedestrian shopping areas, and other areas with potential human targets if failure occurs.

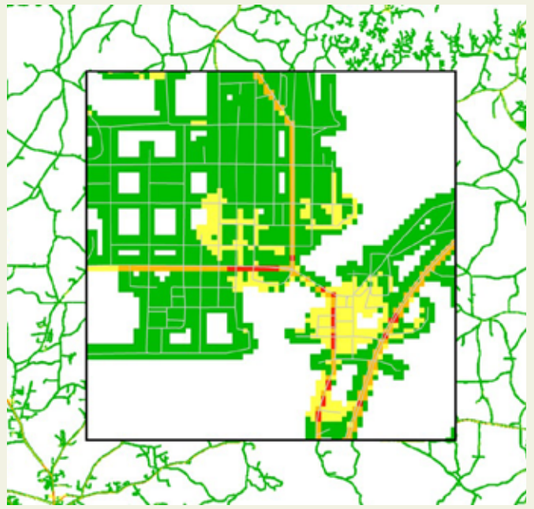
Trees with defects or at risk of failure are flagged for further follow-up.

Choosing where to inventory

"**The Urban Tree Risk Index (UTRI)** is a GIS tool to help arborists and emergency management personnel define, rank, and map the areas of greatest need for tree risk assessment.

If you have GIS capabilities, this model can be built to rank a community, from high to low priority, for tree risk assessment and establish routine inspection schedules.

The tool analyzes such spatial data as roads, parcels, facilities, and land cover data, in order to determine areas where the highest risk of tree failure overlaps with major corridors and prioritized routes. Field verification of the index values is conducted and the values are adjusted, based on field conditions." Instructions for building the model can be found here: https://urbanforestrysouth.org/resources/library/ttresources/urban-tree-risk-index-model

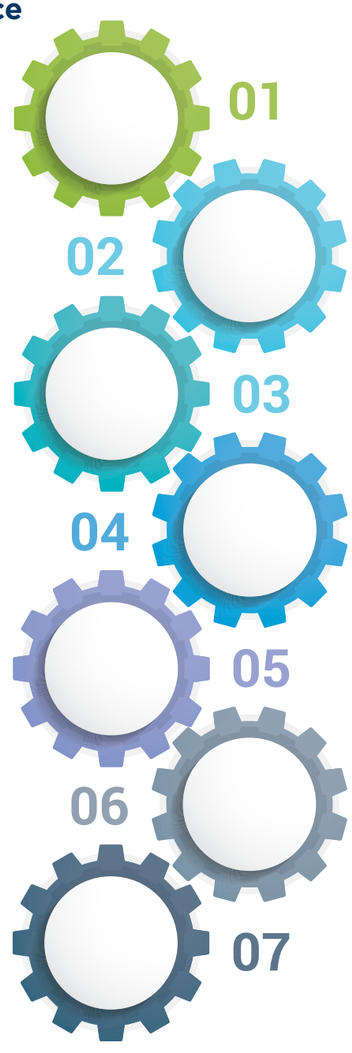

The GIS tool helps the user prioritize which streets to inventory and make note of management needs.

Creating an Urban Forest Plan

Planning Sequence

A community may choose to map its canopy or embark on an urban forest management plan in response to specific needs. However, many communities may not know what they need and would benefit from a proposed planning action sequence. Planning should be based on data so we recommend beginning with data collection and analysis. Attempting to do everything at once is a costly and time-consuming proposition. Building up to a plan with multi-year steps and investments can be a cost-effective way to reach urban forestry goals. Additionally, building a vision and goal with the community may help secure funding from city leadership for further investment in specialized staff, a plan, a tree inventory, or tree maintenance budget. In SC, the SC Forestry Commission offers technical and financial assistance for many of these steps for interested cities, towns, and counties. GIC recommends a planning sequence as follows:

Planning Action Sequence



1. TREE CANOPY
Conduct a tree canopy assessment and analysis of how trees benefit the ecosystem.

2. SET CANOPY GOALS
Use data collected from the tree canopy assessment to set canopy goals for the community.

3. MASTER PLAN
Plan for the spatial distribution of the tree canopy including a visioning process with the community.

4. TREE INVENTORY
inventory of public trees— can be phased by location: streets, parks, rights-of-way, or public facilities.

5. MANAGEMENT PLAN
Plan for the active care of the urban forest (based on community vision).

6. RISK ASSESSMENT
Can be part of a management plan to inform needs and costs. (Note this step could be completed before the management plan and used to inform it.)

7. STORM PLAN
Prepare the urban forest to reduce the risk of damage from major storms.

Form a Planning Team

A planning team of 2-3 people that cross agencies and include those with an interest in trees (parks, public works, and planning departments at a minimum) should be established within the city or municipality to guide the urban forest planning process. Consultants may be hired to manage the process, but internal leadership is needed to guide the process and keep efforts focused on a useful plan or set of plans. A plan made entirely by outside consultants or without extensive city consultation may lack the internal buy-in and local knowledge needed for the plan's success. The planning team should determine the **geographical boundaries** of the plan(s), **type of plan(s)**, and **timeframe** of plan(s) (possibly in conversation with a technical committee).

Cities often plan in silos and don't work across departments – which is how conflicts arise and key buy-in is not obtained for implementation. City agencies may at first think that trees are those items dealt with by the parks or public works department and not by their respective agency. However, tree health, extent and survival are affected by multiple city agencies and boards. Following is a quick list of typical city agencies and why they should be engaged in the core planning team or at least consulted during critical decision points in the process:

City Parks
Responsible for tree health and care at parks and for ensuring public safety (may be under Public Works). May also include tourism, staff, or committees that have an interest in beautification.

Public Works
Often responsible for street trees and clearing road debris and rights of ways, or for ensuring clearance for public utilities (both above and below ground).

Planning
Sets standards for subdivision ordinances, landscape standards and screening; comprehensive plans, neighborhood master plans or area plans, which should include trees.

Engineering
Sets/enforces plans for stormwater management, which may include trees in bioswales, along stormwater ponds, etc., as well as floodplain management, which also affects trees (stream buffers, etc.).

Geographic Information Systems
Manages city data sets, which may include canopy and landcover maps, future planting plans, records of tree inventories, or locations for maintenance needs. If your GIS team is highly skilled, consider it for the role of keeping tree inventory data, instead of paying a third party to store data.

Emergency Management
May have included trees (safety and risk assessments) or debris management and cleanup involving trees in their plans (if not, then they should). Any storm cleanup of trees requires adherence to strict FEMA rules, so these trees and their management and cleanup needs to be part of your city's emergency plans.

City Manager's Office
Sets the budget for the city, so should be engaged early to ensure buy-in for spending needs. Also, it often houses specialist staff or programs for sustainability or resilience. If the city has a resilience or sustainability office, be sure to include it in the process, as good tree cover helps to meet many of the goals for urban heat mitigation, air quality, flood reduction, and energy conservation.

Other boards and commissions to engage at key points in the process:

Tree Board/Beautification Committee
This is an advocacy group for trees and may include needed technical or political expertise. Consider regular updates to the board or having the chair as part of the core planning team.

Planning Commission
Sets long-range goals for the city in the Comprehensive Plan and also recommends new ordinances and Master Plans.

City Council
Adopts long-range goals, recommends city budgets and spending, and adopts new ordinances. Consider at least updating the City Council three times (beginning, middle and near the end) to ensure they are aware of, and supportive of, the process and planning underway (especially if they will need to formally adopt the plan and fund some of its implementation).

Other Committees
Any other city or town committees dealing with economic development, tourism, public health, crime prevention, or other city initiatives will likely have a role to play and should be engaged or updated before plans are finalized.

Build Public Support

There are many excellent guides to community engagement and we do not attempt to replicate such guidance here. However, any planning process needs to have a plan for where, when, and how to engage the various public(s) that make up a city. Many city planning efforts do not include diverse opinions because the same people tend to show up for public meetings over and over again. Certain interest or advocacy groups may also have an outsized influence on city politics, but they may not represent all the varied perspectives. Ask whether those who attend meetings include all potential voices (e.g., are all meetings only attended by folks living north of the river, east of the railroad tracks, etc.?). This can be overcome – partially – by including a robust education and engagement campaign as part of the urban forest management planning process. If consultants are to be engaged to help with this, require that they detail their proposed approach to community engagement as part of their proposal responses and set expectations in the RPF for the number of community meetings or processes intended. For example, if only on-line surveys were used to gauge public opinion, this may leave out certain segments of the population.

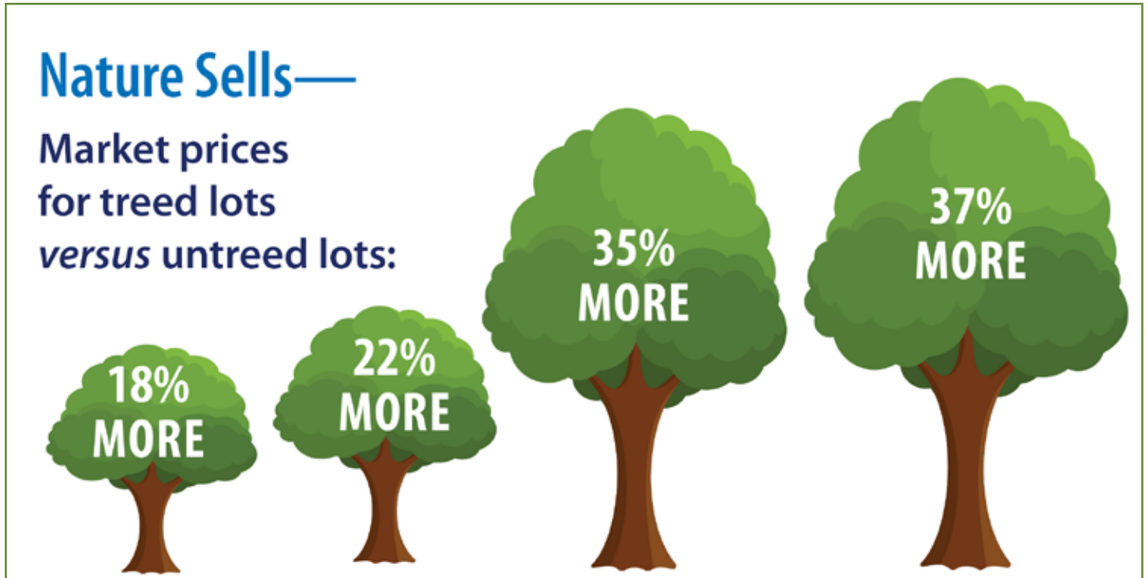
Pro Tip: Community engagement in the visioning process is one of the most important aspects of urban forest plans. This engagement builds ongoing community support for trees and the urban forestry program that often translates into funding and action.

—Rachel Comte, Urban Canopy Works LLC

Also note that more public education is likely needed to make people aware of tree benefits (trees clean our air and make us healthier, trees save us money on summer cooling costs) or to allay fears (trees always fall during storms or, more crime occurs when we plant trees – neither of which are true, but they are common concerns).

Consider forming a multi-stakeholder committee made up of city staff and representatives from the public to build support for the plan during the process. At some point, funds will be needed for implementation and the plan will need the voting public to back the plan.

To learn more about building community engagement see GIC's guide to **Tree Planning and Planting Campaigns** https://gicinc.org/books/tree-planning-and-planting-campaigns/



Assessments: The State of the Urban Forest

Any planning effort should be based on an understanding of the existing conditions of urban forests within a locality. These exiting conditions include ecological, social, and governance conditions. It is ultimately people's values that determine which resources are conserved and how that will be accomplished, so an understanding of those social values is as important as such ecological metrics as a tree canopy assessment. Data should be collected for each of these elements prior to, or as part of, a pre-planning effort. The type of plan and geographic boundaries of the plan should inform the data collection and assessment.

Examples of data include:

- **Ecological or physical data**
  - — Tree canopy assessment.
  - — Ecosystem services analysis – benefit analysis of trees: stormwater, heat mitigation, water quality, air quality, carbon, etc.
  - — Green infrastructure analysis – intactness, habitat, connectivity, wetlands, and other natural land cover.
  - — Risk analysis – risks facing urban trees: disease, pests, invasives, fragmentation, heat, flooding, storm surge, sea level rise, development, etc.
  - — Inventory of public trees (conducted by certified arborists or highly trained volunteers).
  - — Tree risk assessments (conducted by TRAQ professionals).

Social data

—Tree equity analysis – social/physical data, such as distribution of trees by race, income, neighborhoods, etc. (Combining U.S. census data, canopy, and inventory data).

—Survey of public perception of the urban forest and its values.

—Is there a local tree advocacy group(s)?

—Are there civic groups that plant trees? (These may be different than tree advocacy groups.)

Governance data

—Survey of city agencies and elected and appointed leaders for their perception of the urban forest and its value.

—Assessment codes and ordinances that impact trees and the urban forest (see GIC codes tool).

—Cross referencing: What other plans mention urban forestry?

—Is there a tree board or advisory council? Does it meet regularly? Is its advice taken?

—Assessment of current urban forestry program (see GIC's codes audit tool for a comprehensive list):

- Staff – who cares for trees, what are their qualifications: arborist? ISA? TRAQ? What departments are they in? Is there a dedicated urban forestry department?
- Funding – level and source? Is there funding to cover tree maintenance and care? Is there funding for tree planting?
- Maintenance – How are trees cared for? Is there a plan? How do priorities get set? Is the approach reactive or proactive? How is work recorded?
- Is there a tree risk plan or emergency storm response plan in place? How often are trees assessed for risk?
- Is there any coordination with the private sector (neighborhoods, large landholders, the business community, conservation, and tree groups)?

Stakeholders

Determine the stakeholder groups needed to formulate the vision, goals, and actions for the urban forest plan. Stakeholder groups should include representatives from the community and the city government. Workshops with these groups begin with looking at the assessments and the current state of the urban forest then move into crafting a vision for the future, then setting goals and determining actions for working toward that vision.

Public stakeholder committee:
Should embody the diversity and values found in the public survey.

Internal technical committee:
Departments include: urban forestry, planning, parks and rec, public works/utilities (stormwater, sewer, water), transportation, budget, emergency management, fire, police, and GIS.

Gaining Community Support — Before, During and After

When building support for urban forests, realize that many people may never have thought of themselves as living in an urban "forest." Consider doing two or more surveys of community knowledge, attitudes, and desires. For example, learning that people think urban trees are highly risky (and don't want them near their homes) could inform a community engagement plan that includes information about how to address tree risk and survey data and plans to remove unsafe trees or limbs from rights of way. Promoting the use of qualified arborists to treat trees for pests or to remove dangerous limbs is another solution.

If the planning process includes a social media campaign, then support for tree care and planting can be built during the process. Data about the condition of the urban forest (e.g., from a canopy map created at the beginning of the process) can inform statistics on tree loss and build impetus to act. Similarly, a finding that many street trees are at risk (through a tree inventory conducted ahead of any management plan) can build support to treat those risky trees before they become a problem during a storm event.

Vision and Goals

Develop a vision for a sustainable urban forest that defines the purpose of the urban forestry program. What is the plan timeframe and what do we want the urban forest to look like in 5, 10, 20 years? This should be based on where you are starting. (See the Goals Worksheet in the Appendix.)

Other questions include: What do we want the urban forest to provide? How will the urban forest be different with the implementation of this plan?

Gather data. Establish a vision. Then develop a broad set of goals, and determine your timeframe. These priorities will then determine your action plan going forward.

Actions

Stakeholders need to agree upon a list of actions they believe are necessary to achieve their vision and goals. These actions should range from the long term to short term and must include data-gathering (if not done previously). Depending on the scope of the plan, actions may be limited to city management of the urban forest or may include actions to be taken by community groups, local businesses, and citizens. Since 80% of lands within municipal boundaries are usually in private ownership, successful canopy retention or expansion goals must address public participation in planting on private lands.

Implementation Plan

Identified actions also will need to be prioritized, sequenced, funded, and assigned to government agencies, NGOs, or other organizations. Outside parties can share responsibilities for implementation when they are included as part of the planning process. Creating implementation plans, such as a 5-year action plan, and outlining these details will make the implementation work feasible. From the 5-year plan, annual work plans and budgets can be created. The implementation plan will need to be updated a year before its timeframe ends. All implementation actions must be tied to resources available to carry them forward. For example, if the plan's achievement would require 3 FTE arborists to carry them out and there is currently 1, or none, then the plan must include the costs to carry out the work and a method to obtain the funds (source and timeframe).

Adaptive Management/ Evaluation Benchmarks

Monitoring the plan's implementation is essential. The plan should have specific benchmarks for annual achievements. They can be logistical, such as, two more FTE arborists hired and trained, or environmental, such as 500 trees pruned in city parks by the end of the year. An implementation committee should be formalized and meet bi-annually to measure progress and evaluate assumptions, revise outcomes, and modify timeframes as needed.

> Evaluation should include questions such as "Is what we are doing getting us the results we wanted? Do we need to re-evaluate this approach?"

Measures taken in the assessments serve as a baseline for the state of urban forestry at the start of the process. Creating a system for continued measurement and evaluation will allow for adaptive management. Is what we are doing getting us the results we wanted? Do we need to re-evaluate this approach?

As part of the plan performance, metrics and an evaluation timeframe should be determined. For example, a city government may decide to have its tree canopy assessed every 5 years and will evaluate how the actions taken over the past 5 years have impacted tree canopy numbers. Or a city may decide to survey the public on their perception of the urban forest and its value at the end of an education outreach program to see if the program has impacted perceptions.

With continual evaluation and adaptive management that can revise implementation plans when current approaches aren't getting the intended results, the overall master or management plan can continue to serve as a living document and guide urban forestry for many years to come. Also note that for communities who are growing rapidly or face frequent changes in city leadership and staff, education about the importance and benefit of a healthy urban forest must be an on-going process.

Plan Adoption

Before beginning to implement your plan, determine if it will need to be formally adopted by the city, and work to build consensus and approval by including presentations and data-gathering into the initial stages of your process. Hold pot-lucks, public education events, make a presentation video, get the local press on your side, even find some local sponsors to fund your initial efforts. Consider bringing the plan to other community events such as football games, park festivals, and the like. The authors of this guide have found excellent plans languishing in city arborist offices because they were never formally adopted by the City Council or board and thus were never eligible for funding. Some elements of the plan may require coordination with the local capital improvement plan if it requires storage facilities or major equipment, such as a new bucket truck and a garage in which to park it, or a greenhouse and acreage to produce new tree stock.

Any new staff positions recommended in the plan will also require government approval and adequate budgeting. Keep in mind that arborists are often the first to be laid off during economic downturns. Some communities have insulated their field staff from such cuts by linking a percentage of tourism revenues (restaurant and lodging taxes) to parks and public works funding, since both are essential to a well-managed and attractive city.

Image Courtesy of Town of Irmo, SC

Bring the plan to other community events such as football games and park festivals. Engage young people who will be the tree stewards of the future.

Image Courtesy of JEA

Internal Planning vs. Consultant Planning

Urban forest plans may be led, developed, and written by city staff or an outside consultant may be hired to lead the process and deliver the final report. There are pros and cons to each approach. Internally developed plans are often tailored more closely to the specific needs of the community but take up a lot of staff time. Consultants offer expertise that a city may not have on staff but their services may be expensive. And, fair or not, recommendations made by consultants may be considered more credible by decision-makers than those made by staff. However, regardless of whether the plan is developed by consultants or internal staff, two-to-three staff from different city departments should guide the process internally.

Note that, even for internally-developed plans, it is common for a city to hire a consultant for part of the planning process, such as a tree canopy assessment, a tree inventory, or the community engagement process. If you are planning to hire consultants for all or part of the process, see Appendix 1 for recommendations on what to include in your requests for proposals (RFPs).

Feel free to contact GIC for more information and be sure to download and review the Center's guide for *Tree Planning and Planting Campaigns* at https://gicinc.org/books/tree-planning-and-planting-campaigns

Urban Forest Plan Case Studies

Reviewing example plans is useful for determining what elements your community may want to emulate for a new proposed plan. On the following pages are examples of plans that GIC's staff of planners, foresters, and landscape architects have found to be well constructed and actionable. Note that we have not fully evaluated their implementation successes, but we do endorse these plans as having the right ingredients for success. A brief synopsis of best practices found in each plan is provided, along with a link to obtain and review the plan yourselves.

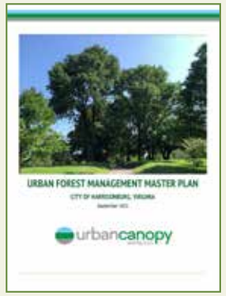
Can Small Communities Create Urban Forest Plans?

St. Augustine Beach is a small city in Florida with a population of 6,979 (2021). In 2019, it hired a consultant to prepare a tree inventory and Urban Forest Management Plan for the city. This plan provides guidance to the Department of Public Works and to the City Sustainability and Environmental Planning Advisory Committee (SEPAC) regarding the management of trees. According to Sandra Krempasky, Chair of SEPAC, "It is our job to make sure our urban forest is able to withstand intense weather and will be around for years to come." By completing an inventory of public trees and creating a management plan, this small city intends to proactively care for its trees before the next hurricane hits.

To learn more and get a copy of the plan go to https://www.staugbch.com/community/page/urban-forest-management-plan

CASE STUDY: Harrisonburg, Virginia

Urban Forest Management Plan



Small city in the Shenandoah Valley, Virginia

Population 51,000+

Tree City USA: 18 years

Plan prepared by: Urban Canopy Works, LLC (private forestry consultants, women-owned small business)

NOTABLE ASPECTS:

Engagement: The city formed a very diverse planning committee made up of both public and private sector groups to build community knowledge, ideas, and support. They also held community meetings and conducted surveys.

The plan itself lays out a clear purpose at the very beginning:

> The City of Harrisonburg has a vision that its urban forest is safe, efficient to maintain, complements its development goals, delivers equitable benefits, and enhances the character and livability of the city.

This plan was developed to assist Harrisonburg to better understand its urban forest's composition, structure, and tree maintenance needs as well as plan for both short-term and long-term resource allocation and develop risk management strategies.

The plan was accomplished by completing these tasks:

- Analyzing tree inventory data
- Incorporating citywide canopy cover information
- Obtaining public and stakeholder input
- Making data-driven, sustainable urban forest management recommendations
- Presenting a multi-year budget.

The plan goes on to make the case for management, noting:

> When properly maintained, trees return economic, environmental, and social value to the community. These benefits greatly outweigh the time and money invested in planting, pruning, protection, and removal.

The plan utilizes both the tree canopy map created for the city by GIC in 2018 and a new inventory conducted by city staff in 2020 and 2021 of trees in streets, parks, and school grounds. The inventory showed there are 48 genera and 78 species represented within Harrisonburg's public tree population so the urban forest successfully meets the recommended standard for genera diversity. Of the inventoried trees, 87% were recorded to be in good or better condition, with Excellent trees (7.2%); Very Good trees (21.6%); Good trees (58.3%); Fair trees (8.6%); Poor trees (3.0%); and Very Poor trees (1.4%). This led the city to conclude that, with the majority of public trees in good or better condition, required maintenance was limited to routine pruning for the vast majority of the trees, and removal was recommended for just 75 trees (3.5%).

The city used its canopy data to determine what a reasonable tree coverage would be for the future and to benchmark its coverage in comparison to similar cities. They also noted that the age distribution of its trees indicated that Harrisonburg's urban forest had a close-to ideal distribution, which is a good indicator of future sustainability.

Budget projections for maintenance and management were made using industry knowledge and regional tree maintenance costs, if a commercial company was to perform the work.

The plan includes clear goals and specific action steps to achieve them. It makes recommendations for updating the tree ordinance and also recommends monitoring of the plan's success as follows:

"The city should institute three forms of monitoring in association with the urban forest management plan: implementation, effectiveness, and validation.

- **Implementation Monitoring**: this determines if the plan is being implemented as designed, within resource and funding constraints. It asks, "Did we do what we set out to do?"
- **Effectiveness Monitoring**: This determines if the action taken achieved their stated goals and objectives. It asks, "Did it work?"
- **Validation Monitoring**: This determines if the assumptions, data, and models being used to make decisions were valid and appropriate."

According to Jeremy Harold, City Forester, Harrisonburg's plan has provided a roadmap for the next steps for the urban forestry program. It has built support in the city for urban forestry, justified new funding, and enabled him to create and hire a new position. Jeremy noted that hiring a consultant to create their Urban Forest Management Plan was the best path forward for Harrisonburg. Urban Canopy Works, LLC, the consultant, made the best case for the plan to City Council and achieved more notice for the plan than internal staff could have done alone.

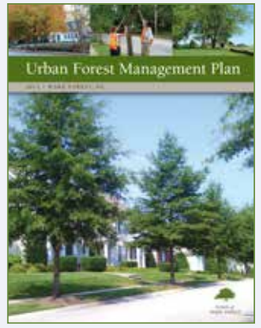
> *Pro tip from city Greenspace Manager Jeremey Harold:*
> **"Be patient and take advantage of changes in city leadership to make the case for trees and the urban forest."**

Multiple ideas from the plan have already been implemented.

To read the plan:
https://www.harrisonburgva.gov/sites/default/files/PublicWorks/files/Urban_Forestry/UFMP%20Final.pdf

CASE STUDY: Wake Forest, North Carolina

Urban Forest Management Plan



Mid-sized urban town in North Carolina's Piedmont Region

Population: 50,000

Tree city USA:
44 years, and winner of Arbor Day Foundation's growth award for the past 23 years.

Plan prepared by the Town of Wake Forest staff.

The plan lays out a clear vision and cites the benefits of trees for the city, noting that the management plan it is supported by the town's Community Plan:

> Support for street trees in Wake Forest is very strong. Area residents at town meetings held for the community plan offered a firm consensus in support of tree planting and preservation. Comments received at the first town meeting, for example, included "strong tree preservation ordinance" and "replant trees."

The plan was accomplished by analyzing tree inventory data and canopy cover estimates, consulting with stakeholders and the tree board, and referencing goals from the Comprehensive Plan, using data-driven, sustainable urban forest management recommendations, and presenting a multi-year budget and comparisons of cost of using city staff versus hiring consultants.

The plan lays out clear policies to implement espoused visions:

Policy ST-1: The town should prepare and maintain an official STREET TREE PLANTING MASTER PLAN to address: 1) the retrofitting of existing streets, where appropriate, 2) the planting of future streets and 3) the maintenance and replacement of dead, diseased, or disfigured trees.

Policy ST-2: So as to create a unity of design and effect, CONSISTENT STREET TREE SPECIES should occur along predetermined sections of streets.

Policy ST-3: To prevent future decimation of tree cover over entire areas of the community by disease (e.g., Dutch Elm disease), NO SINGLE TREE SPECIES should comprise more than 10 to 15% of the total street tree population of the town. Further, trees in a neighborhood area should vary from street to street.

Policy ST-4: REGULARLY SPACED STREET TREES should be planted in central medians, frontage street medians, plaza strips and, where necessary, in dedicated easements on private property.

Policy CC-5: Large trees, ponds, creeks, or other natural features of the landscape should be saved when locating new streets, buildings, parking lots, etc.

Policy HSE-6: VEGETATED RIPARIAN BUFFERS (natural or planted) shall be required along all creeks, rivers, lakes, and other water bodies in Wake Forest.

Policy HSE-12: A combination of incentives and disincentives may be employed to protect EXISTING TREES and/or require the replacement of trees removed for development.

The town also has a simple story map for notable trees in the downtown. https://storymaps.arcgis.com/stories/117e527f9aca45e88970f35d83e9d7d6

The plan made the following recommendation:

> RECOMMENDATION: Conduct a tree inventory for all maintained trees on Town property, and inspect all trees along trails and greenways periodically. Create a plan to respond to trees damaged by storms, which may fall across streets or greenways.

They have since conducted the inventory and update each tree record every 5 years. The inventory is posted by species on an online map, so as to easily share plan data: https://wakeforestnc.maps.arcgis.com/home/webmap/viewer.html?webmap=69405d48ed494889b83f4afb2b9bdb82

The plan also notes opportunities that exist for new trees:

> There are approximately 200 stumps from recently removed trees, 100 standing dead trees, and more than 5,000 locations where additional trees could be planted.

The plan uses its inventory data to inform what trees to plant where:

> It is generally recommended that no more than 10% of a town's street trees be of the same species, no more than 20% of the same genus, and no more than 30% of the same family. Following this 10/20/30 rule will help to ensure that pests and diseases are isolated and controllable, and have little impact on the total value of the urban forest. According to the 10/20/30 rule, Wake Forest has too many oaks, red and Freeman maples, and crape myrtles. Recommendations for alternatives to commonly planted species are provided.

The town focuses the plan inventory data to inform strategies to achieve needed tree age and sizes classes:

> RECOMMENDATION: Focus efforts to identify, protect, and maintain large-diameter trees, which are relatively rare, but have tremendous value. Ensure that the large number of young trees are receiving necessary care to correct problems when they can be addressed quickly and inexpensively.

It also noted that 8% of trees were in "Poor" or "Very Poor" condition, indicating major health or structural problems that could lead to death or structural failure. Such trees were likely to require removal in the near future.

continued

CASE STUDY: Wake Forest, North Carolina *(continued)*

Finally, the plan's budget charts clearly show costs to plant and maintain trees, allowing data to inform budgeting and for providing the various levels of service, as well as what those levels mean for the town. It notes that:

> When fewer resources are available, the program must operate at a lower level of service, often becoming reactionary and focusing on emergencies and major problems as they arise. While maintenance costs may be less, the health and quality of the forest is lower, and the work that is performed is less efficient. As service levels increase, more frequent preventative work is possible, and the safety, health, aesthetics, and benefits of the urban forest increase, often allowing the municipality to achieve both higher total benefits and receive more value per maintenance dollar.

Description of Service Levels

- **SERVICE LEVEL 1** represents a minimum responsible level of service. Below this level, community safety is threatened by falling trees and limbs. At this level of service, large trees are periodically inspected and pruned, and dangerous trees or limbs are removed Residents and volunteers are responsible for planting and maintaining trees. Wake Forest's previously expressed goals for the urban forest cannot be met at this level of service, and it would be difficult to maintain Tree City USA status.
- **SERVICE LEVEL 2** represents a program that provides a degree of preventative maintenance and planting. The town actively plants and maintains trees in the right of way, and problems with trees are eventually addressed. Without the assistance of residents and volunteers, trees cannot be replaced as quickly as they are removed. Currently, most aspects of Wake Forest's Urban Forestry Program fall within this level of service.
- **SERVICE LEVEL 3** represents a typical mature urban forestry program that is both financially efficient and arboriculturally effective. A focus on preventative maintenance ensures that most problems are addressed at an early stage, decreasing mortality and unplanned work requests. More trees are planted than are removed, and the value of the resource steadily increases over time. This overall level of service is the recommended goal for the program by 2017.
- **SERVICE LEVEL 4** represents an advanced urban forestry program that provides the highest reasonable level of service for a given street tree population. While the total costs of level 4 are the highest, the benefits are also the highest, and the benefit to cost ratio is better than in other levels. This level of service is usually only seen in areas in which landscaping is of very high importance. Over the next 5 years, only a few program components are recommended for this level of service.
- **BEYOND SERVICE LEVEL 4**, the increased costs of maintenance are unlikely to result in significant improvements in the quality of the urban forest.

According to Luke Devores, Urban Forestry Program Manager for the Town of Wake Forest, since the plan was adopted, the town has achieved Service Level 3. The department has four full-time staff: two tree trimmers, an urban forestry technician, and a program manager. The urban forestry program has the equipment and funding needed to deliver Service Level 3. Luke reported that the town had recently finished their first 5-year rotation of street tree inventories.

To read the plan:
https://www.wakeforestnc.gov/public-works/urban-forestry/urban-forest-management-plan#:~:text=Wake%20Forest%20is%20recognized%20for,in%20parks%20and%20town%20property.

CASE STUDY: Syracuse, New York

Urban Forest Master Plan

June 23, 2020

- City in central New York
- Population: 145,000
- Tree City USA for 33 years

Plan prepared by: Davey Resource Group (private forestry consultants)

NOTABLE ASPECTS:

Engagement: This plan was created with the city and project partner Onondaga Earth Corps. This partnership led to high levels of engagement with a very diverse planning committee made up of both public and private sector groups to build community knowledge, ideas, and support.

Data: The plan provides the ecosystem benefits of trees (air, water, etc.) and builds a compelling argument for why the plan is needed in the executive summary (including the consequences of not planning). Additionally, it makes use of public tree inventory data in its analysis and needs assessment. For example, the plan notes that:

> Tree canopy (and its many benefits) is not equally distributed across the city; canopy percentage across the neighborhoods ranges from a low of 9% to a high of 49%. Those citizens who live in the low canopy areas do not have access to the important benefits trees provide, which affects public health, economic prosperity and more.

Strategies: The plan does an excellent job of explaining the problems affecting the urban forest, backed up by supporting data, and of describing why action is needed, setting the table for its recommended actions. It makes good use of the data about city trees when expressing such arguments as:

> More than 60% of publicly-managed trees in Syracuse are in Fair condition, meaning a large percentage of city trees could fail in a storm, suffer from drought, and/or succumb to insect and disease pressures. Healthy trees are resilient trees and provide maximum benefits. Proactive care could improve these trees' condition to Good; lack of care may see them become Poor.

The consultants also made a concerted effort to reach out to many citizens who may have not been engaged previously, including new immigrant communities. They also summarized the urban forests' needs and how to improve community education going forward. They recommended the city develop a management plan and provide costs for such an undertaking, including future estimates of tree care costs. The city has already begun to implement recommended steps and has hired a firm to evaluate and redraft its tree ordinance, in order to improve its effectiveness in protecting city trees. According to the city arborist, the community engagement in the planning process has had lasting impact with community support and buy-in across the city.

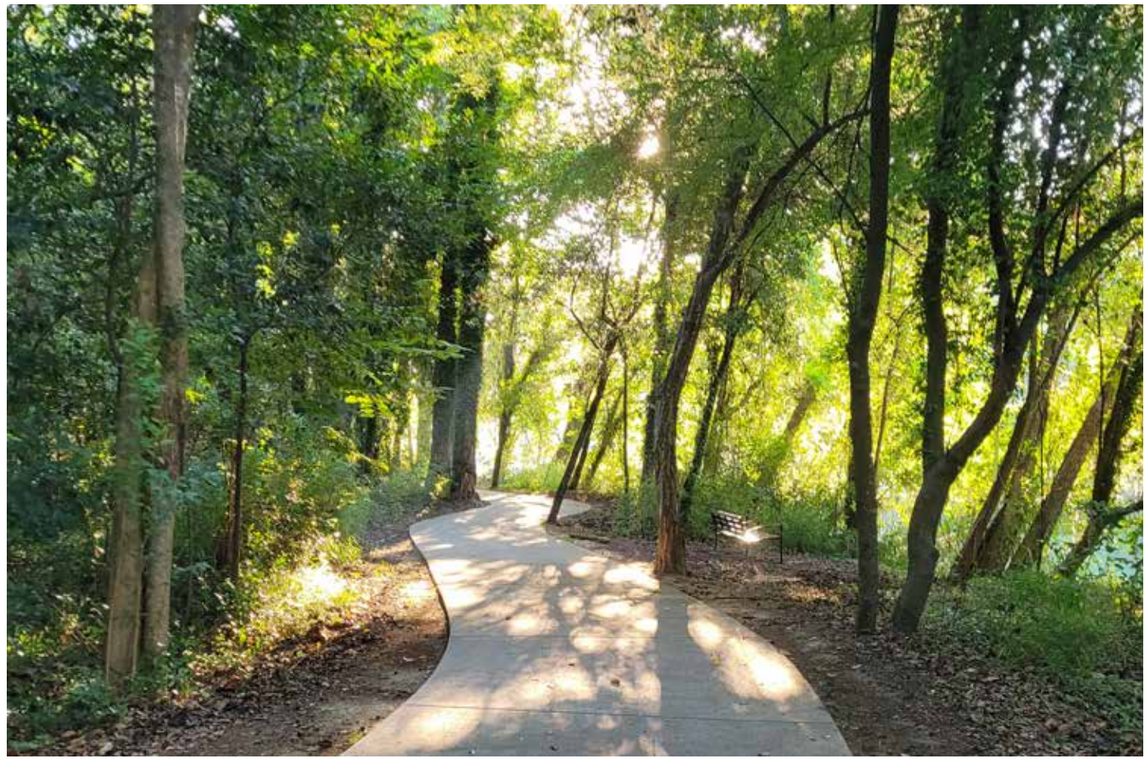
To read the plan:
https://www.syr.gov/files/sharedassets/public/2-departments/parks-recreation/documents/forestry/urban-forest-master-plan.pdf

Conclusion

As we end this guide, remember the old adage that, “Failure to plan is planning to fail.” Our urban forests need to be planned for and managed, just as we manage other natural assets, such as rivers, or built assets, such as roadways. As that wise guru Yogi Berra one noted, “If you don’t know where you’re going, you’ll end up someplace else.”

With our cities and towns facing many complex and difficult futures from new pests, to extreme weather, to growth and development, now more than ever we need coherent, thoughtful data-informed strategies. Achieving a balance of livable communities while maintaining our natural assets requires vision, data, commitment, and proactive planning.

Contact either GIC or your state’s urban forestry agency for further information on planning, planting, and funding opportunities.



Appendix 1

RFP Checklists *(Request for Proposal)*

for Tree Inventory, Canopy Mapping, Urban Forest Management Plan and Tree Risk Assessment

Communities may wish to hire consultants for tree inventory work, tree canopy assessment, tree risk assessments, or creating a plan. GIC has created reference sheets for those elements to include in these RFPs. Checklists for each service can be found here. To download the full documents go to South Carolina Forest Commissions' website: https://www.scfc.gov/wp-content/uploads/2021/07/SampleRequestBid.docx and https://www.scfc.gov/wp-content/uploads/2021/11/urbansamplereqproposal.docx

Tree Inventory RFP Elements to Include:

- All data created for this project becomes the property of [City/Town] and must be turned over at the project's completion.
- Specify exact locations for inventory, such as street rights of way, parks, schools, etc.; also include an estimate of the # of trees.
- Data fields must include, but are not limited to:
  - Location – street address, GPS coordinates to decimeter precision (4 inches), assign record # to tree (e.g., 1, 2, 3)
  - Image of Tree (photo)
  - Tree Common Name
  - Tree Latin Name (Genus, species) unless unknown (e.g., crabapple)
  - Trunk Diameter at Breast Height (DBH at 4.5' above grade)
  - Tree Height (Estimated in feet)
  - Trunk Spread (Visual estimated in feet)
  - Stems – number of stems below DBH
  - Tree Health Condition (Overall) – good, fair, poor, dead
  - Tree Structure: Condition of mechanical or structural portions of the tree, expressed as good, fair, poor, very poor.
  - Observations – general observations warranting recognition
  - Primary Maintenance needed:
    - — Overhead utilities: presence of primary or secondary electrical distribution wires or telephone or street lighting.
    - — Site Type, including Planting Area: The most limiting dimension of the planting area in feet.
    - — Other: for trees requiring further inspection:
      - Risk: flag e trees that need a follow up Level-2 Tree Risk Assessment.
      - Check Right of Way (RoW): determine if the tree is in a RoW.
      - Describe any limitation on access to the tree.
  - Growing Space Type: The type of location in which the tree is growing, such as lawn, natural area, border tree, tree pit, stream bank, etc.
  - Quality Control: All data, as itemized below, to be reviewed digitally for errors, and those errors corrected. The contractor will report its findings and corrections at the completion of each step.

- The consultant shall provide a map and database of all collected tree data.
- The consultant shall provide an inventory report summarizing the methodologies used and urban forest management statistics, outlined as follows.
  - Inventory Methodologies
  - Quality Control Summary (methods and results)
  - Management Statistics:
    - — Species Distribution
    - — Diameter Distribution
    - — Health Distribution
    - — Work Need
    - — Trees Flagged for Additional Risk Assessment
    - — Work Needs/Recommendations
    - — Tree Species Exceeding 10% of the Total Population

For details: https://www.scfc.gov/wp-content/uploads/2021/07/SampleRequestBid.docx

Appendix 1. RFP Checklists *(continued)*

Tree Canopy Mapping RFP Elements to Include:

- All data created for this project becomes the property of [City/Town] and must be turned over at the project's completion.
- The consultant will conduct the classification of citywide land cover using the most recent aerial imagery from the National Aerial Imagery Project (NAIP) (4-bands) available for [City/Town].
- Imagery will be classified into all classes, including: tree canopy, other vegetation (turf, shrubs), impervious surfaces, bare earth/sand, building and non-building impervious surfaces, and water.
- If available, the consultant will obtain the most recent LiDAR data to differentiate smaller shrubs from trees.
- Land cover classes will be calculated by percent, and also by specific requested areas of analysis for urban tree canopy (e.g., trees citywide, in parks, historic districts, census blocks/tracts, downtown).
- The consultant will also prepare a QA/QC report for derived data to achieve at least 95% overall mapping accuracy. The consultant to report on how such accuracy was determined (e.g., confusion matrix, field verification, etc.).
- The consultant will provide, at minimum, the following information, based on the data collection in the form of data, maps, and narrative:
  - Calculation of acres and percent of land area covered by tree canopy citywide, and at least three other geographies (e.g., land use type, neighborhood, rights of way, census block groups, parks).
  - Identification and mapping of areas that are suitable for tree planting = Potential Planting Areas (PPA). The consultant shall detail how unsuitable areas (e.g., sports fields, utility conflicts, etc.) will be accounted for and removed from the PPA. Areas suitable for planting may also be categorized in terms of priority areas related to benefits of trees, such as urban heat island, stormwater flooding, or other benefits.
  - Quantification of ecosystem services of the city's tree canopy, which may include, but is not limited to, stormwater management, air quality, carbon sequestration, and urban heat island mitigation. At the completion of this task, the consultant will present results to [City/Town] staff. Tools in the i-Tree suite https://www.itreetools.org/ can be used for some of these calculations.
  - Recommendations for a percentage tree canopy goal shall be based on the current tree canopy percentage and the determined PPA.
  - The consultant will present a draft of the canopy data and maps to [City/Town] staff to review and staff comments will be addressed before the final maps and report are complete.
- The consultant will deliver a report and data as follows:
  - A tree canopy assessment report [XX pages], to include findings and methods, as well as maps of the tree canopy, potential planting areas, identified priority areas by canopy cover (e.g., parks), and documentation of ecosystem services' calculations. The report will be formatted for printing and an ADA compliant version digital version will be provided for the City/Town website. [Optional: Specify X # printed copies to be provided by the consultant].
  - A PPTX presentation of results in slide deck format, to be used for community education [15-20 slides], including maps and canopy assessment results.
  - A GIS file and geodatabase of the tree canopy and land cover to incorporate into the city's GIS system. GIS files must include tree canopy data in both raw raster and vector formats, as well as pre-made map documents from (1) above that include all relevant files created for the project.
  - [Optional: ___# of community education events, workshops or surveys of tree values will be held to engage the community in understanding canopy assessment and supporting canopy protection or expansion.]

For details: https://www.scfc.gov/wp-content/uploads/2021/07/SampleRequestBid.docx

Tree Risk Assessment RFP Elements to Include:

- All data created for this project becomes the property of [City/Town] and must be turned over at the project's completion.
- The bidder shall be able to recognize the native trees of ____ (state/region), as well as a wide variety of exotic and ornamental trees and be proficient in the use of common tree risk assessment tools and techniques.
- The bidder shall be an ISA Certified Arborist of at least 3 years standing, with Tree Risk Assessment Qualification (TRAQ) for at least 1 year.
- The bidder must provide documentation of ISA Certified Arborist Number and TRAQ qualification.
- Specify locations for tree risk assessment, such as specified trees, areas, or miles of RoWs and risk assessment level (Level 1 or 2) for each area.
- If advanced assessment tools or techniques are needed at an additional cost on high-value trees, authorization shall be obtained before proceeding.
- Risk assessment data fields must include, but are not limited to:
  - Name of the tree risk assessor and date of the assessment(s).
  - Location – street address, GPS coordinates to decimeter precision (4 inches), assign record # to tree (e.g., 1, 2, 3).
  - Level of assessment (limited visual, Level 1; basic, level 2; or advanced, Level 3) and details of the assessment (such as tools or techniques used).
  - If contracting for a Level-2 or Level-3 assessments also include:
    - — targets, occupancy rates, likelihood of failure and impacting a target, and potential consequences of failure.
    - — Site factors that were considered (history of failures, storm patterns, changes in wind exposure, soil conditions, or changes in grade).
    - — Documentation of likelihood of failure, such as a list of tree conditions, structural defects, and response growth that were observed; measurements of defects (size, shape and fall distance) may be included.
    - — Risk rating for each potential target and condition of concern, including information on specific failure mode/target combinations, and conclusion.
    - — Overall risk rating for each tree.
    - — Options and/or recommendations for mitigation and recommended timetable for mitigation (immediate, as soon as possible, as soon as work schedule allows, or if desired).
    - — Information on residual risk (risk after mitigation measures are completed).
    - — Recommendations for reassessment (interval level and type).
    - — Limitations of the assessment.

For details: https://www.scfc.gov/wp-content/uploads/2021/11/urbansamplereqproposal.docx

Appendix 1. RFP Checklists *(continued)*

Urban Forest Master Plan RFP Elements to Include:

- All data created for this project becomes the property of [City/Town] and must be turned over at the project's completion.
- The plan should be based on tree canopy and plantable areas data (if existing, or include spatially-based canopy mapping as part of the process).
- Current canopy cover (by percentage if known; if not available, to include canopy mapping in RFP – See the Canopy Mapping RFP above).
- Trends – canopy change (either use prior data, if it is available and is of comparable accuracy for comparison; or fund two assessments 5-10 years apart.
- Ecosystem benefits – use canopy data to derive values for air quality, stormwater uptake, heat mitigation, etc. (Use i-Tree tools or generate report through i-Tree Eco).
- An assessment of tree cover adequacy by any of: neighborhood, zoning, enterprise areas, census tracts, historic districts, etc.
- A full public engagement process (if intended to be run by the consultant), including methods for outreach, targeted audiences, process duration, follow-through, and timing. If attitude or awareness surveys are to be conducted, specify if such surveys should be qualitative (self-selected participants) or quantitative (random sampling).
- Detail the process for engaging City staff (see earlier recommendations for muti-agency planning team) to make recommendations, set goals, and make final decisions for the plan.
- Strategies for where, and how, to plant trees or maintain existing tree cover (to be developed during the planning process), including spatial maps showing target locations for areas to manage or plant.
- Optional: Consider a review of existing tree codes to guarantee that the right standards are in place to ensure tree planting success such as planting standards, tree well sizes, tree lists, etc. See GIC's tree codes audit tool.

Urban Forest Management Plan RFP Elements to Include:

- All data created for this project becomes the property of [City/Town] and must be turned over at the project's completion.
- Public engagement process (if intended to be run by consultant) including methods for outreach, targeted audiences, process duration and timing. If attitude or awareness surveys to be conducted, specify if such surveys should be qualitative (self-selected participants) or quantitative (random sampling)
- Plan should be based on tree inventory data (if existing, or include inventory as part of the process)
- Trends – species diversity, size distribution, condition, primary maintenance needs, etc.
- Ecosystem benefits – use canopy data to derive values for air quality, stormwater uptake, heat mitigation, etc. (Use i-Tree tools or generate report through i-Tree Eco).
- Current canopy cover (by percentage if known; if not available, to include canopy mapping in RFP – See the Canopy Mapping RFP above).
- Tree risk assessment data (if known). If not known, consider including canopy cover mapping and see RFP above.
- 5- and 10-year strategies for maintenance schedules and responsible parties.
- Annual, 5-year and 10-year budgets for maintenance activities.
- Assessment of current personnel, equipment, and capacities to meet management needs.
- Potential pest and disease management needs.
- General recommendations including relevant goals for forest cover.
- Applicable charts and graphs.
- Appendices.
- Optional: Consider a review of existing tree codes to ensure the right standards are in place to ensure tree planting success such as planting standards, tree well sizes, tree lists, etc. See GIC's tree codes audit tool.

For details: https://www.scfc.gov/wp-content/uploads/2021/07/SampleRequestBid.docx

Appendix 2

Checklist: for Urban Forest Master Plan

Essential Elements

List benefits trees provide for:
- Beautification, character
- Economy (taxes, real estate, shopping)
- For health (exercise, clean air, etc.)

Tree canopy assessment:
- Percent tree canopy
- Canopy extent and analysis
- Potential planting areas
- Number of new trees potential to plant

Urban forestry program assessment:
- Tree management program
- Policy and planning – tree codes
- City agency & leadership roles

Community assessment:
- Community survey of attitudes
- Evaluation of capacity available – advocacy and interest groups
- Tree equity analysis

Community engagement:
- Stakeholder engagement
- Public outreach

Vision and goals for the urban forest:
- Canopy goal based on data (existing and potential new canopy) and community input

Implementation Actions for Agency(s):
- Steps for government agencies, leadership needs
- Coordination between city departments and boards

Implementation Plan:
- Prioritized short- and long-term actions

Measurable Benchmarks:
- Number of trees to be planted (by location, by year)
- Comparison to similar cities
- Comparison to region

Recommended Elements

Ecosystem services calculations (measures):
- Trees and stormwater uptake/cleansing
- Trees and heat mitigation
- Air quality and carbon capture

Tree canopy geometries' maps:
- Canopy by census block groups (income, race) neighborhoods, streets, council districts, etc.
- Parks, schools, watersheds, waterways

Risk analysis:
- Disease, pests, and invasives impacts
- Development and growth
- Climate change (e.g., heat, sea-level rise, storm surge)

Green Infrastructure analysis:
- Important habitat and connectivity
- Forested wetlands, stream buffers, etc.
- Access to forested natural areas/recreation

New advocacy group formation:
- Create and mentor new groups
- Create networking and co-learning options

Policy and Planning Tools:
- Codes and policies audit for trees
- Codes driving impervious area expansion
- Recommended code changes

Implementation Actions for All:
- Roles for nonprofits, private sector, businesses and neighborhood groups and citizens (requires robust engagement/seeking agreement)

Implementation Plan Logistics:
- Responsible parties, cost for actions, timetables
- Assessment criteria/process/schedule for regular updates

Percent Canopy Maintained/Achieved:
- Areas retained in tree cover (citywide, by neighborhoods, by zoning class)
- Adaptive management – process to change approach if benchmarks not achieved

Checklist: for Urban Forest Management Plan

Essential Elements

List benefits trees provide for:
- Beautification, character
- Economy (taxes, real estate, shopping)
- For health (exercise, clean air, etc.)

Public tree inventory & report:
- Street trees, park and school trees, public facility trees, utility trees
- Species diversity
- Health
- Maintenance needs
- Invasive species/removal needs

Urban forestry program assessment:
- Tree management practices
- Budget/funding
- Equipment inventory (tools, trucks, etc.)
- Staffing and qualifications required
- Policy for tree care, protection, retention
- Storm/emergency planning status

Tree canopy assessment and goal:
- From master plan or new spatial-based canopy maps using aerial imagery

Community engagement:
- Tree board/advocacy groups

Vision and goals for the urban forest:
- Vision from master plan
- Goals for public trees (by percent, by type of facility such as parks or schools)

Government-based Actions:
- Steps for government agencies, leadership needs
- Coordination between city departments and boards

Implementation Plan:
- 5-year plan
- Annual work plan
- Budgets (annual, long term)

Measurable Benchmarks:
- Canopy goals for 5, 10, 15 years
- Numbers of trees assessed, pruned, planted
- Assessment criteria/process

Recommended Elements

Ecosystem services calculations (measures):
- Trees and stormwater uptake/cleansing
- Trees and heat mitigation
- Air quality and carbon capture

Managing Risk:
- Tree risk management program or plan for where to assess tree risks such as disease, poor form, utility conflicts
- Storm planning for urban forest including pre-contracting, debris management, emergency response and recovery

Policy and Planning Tools:
- Codes and policies audit for trees
- Codes driving impervious area expansion
- Recommended code changes
- Sample plots of trees to estimate species diversity for an entire city
- Web maps of trees assessed, planted
- Regular webinars, workshops, trainings
- Canopy goals by neighborhoods, special districts, downtowns or watersheds

Appendix 3

References and Resources

Clark, James R., and Nelda P. Matheny. "A model of urban forest sustainability: application to cities in the United States." *Journal of Arboriculture* 24 (1998): 112-120.

Kenney, W. Andy, Philip JE Van Wassenaer, and *Alexander L. Satel. "Criteria and indicators for strategic urban forest planning and management." Arboriculture* & Urban Forestry 37, no. 3 (2011): 108-117.

Nowak, David J., and Eric J. Greenfield. "Declining urban and community tree cover in the United States." *Urban Forestry & Urban Greening* 32 (2018): 32-55.

Parmehr, Ebadat G., Marco Amati, Elizabeth J. Taylor, and Stephen J. Livesley. "Estimation of urban tree canopy cover using random point sampling and remote sensing methods" *Urban Forestry & Urban Greening*, 20 (2016): 160-171

GIC Resources:

A Community Forest Storm Mitigation Plan can be made part of the community's existing emergency plan or can be a standalone plan. Such a plan should focus specifically on ways to avoid or mitigate the damage trees may cause during a storm or other catastrophic event. To get GIC's guides and case studies visit: https://gicinc.org/projects/resiliency/storm-mitigation-planning/

Tree Planning and Planting Campaigns: https://gicinc.org/books/tree-planning-and-planting-campaigns/

Planners Forest Toolkit: https://gicinc.org/books/planners-forest-toolkit/

Tree Canopy Mapping and Assessment https://gicinc.org/projects/healthy-green-cities/tree-planning-and-planting/

Policy and Ordinance Tools https://gicinc.org/resources/tools/

Appendix 4

Goal and Objectives Worksheet

Created by Karen Firehock

This worksheet is intended to help you craft a strategy for creating, maintaining, and sustaining a viable, long-term tree canopy for your urban community. If your strategy is intended to achieve a larger vision, a vision statement is usually prepared. Vision statements look toward future desired conditions and should be inspiring and achievable.

A **strategy** contains the purpose and action plan to help you achieve your goals.

A **goal** explains what you want to achieve and why.

An **objective** details what you will achieve/do to meet your goal. An objective should be measurable and quantifiable. You should be able to tell if you did it or not achieve it, so objectives should be as specific as possible.

A timeframe for each objective should be included. You may also add specific benchmarks along the way so, if your goal will take two years to achieve, you may also have specific benchmarks to help determine if you are on track to meet your objective(s). If you miss a benchmark, then evaluate why and what fixes may be needed to achieve your benchmark and ultimate objective(s). An objective can help to meet more than one goal.

Following is a suggested format structure.

Goal 1: What you want to achieve and the purpose for doing so.

Objective 1A: A specific measurable outcome to achieve the goal above.

Task 1: A specific task to achieve the objective 1A.

Task 2: A specific task to achieve the objective 1A.

Task 3: A specific task to achieve the objective 1A.

Timeframe: by a specific date or over a defined period of time.

Responsible parties: identify who will participate in the objectives and in each task.

Cost: If your strategy has a cost, define the amount and ideally, the source of the funding.

A good strategy needs to have measurable outcomes. For example, if your goal is to reduce urban runoff by planting more trees, you should have objectives that are specific to meeting this goal. Avoid vague statements, such as, "To plant more trees" or "To increase forest canopy." Be specific. How many more trees will you need to plant? How much new canopy is needed, and where is it needed? How much of your area is currently forested? Do you need to increase that amount and, if so, by what percent? Is your area forested on ridges, but not along valley streams? If you determine that forested stream buffers are needed, how wide a buffer can you recommend and for how many miles? How will you measure achievement of this objective? Who will do this work and who will pay for it? Who will track progress and make changes if sufficient progress is not met?

Optional: You may also include a rationale in which you state 1-2 paragraphs on the background of the issue or need for which you are writing your goal. Your rationale can follow each goal. Here, you can include key statistics or data about the current state of the resource and why action is needed. This provides the reasons and basis for your goal for others who may not be familiar with the issue.

STRATEGY WORKSHEET

Date:_____

Your name(s) for reference: _____

GOAL #_____**:**_____

_____

WHY? what do you want to achieve and why?_____

_____

_____

WHAT? what will you do? what measures achievement?_____

_____

_____

OBJECTIVE #_____**:** _____

HOW? what steps will you take to achieve your objective?

TASK 1: _____

TASK 2: _____

TASK 3: _____

WHEN? TIMEFRAME:_____

WHO? who will carry the work forward e.g., which city department or partner group?

RESPONSIBLE PARTIES: _____

_____

_____

COST: _____

(optional, add sources for funding $)_____