Urban Forest Management:

A Primer to Strategic Planning for Municipal Governments

Robert J. Northrop
Michael G. Andreu, Ph.D.
Wayne Zipperer, Ph.D.

UF IFAS UNIVERSITY of FLORIDA

FOREST SERVICE
USDA
DEPARTMENT OF AGRICULTURE

Urban Forest Management: A Primer to Strategic Planning for Municipal Governments

Robert J. Northrop, Extension Forester, UF/IFAS Extension, Hillsborough County

Michael G. Andreu, Ph.D., Associate Professor, UF/IFAS School of Forest, Fisheries, and Geomatics Sciences

Wayne C. Zipperer, Ph.D., Research Forester, USDA, Forest Service

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Neighborhood shopping district in Barcelona, Spain.

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Park in Tampa, FL. UF/IFAS photo by Tyler Jones

Introduction

The purpose of this guide is to assist in the organization of a strategic plan for urban forest management. This guide was written specifically for use by people responsible for the initiation, or redesign, for an urban forest management program. The methodology is flexible, adaptable and appropriate for town, city, county and state urban forest management program development. It was initially developed for use in the State of Florida, but this framework can be applied universally.

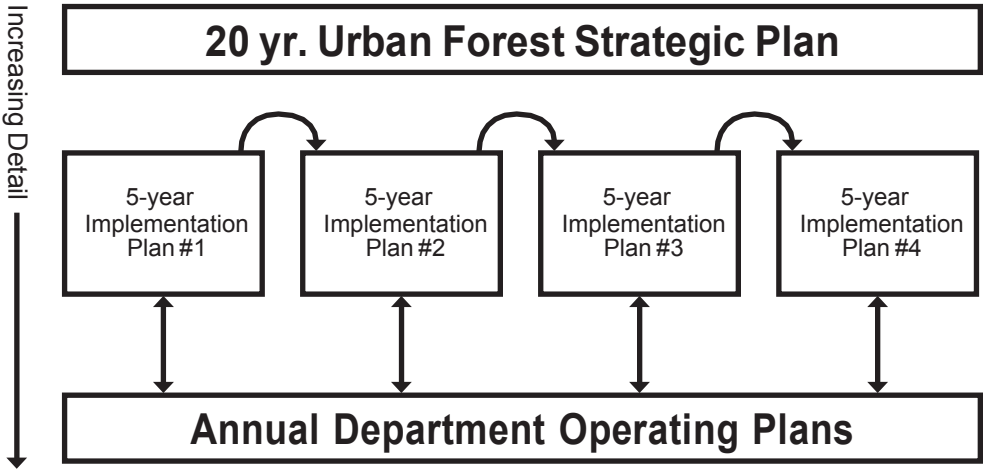
Our experience suggests that in the current environment, urban forest management tends to involve short-term decision-making reacting to immediate needs (safety, tree hazards, etc.), principally driven by rapid land-use change and local economic concerns. It tends to address the symptoms of the problem rather than the problem itself (reactive vs. proactive). As a result, decisions and actions are often redundant, inefficient, and sometimes have to be completely redone as other priorities are identified later. What is needed is a longer-term perspective that puts forest management within the broader context of the city's infrastructure and does not leave it as an afterthought.

Decision making has short-term and long-term implications. In the short term, the implementation of urban forest management on a project-by-project basis often meets the immediate needs of citizens and their government leaders. However, in the long run, a focus on immediate objectives and outcomes often misses the opportunity to address the resilience of the urban forest system and its capacity to adapt to the pressures of urban densification, expansion, and climate change.

An effective and sustainable urban forest management program must address three major components: social systems, governance systems, and the ecological systems. The social component provides the justification for the plan by demonstrating value to the people that live and utilize the forest. The governance component provides guidance to responsible entities on how, when and where management activities will occur. The ecological component addresses the dynamic nature of the system, which is the reason this process is different than simply managing other infrastructure such as transportation systems, sewer systems or electrical grids. As you might expect, the social and governance components add a level of complexity to the planning process not often encountered when developing an urban forest management program. Ideally these three components are integrated throughout the plan to inform government department procedures, policies, and other activities.

This guide will lead you through a series of steps to develop a long-range strategic plan* that will:

1. Identify the perceptions and values of the citizens.
2. Create a citizen-based vision for the urban forest.
3. Identify broad qualitative goals that define the vision.
4. Draw up guiding principles that define the limits of government purpose and action.
5. Identify quantifiable management objectives.
6. Implement plans (short range).
7. Develop annual work plans; and
8. Monitor implementation and effectiveness.



**Here we use a 20-year strategic planning horizon together with 5-year implementation plan horizons to illustrate long- and short-range planning components.*

There are five sections in this guide: 1) the conceptual framework, 2) plan initiation and engagement, 3) plan development, 4) plan re-engagement and adoption, and 5) plan implementation and accountability.

For each implementation step, we provide the *what, who, how, and why*. In addition, we indicate specific appendices with information on various techniques, methodologies and examples, as well as an annotated bibliography.

Our Rationale for Strategic Planning

1. Natural resource conservation management is principally a social endeavor. Whether on private property or on publicly owned land, it is ultimately people's values that determine which resources are conserved and how that will be accomplished.
2. Many urban forest management programs fail because they ignore residents' values, ignore how they came by them, and how firmly they hold them.
3. There is no right or wrong time to initiate an urban forestry program. Urban forest management is an ongoing dialogue between society (social and governance) and the land.
4. Urban forest management is not static. It is dynamic and changes with changes to the social, governance and ecological conditions.
5. The process for urban forest management planning takes time. Expect delays when working cooperatively with private citizens, numerous government agencies and businesses. It is best not to promise delivery of the final draft before 2 years from the project start date.
6. Depending upon the history of urban forestry, size of the city, and the complexity of the government, some of the steps can be accomplished simultaneously, though it is advised that all steps be completed in the sequence recommended.
7. Thoroughly review how early phases of the planning process are working and adapt subsequent phases accordingly. Anticipate complexity and change, and incorporate checks, balances and feedback.
8. The intent of strategic planning is not to eliminate risk, but to increase the odds of success. There are no right answers, simply better choices.
9. We assume all individuals involved in the process are working in good faith to represent what is best for the forest and the people for which the plan addresses.

Residential district, New York City, NY.

Conceptual Framework

Urban planners and city administrators face daily challenges in managing complex urban environments, such as maintaining sufficient levels of clean water, clean air, energy, housing, and green spaces, as well as addressing conflicts of interest related to land use. More than ever, they must rise to the challenge of ensuring that their cities are economically, socially, and environmentally sustainable. Well-designed and managed urban forests are integral to meeting this challenge: urban forests can make significant contributions to the sustainable development, economic viability and livability of cities. In an urban environment, healthy and thriving trees, woodlands, and parks require careful planning, design, and management to achieve their full economic, social, and ecological potential.

Urban forest

A human ecosystem in which there are formal regimented plantings of trees, palms and shrubs along roads and boulevards, to small groups of trees and shrubs in residential yards, to trees in planned parks, woodlots and remnant native forests.

Sound governance of a modern city implies a fundamental transition from the traditional notion of municipal government with a top-down decision-making process to that of local governance, in which community stakeholders have the opportunity to participate in policy development, planning, and management.

A scientifically grounded management program is necessary to maximize the value and minimize the risk associated with trees within this complex and dynamic human ecological system. The initial step in meeting these challenges is to identify and organize baseline information on the social and bio-physical context in which the urban forest must exist. The values of residents regarding the urban forest can be determined by formal (social science) surveys; focus groups; and nominal group sessions. Economic trends and their analyses can be gathered through municipal and state government agencies and business associations. Baseline bio-physical information can be generated through various science-based inventory and analysis methods that describes the extent, distribution, composition, and health of the trees and woodlands within the municipal boundary.

Organization of the Plan for an Urban Forest Management Program

A strategic plan for urban forest management identifies a series of practical and quantifiable steps that guide activities and resources to accomplish predetermined outcomes, the time frame for implementation, and the responsible agency or partnership. By establishing clear lines of responsibility and measurable objectives tied to reasonable timelines, the city can measure successes and identify programmatic areas in need of further attention. The plan itself is best seen as a long-term process, a living and adaptable plan of action, and not a static product.

Vision, goals, guiding principles, elements, performance indicators and objectives provide a framework for defining a sustainable urban forest management program and assessing progress toward efficient and effective operation and delivering public services. The ultimate aim of the Strategic plan is to promote improved place-based urban forest management over time, and to further the development of a healthier and more productive urban forest to support a healthier human community.

The **vision** statement defines the future desired condition of the urban forest based upon the collective values of the city residents.

In the context of strategic planning, **goals** are qualitative targets, an end result or something to be desired. It is a major step in actualizing the vision. A goal is a place where the urban forestry program wants to be—its destination.

Guiding principles define the legal limits and constraints of city management.

Elements (see Appendix E) define essential plan components against which sustainability of urban forest management is measured, with due consideration paid to the environmental, economic, and social and cultural roles of the urban forest. Elements are envisioned as a large-scale reflection of public values as described by the vision and goals initially set by a public committee. Each element has a corresponding management objective.

An **Objective** is the quantifiable target of management. Objectives also reflect the limits of municipal government activities as defined by the guiding principles.

Performance indicators (see Appendix E) measure progress towards the achievement of objectives. Performance Indicators allow the city to monitor and assess the effectiveness of management actions, and to facilitate decision-making in the city's urban forest policy processes. This evaluation component sets up a process of learning and adaptive management that will inform future plans.

Elements, objectives and performance indicators are tied to a 5-year cycle of social and bio-physical assessment. These assessments provide a source of reference information for policy makers, resource managers, and concerned citizens. They provide a concise and comprehensive picture of the condition of the social, economic and bio-physical components of the city's urban forest. They are designed to allow the City to track and analyze long-term trends concerning management of the City's urban forests for present and future generations.

Elements, objectives and performance indicators also allow the city the assessment capability to use an adaptive management approach to urban forestry and promote flexible decision-making. Careful monitoring of the performance indicators will help the administration adjust policies or operations as part of an iterative learning process, leading to more efficient and effective decisions and enhanced benefits, while reducing tensions among stakeholders.

Performance indicators allow the city and its partners the assessment capability to use an **Adaptive Management approach** to conservation management and promote

flexible decision-making. Careful monitoring of the indicators helps the County's administration adjust policies or operations as part of an iterative learning process leading to more effective decisions and enhanced benefits, while reducing tensions among staff and partners.

Adaptive Management is a scientific approach that can be used in a conservation management decision process. It promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. (See Appendix C)

UF/IFAS photo by Tyler Jones

Workflow of an adaptive management approach.

Key Attributes and Components to Consider in Urban Forest Strategic Planning

An effective and sustainable urban forest management program (UFMP) addresses three major elements: social systems, governance systems, and the ecological systems.

Commercial district in Barcelona, Spain.

Social-economic system

Population size

1. Age
2. Gender
3. Race
4. Wealth
5. Knowledge
6. Values – individual identity, norms, cultural diversity, equity, inclusion
7. Business and residential neighborhoods
8. Institutions – health, justice, faith, education
9. Historical land use
10. Environmental stewards and volunteers

Governance system

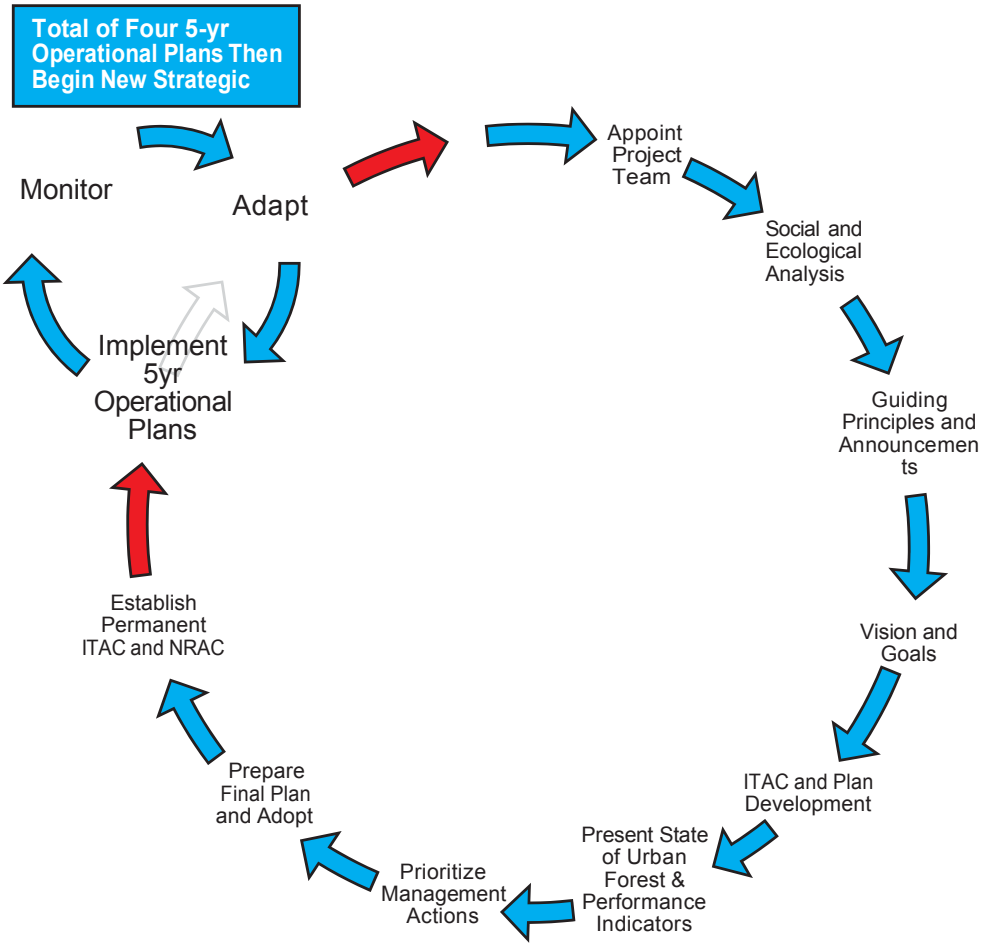
1. Form of governance –
2. Government complexity
3. Budget - Tax receipts and expenditures; capital vs expense funding
4. Alternative funding sources – trust accounts, state, federal, utilities
5. Community engagement practices – direct and indirect
6. Public participatory processes -
7. Policies/guidelines
8. Internal government culture and processes
9. Regulations/rights and permits
10. Plans – land use, commerce, natural resources, etc.
11. Incentives/grants
12. Existing urban forestry/ arboriculture programs
13. Direct management of the urban forest

Ecological system

1. Plant, shrub and Tree Species
    a. Plant, shrub and tree species
    b. Population sizes and aggradations
    c. Distribution across the metropolitan area
    d. Size distribution of trees
    e. Condition of trees, shrubs and forest patches
    f. Regeneration trends of public trees and forest patches
    g. Native/non-native
    h. Invasive species
2. Hydrology
3. Soils
4. Fauna
    a. Domestic
    b. Native – Invasive
5. Natural Areas/Naturalized Parks
6. Land use history
7. Fragmentation of forest patches and connectivity

Planning Cycle

Sustainable management of an urban forest, with its long biological life cycles and slow growth, requires a long-term perspective. Sustaining the urban forest will not be achieved through a series of short-term intervention and actions.



Strategic urban forest management planning with a 20-year planning horizon meets the challenge of programmatic continuity by planning on a long-time framework. It also provides opportunity for direct guidance on intermediate 5-year departmental/ operational planning cycles and provides direct input into annual work plans and decision-making. Sustaining the new urban forest management program will require a collaborative effort between citizens and their government. It will need to be directly supported by the City Mayor/Manager and City Commission, and involve of all city agencies, business and professional organizations, neighborhood associations and citizens during the plan's development.

Strategic Planning Steps

The following 28 strategic planning steps represent a deliberative, iterative and inclusive process for the organization of a comprehensive urban forestry program. The resulting urban forestry program will be place-based, cooperative, multiparty and grounded in high-quality science.

It all starts with a Vision of the future urban forest.

1. Plan Initiation and Engagement

Year 1											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
x											

Step 1: Appoint Project Team

What:

Appoint a Project Team (2-3 people) to actively guide, facilitate and oversee the strategic urban forest management planning process. They need to be able to work together to meet a common goal of crafting a strategic plan for urban forest management programs.

Why:

Professional skills will be essential to successfully guide the strategic urban forest management planning process.

Who:

City Administration

How:

Appoint members of the Project Team that will bring needed expertise in project planning, meeting planning and facilitation, and consensus building, as well as forest science and ecology.

Attributes of a successful project team include:

- Knowledgeable and experienced in facilitation, consensus building and conflict resolution
- Experienced in multi-year strategic planning
- Knowledgeable about social survey design and analysis
- Knowledgeable and experienced in forest ecology, arboriculture and urban forest management.
- Knowledgeable and experienced in government processes including budgetary cycles; comprehensive planning; policy development; and development of ordinances and laws pertaining to urban forest management and land use change.

Our experience suggests...

1. Outside consultants may be disinterested and guide development of a strategic plan that is not tailored to specific social, ecological and governance conditions.
2. Ideally, the mandate for the initiation of this strategic planning process comes from the government's chief executive, to ensure that all departments and agencies fully cooperate in its development.

Project planning team. UF/IFAS photo by Tyler Jones

Step 2(a): Community Engagement

Year 1											
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Investigation of attitudes, perceptions and values concerning the urban forest held by the public and government agencies. Note: Steps 2(a) and (b) can be conducted simultaneously.

What:

Conduct a valid science-based investigation of the attitudes, perceptions and values of residents and public agencies concerning their interest in the conservation of the urban forest and its management. The responses to the investigation should reflect the diversity of public as expressed by the U.S. Census.

Why:

Urban forest management is a social endeavor. Whether on private property or on publicly owned land it is ultimately people's values which will determine which urban forest resources are conserved and how that will be accomplished.

Unlike the one-way flow of information in public relations, public participation is a two-way process between managers and the public. There are many 'publics' which often requires the use a more than one engagement tool.

Participatory processes and engagement tools:

- Random sample surveys
- Small workshops
- Neighborhood listening sessions
- Advisory committees
- Focus groups
- Nominal groups

Although urban forest management is often seen as a technical or a scientific discipline, it is primarily an expression of the values of those involved in mandating, shaping, opposing, or practicing it.

Who:

City Administration in cooperation with the Project Team

How:

Online and in-person surveys, nominal groups sessions and focus groups (as needed) can provide structured information. Community meetings and listening sessions provide opportunities to interact with the community and learn from people's life experiences.

Work with people experienced in participatory planning (including the Extension Service and community organizers) to learn the best ways to engage the diversity of your city's residents. See Appendix A for an example of an online survey instrument.

Our experience suggests…

- It is not uncommon to find disenfranchised publics, competing and overlapping agencies and institutions, and a lack of awareness of environmental problems and solutions. If these issues are not recognized and addressed, problems will continue throughout the strategic planning process. A strong constituency of both the public and institutions is needed during the strategic planning process and to affirm and validate its continuation.
- The social survey should seek to answer questions concerning an understanding of the urban forest and residents' vision for the future urban forest.
- Contract out the design and implementation of the investigation to an experienced natural resources social scientist.

Help may be found at your state's land grant university or other colleges and universities.

City park in Tampa, FL.

Year 1											
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Step 2(b): Design and Conduct the Ecological System (bio-physical) Inventory and Analysis

What:

Conduct a science-based ecological systems (bio-physical) inventory and analysis of the urban forest.

Why:

Results from this effort are used to advance the understanding of the urban forest resource; improve urban forest policies, planning, and management; provide data for potential inclusion of trees within environmental regulations; and determine how trees affect the environment and consequently enhance human health and environmental quality in urban areas.

Who:

City Administration in cooperation with the Project Team

How:

1. Inventory and analysis should be undertaken by individuals knowledgeable in designing urban forest inventories in cooperation with the Project Team.
2. The inventory and analysis should focus on data and information that is directly needed to support the strategic planning process. Conserve time and financial resources by gathering the highest priority and/or most easily obtained data first.
3. The inventory design should take into consideration capturing data at the various geographic scales (neighborhood, planning district, etc.) typically used by the city in planning and operations. This will be critically important in allowing the integration of city forest information into broader planning activities.
4. The physical field work can be contracted out and overseen by the Project Team.

Time to accomplish this step will depend upon size of area, diversity of land use types and level of detail required and funding available.

Year 1											
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Step 3: Reports on Analysis of the Social Survey and Bio-physical Inventory/Ecological Analysis

What:

Prepare reports on the results of the social survey and bio-physical inventory and ecological analysis. Place them on the city's dedicated urban forest management program website. Distribute them to all news and social media outlets, and workshop it with the City Administration and City Commission/Council.

Why:

The reports form the foundational information that sets the course for the strategic planning process.

Who:

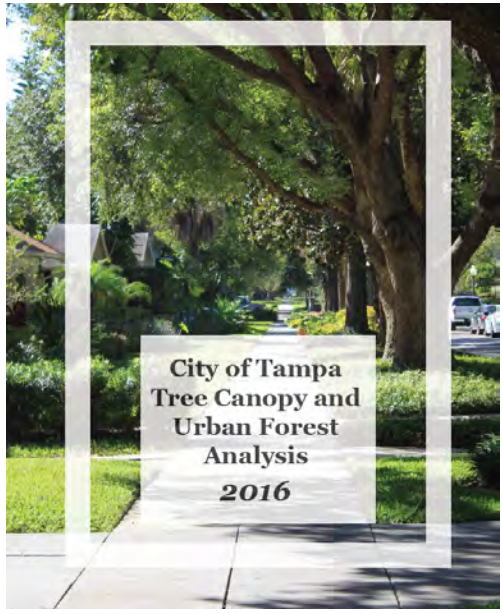
Project Team in cooperation with the natural resources' social scientist.

How:

The reports should be edited by a professional editor and graphic layout should be designed by a professional familiar with formatting for print, digital media, and social media.

See Appendix A.

Note: Enhance the reception of these reports by non-technical audiences through the development of concise and non-technical fact sheets and graphic illustrations.



Example of a bio-physical and ecological analysis report

Year 1											
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Step 4: Develop Guiding Principles

What:

Identify a set of Guiding Principles that define the legal limits and constraints of City management.

Why:

The Guiding Principles define and frame the broad constraints for municipal government management of the urban forest.

How:

Project team shall offer examples of common Guiding Principles for Municipal governance to initiate the discussion and guide a consensus building session.

Who:

City Administration in cooperation with the Project Team

How:

Facilitated meeting of City Administration and Project Team

Examples of Guiding Principles:

- Government efficiency
- Economic growth
- Support social equity
- Maintain environmental integrity
- Increase the social, environmental and economic benefits of the urban forest while reducing costs
- Support unique character of neighborhoods
- Support basic tenets of the city's comprehensive plan

Our experience suggests…

- The Guiding Principles allow everyone working in the strategic planning process to understand the scope of what the municipal government can and cannot do regarding urban forest management.

The Guiding Principles should be revisited repeatedly throughout this entire process to as a helpful way to keep the process moving forward in a positive manner.

Year 1											
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Step 5: Announcement

What:

Announce intent to develop a strategic plan for urban forest management.

Why:

Publicly initiate the strategic urban forest management planning process with clear intent to operate transparently and engage the community throughout the strategic planning process.

Who:

City Administration

How:

1. Provide news and social media outlets a narrative concerning the city's intent to develop a strategic plan for the urban forest management program and the proposed process.

Establish a dedicated City Strategic Urban Forest Management Planning website to provide a mechanism for open access to all associated strategic planning documents and allow public comments.

Example of urban forest management plan website.

Year 1											
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Step 6: Appoint a Public Committee

What:

Appoint a Public Committee representing the numerous and various societal interests in managing the urban forest.

1. The Public Committee should be limited to 10 – 15 people to allow for constructive facilitated interaction and development of trust.
2. The Public Committee should embody the diversity of values identified by the social survey.

Public Committee Membership:

Categories:

- Citizens
- Stakeholder groups
- Businesses
- NGO's
- Professional organizations
- Researchers

Characteristics:

- Volunteers
- Diversity
- Multiple partners
- Inclusive
- Skills and knowledge match the task

Why:

The Public Committee will represent the values of the public as identified in the social survey and articulate those values as a Vision and Goals for management. They will also serve as advocates for the public's values throughout the entire strategic planning process.

Who:

City Commission/Council with the Project Team

Year 1											
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Step 7: Workshop with Public Committee

What:

Workshop the results of the social systems survey, ecological system (bio-physical) inventory/analysis and Guiding Principles with the Public Committee.

Why:

The social systems survey and ecological system (bio-physical) inventory/analysis are the primary source information for the Public Committee's work.

Who:

Project Team

How:

Distribute complete written and digital reports to all members. Conduct a series of presentations and discussions guided by the Project Team.

Public committee workshop.

2. Plan Development

Year 1											
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Step 8(a): Development of the Vision

What:

Develop a **consensus** Vision Statement for urban forest sustainability.

Definition of Consensus:

A group decision-making process in which participants develop and decide on proposals with the aim, or requirement, of acceptance by all. The focus on avoiding negative opinion differentiates consensus from unanimity, which requires all participants to positively support a decision.

Example:

Vision Statement:

The urban forest is abundant, diverse, healthy, and benefits the community

Why:

1. The vision statement defines, in qualitative terms, the purpose of the city urban forestry program; what the City is striving to achieve.
2. Vision statements ensure that developers of a plan have a common understanding about the intended outcome of management.

Who:

Public Committee

How:

The Project Team will guide a series of consensus building sessions for the Public Committees.

Our experience suggests…

- The Project Team remains completely neutral, resisting any calls or suggestions to provide options on the Vision.
- The Vision should be strictly based upon the values of the people, not technical experts.

This step may take 3 to 4 sessions. Take the time needed; it is fundamental to the planning process and committee members may be new to such a process.

Public committee developing a vision statement.

Year 1											
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Step 8(b): Development of the Goals

What:
Develop a broad set of Goals for urban forest sustainability. The Goals will frame the Plan's management actions toward achieving the Vision.

Example:

Vision Statement:
The urban forest is abundant, diverse, healthy, and benefits the community.

Goals:

1. The urban forest should predominantly reflect the diversity of the surrounding native forest.
2. The urban forest should be healthy, resistant to insect infestation and diseases, and resilient to damage and disturbance.
3. The urban forest should include woodlands, parks, old trees that reflect the historic character of the region, tree-lined roadways, individual trees, and understory vegetation.
4. The urban forest should support a mutually enhancing relationship between the natural and the built environments.
5. Citizens and their government should be educated about the urban forest and its benefits.
6. The urban forest should bring beauty, interest, and a calming atmosphere to the urban environment.
7. The urban forest should support the city's communities' values and unique character.

Why:
Goals are envisioned as a large-scale reflection of public values concerning the bio-physical condition of the City's urban forest. They will be used to judge urban forest sustainability.

Who:
Public Committee

How:
The Project Team will guide a series of consensus building sessions for the Public Committee.

Our experience suggests…

All goals are tied to and directly support the achievement of the Vision.

Goals are outcomes not actions

Planning team should encourage public committee to be able to justify how each goal support the Vision.

Residential neighborhood in Paris, France.

Year 1											
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									x		

Step 9: Report Vision/Goals

What:

Prepare report on the Public Committee's consensus Vision and Goals.

Why:

1. Foster collaboration and public participation in the decision-making process.
2. Ensure that all government officials continue to have full and open access to the process and that the public continues to see that the strategic planning process is operating transparently.

Who:

Project Team with Public Committee

How:

Place the report on the city's dedicated urban forest management website, release it to all news and social media outlets, and workshop it with the City Administration and City Commission/Council.

Note: Your municipal government may not need a formal workshop at this time. A concise briefing paper my suffice.

Year 1											
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Step 10(a): Appoint Internal Technical Advisory Committee

What:

Appoint an Internal Technical Advisory Group (ITAC) consisting of the directors of all agencies whose activities effect and/or are affected by the urban forest.

Example of Internal Technical Advisory Group memberships for a typical mid-size city in Florida:

- Budget
- Transportation
- Stormwater
- Water
- Wastewater
- Solid waste
- Police
- Fire
- Natural resource management
- Parks and recreation
- Urban forestry (natural resources)

Why:

1. The Internal Technical Advisory Committee will be responsible for crafting the body of the urban forest plan in a manner consistent with the Public Committee's Vision and Goals and the city's Guiding Principles.
2. The Internal Technical Advisory Committee will be responsible for ensuring that the City's urban forest plan is integrated into the formal and informal processes, functions and operations of the City government.

Who:

City Administration and City Commission/Council

1. Effective interdepartmental coordination is essential for consistent delivery of urban forestry programs.
2. Directors, or their appointees should follow the process throughout the plan development process.

Directors need to recognize that they are responsible for, and will sign off on, the final urban forest management plan for the city.

Year 1											
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Step 10(b): Workshop Internal Technical Advisory Committee

What:

Workshop the results of the social systems survey, ecological system (bio-physical) inventory/ecological analysis, established Vision, Goals and Guiding Principles with the Internal Technical Advisory Committee.

Examples of Analysis Outputs:

- Number of trees by land use
- Relative frequency of tree species
- Canopy cover by planning district
- Condition of street trees
- Demographics of people who participated in the social survey
- Barriers to tree care by homeowners
- Average walking distance to green spaces and parks
- Added value to home values
- Value to stormwater management system

Why:

These inventories, analyses and documents form the primary source information for the Internal Technical Advisory Committee' work.

Who:

Project Team

How:

Distribute complete digital and print copies of reports to all members. Conduct a series of presentations and facilitated discussions.

Our experience suggests…

- The Project Team should be prepared to articulate the Vision and Goals.
- The Vision and Goals are not to be debated by the Internal Technical Advisory Committee; they are value statements derived from the public.
- If appropriate, consider having a member of the Public Committee present at these workshops to explain the rationale for the Vision and Goals

Year 2											
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Step 11: Develop Elements

What:
Develop one or more Elements (basic quantitative building blocks) for each of the Public Committee's Goals (qualitative).

Example:

Vision
The urban forest is abundant, diverse, healthy, and benefits the community.

Goal
1. The urban forest should predominantly reflect the diversity of the surrounding native forest.

Elements
- Canopy cover
- Invasive Species
- Abundance
- Standing Dead and Down Woody Material

See Appendix E for examples of Elements.

Why:
Elements, basic quantitative building blocks of the strategic plan, bring the broad qualitative goals that directly represent public values, into a quantifiable planning and operational framework.

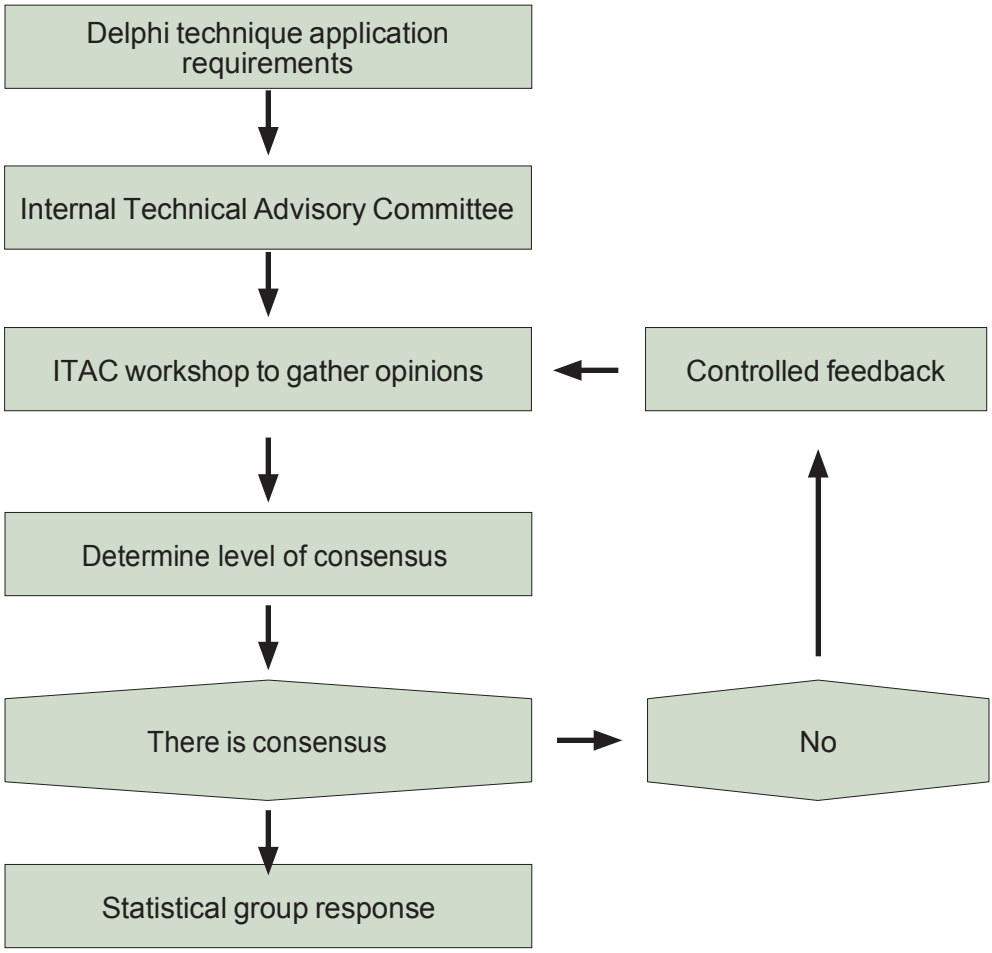
Who:
Internal Technical Advisory Committee

How:
Project Team guides a series of in-person consensus building sessions; may also use the **Delphi method** to reduce the number of in-person workshops.

See Appendix B for a description of Delphi method.

Our experience suggests…

1. The Delphi method reduces time on face-to-face meetings to aggregate opinions from a diverse set of experts, and it can be done without having to bring everyone together for a physical meeting.
2. The Delphi method is a process used to arrive at a group opinion or decision by surveying a panel of experts. Experts respond to several rounds of questionnaires and the responses are aggregated and shared with the group after each round.
3. The experts can adjust their answers each round, based on how they interpret the "group response" provided to them.
4. The ultimate result is meant to be a true consensus of what the group thinks.



Delphi method for use in iterative engagement to reach consensus.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
	x										

Step 12: Determine Geographic Scale of Management

What:

Determine the appropriate geographic scale(s) of urban forest management units (i.e., land use, neighborhoods, planning districts, zoning districts, environmental justice areas, etc.) to achieve the Vision and Goals.

Why:

Working with planning districts, land use and/or neighborhoods allows the city the capability to identify site specific sets of long-term management objectives and short-term work plans. It also encourages the integration of urban forest management into the existing process fabric of city planning and operations.

Who:

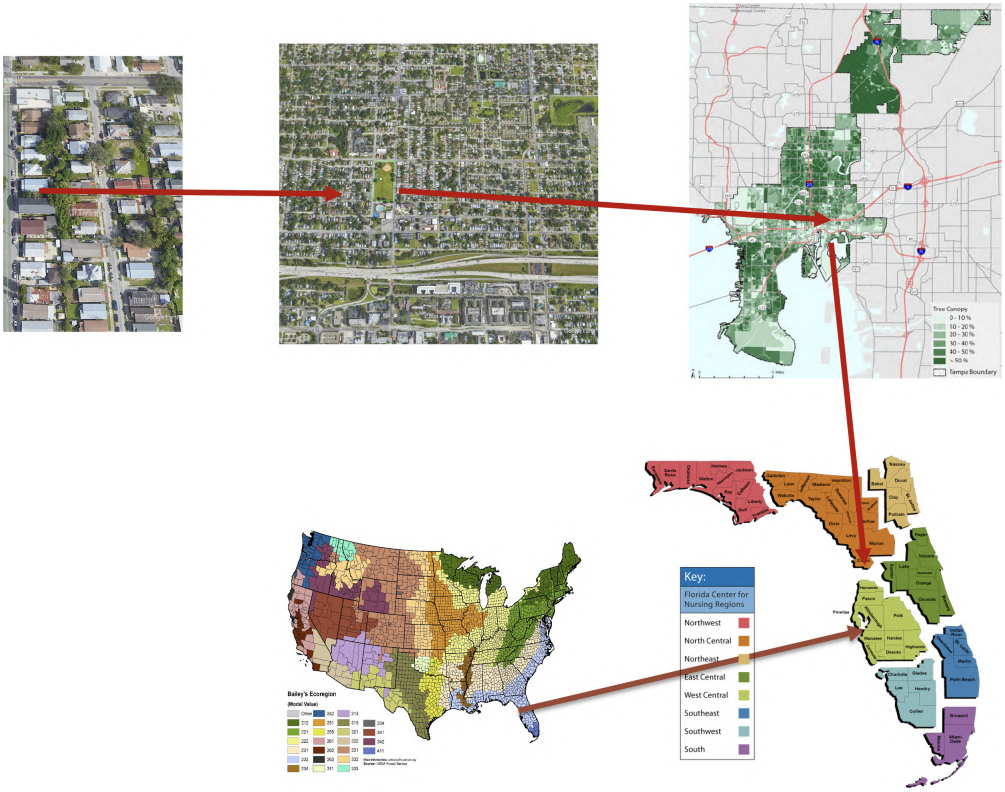
Internal Technical Advisory Committee

How:

City planning typically takes place along planning district's boundaries; neighborhood boundaries; or census data tracts. Choosing the appropriate planning unit will vary from city to city.

Note

1. The scale used should support achieving the Vision and Goals.
2. Choosing the appropriate planning unit will vary from city to city.



Urban forestry needs to integrate knowledge and operate at various ecological region scales. Clockwise from top left: House, city, planning district, region, state.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
		x	x								

Step 13: Develop Objectives

What:

Develop one or more specific and measurable Objectives for each of the Elements.

Why:

Objectives are specific intended outcomes of the Elements. They are written in the present tense and become the long-range measurable targets of management.

Who:

Internal Technical Advisory Committee

How:

Project Team guides a series of in-person consensus building sessions; and may also use the Delphi technique (see Appendix B) to reduce the number of in-person workshops.

Our experience suggests…

1. This is a key step that initiates the shift from a qualitative statement description of the future in the Vision and Goals to quantifiable objectives that lead to the definition of actions.
2. It is important to remember that just because an Objective is not presently quantifiable it does mean that it is not relevant or important and should be left out.
3. Use the Delphi technique (see Appendix B) to reduce the number of in-person workshops.

Residential district in New York City, NY.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
		x	x								

Step 14(a): Form Consensus on Internal Consistency

What:

Critically review the Elements and Objectives for consistency with the Vision, Broad Goals and Guiding Principles.

Why:

Ensure internal continuity and integration of the Vision and Goals, Guiding Principles, Elements and the Objectives.

Who:

Public Committee determine if the Elements and Objectives are consistent with the Vision, Broad Goals and Guiding Principles.

How:

The Project Team, with assistance from the Internal Technical Advisory Committee, facilitates the review and documents comments. A follow-up facilitated meeting (Project Team) of both committees should be used to formalize consensus, if necessary.

Our experience suggests…

- This review for consistency can more easily be achieved by looking for Elements and Objectives that are 'inconsistent' with the Vision, Goals and Guiding Principles.
- The Delphi process can be used to allow members of both committees to review and make initial comments.
- This is a critical point where the strategic planning process can breakdown if the two committees cannot be reconciled.
- This is an opportunity in the process to step back and review progress to date.

Example:

Vision

The urban forest is abundant, diverse, healthy, and benefits the community.

Goal

1. The urban forest should predominantly reflect the diversity of the surrounding native forest.

Elements

Canopy cover

Guiding Principles:

1. Government efficiency
2. Economic growth
3. Social support equity
4. Maintain environmental integrity
5. Increase the social, environmental and economic
6. benefits of the urban forest while reducing costs
7. Support neighborhoods
8. Support basic tenets of the
9. City's Comprehensive Plan

Element:

Canopy Cover

Objective:

No statistically significant net loss of canopy cover since the last Urban Forest Canopy Analysis.

See Appendix D.

Year 1			Year 2								
Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
x	x	x	x	x	x						

Step 14(b): Prepare and Distribute a Briefing Paper on the Plan To-date

What:

Prepare a briefing paper, with examples, demonstrating the consistency of the Vision, Goals, Guiding Principles, Elements and SMART Objectives. Place it on the city's dedicated urban forest management strategic planning website, release to news and social media outlets, place on the City's dedicated strategic planning web site, and workshop with City Administration and City Commission/Council.

Why:

Ensures that all government officials continue to have full and open access to the process and that the public continues to see that the strategic planning process is operating transparently and is consistent with societal values.

Who:

Project Team in cooperation with the Public Committee and Internal Technical Advisory Committee.

Natural area park, Tampa, FL.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
				x	x	x					

Step 15: Performance Indicators

What:

Develop a stepwise series of Performance Indicators for each Objective.

See Appendix E for examples of Performance Indicators, and short- and long-term examples.

Why:

Quantifiable Performance Indicators enable measurement of progress toward the achievement of an Objective.

Who:

Internal Technical Advisory Committee

How:

1. Using the consensus Objectives, each member of the Internal Technical Advisory Committee drafts Performance Indicators on the Objectives most closely associated with their department's operational responsibilities. These draft Performance Indicators are then shared with all members of the Internal Technical Advisory Committee.
2. Project Team guides in-person workshops with the Internal Technical Advisory Committee to formalize consensus on the Performance Indicators and their language.

Our experience suggests…

- Performance Indicators are not management actions, but the outcomes of management.
- Identify the low and optimum performance indicators first, and then the moderate and good.
- There is no lead agency in this process—all members of the ITAC need to be engaged.
- Careful attention should be focused on the language of the Performance Indicators to ensure that they can be measured wherever possible.
- Pay close attention to the thresholds between adjacent Performance Indicators, they need to be clear and demonstrate a marked improvement in management outcomes.

Example:

Vision

The urban forest is abundant, diverse, healthy, and benefits the community.

Goal

1. The urban forest should predominantly reflect the diversity of the surrounding native forest.

Elements

Canopy cover

Guiding Principles:

1. Government efficiency
2. Economic growth
3. Social support equity
4. Maintain environmental integrity
5. Increase the social, environmental and economic
6. benefits of the urban forest while reducing costs
7. Support neighborhoods
8. Support basic tenets of the
9. City's Comprehensive Plan

Element:

Canopy Cover

Objective:

Total tree canopy coverage is 50% or greater (Citywide).

Performance Indicators:

Optimal – canopy cover is 50% or greater;

Good - Canopy Cover is 45% but less than 50%;

Moderate - Canopy Cover is 40% but less than 45%;

Low - Canopy Cover is lower than 40%.

Element:

Invasive Species

Objective:

Invasive plant and animal species are eliminated.

Performance Indicators:

Optimal - All Commercial/Industrial/ Institutional land is free of invasive plant species;

Good - Net decrease in the abundance and diversity of invasive plant species on Commercial/ Industrial/Institutional land;

Moderate - City-wide formal assessment of invasive species;

Low – No formal assessment of invasive species

See Appendix E.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
						x					

Step 16: Determine the Present State of Urban Forest Management Using the Performance Indicators

What:

Determine the present state of the urban forest system and its management.

Why:

Provide a baseline assessment of the urban forest's present condition and management relative to residents' expressed social values and identifies points of departure for future City management activities.

Who:

Internal Technical Advisory Committee

How:

Use bio-physical inventory/analysis; social survey; other credible data; guiding principles and internal data from city departments to identify where the urban forest management program stands along the continuum of Performance Indicators for each of the Objectives.

Note

1. The tendency is for agencies to avoid giving themselves low marks. This will subvert the process and does not allow the future opportunity to recognize true progress in achieving management outcomes.
2. At times the present state is the optimal Performance Indicator.
3. Sometimes we are not sure of the present state.

Example:

Citywide

Element	Performance Indicators	Objective
Canopy cover (goal 1; element e)		Total tree canopy coverage is 50% or greater
Optimal	No statistically significant net loss of canopy cover since the 2016 Urban Forest Analysis	
Good	Canopy Cover is 45% or greater	
Moderate	Canopy Cover is 40% or greater	
Low	Canopy Cover is lower than 40%	

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
						x	x				

Step 17: Determine How Performance Indicators Will Be Monitored

What:

Determine how progress on each Objective will be measured for timing of implementation and effectiveness in advancing the sustainability of the City's urban forest. This includes the frequency of measurement and the agency responsible.

Examples of monitoring implementation and effectiveness:

- Urban forest canopy – GIS or point sampling with aerial photography
- Stormwater function – 5-year cycle of iTree urban forest analysis
- Staff continuing education – departmental accounting reports
- Invasive species – 10-year cycle of natural areas assessments
- Energy reduction - % of new landscape plans that directly incorporate reduction of heat loading on buildings

Why:

1. Monitoring allows the City an opportunity to formally track the implementation of the 5-year operational plans; annual work plans; assess the effectiveness of the work undertaken, and demonstrate the continuing effort for process transparency. (See Appendix F)
2. Monitoring allows the City Administration an opportunity to report back to the City Council/Commission and the public on implementation of the Plan and progress on meeting intended outcomes.

Who:

Internal Technical Advisory Committee

How:

In cooperation with technical experts conduct a thorough review of data collection activities and timing of data acquisition for all Objectives.

Example:

Canopy cover – once every 5 years using USDA iTree tree cover assessment methodology (or other scientifically validated and inexpensive inhouse staff assessment)

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
						x					

Step 18: Identify a Concise and Specific Set of Management Actions for Each Objective

What:

Identify concise and specific recommendations and measurable actions intended to incrementally elevate each set of Performance Indicators from its present state toward the next highest level.

Who:

Internal Technical Advisory Committee

Why:

These actions will be evaluated for proper sequencing of projects, costs, personnel and lead department or agency. It will be used to guide the organization of the 5-year operational plan.

How:

The Project Team uses brainstorming techniques to guide the Internal Technical Working Group in the identification of a concise and specific set of actions intended to elevate each present state Performance Indicator.

Note

1. This should produce the full set of all valid actions and their sequencing that can elevate each set of Performance Indicators to its next highest level.
2. All valid actions are not to be judged by budget needs, resources, etc. at this time

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
							x				

Step 19(a): Form Consensus on the Preferred Set of Management Actions

What:
Form consensus on a preferred set of management actions that will constitute the city's 5-year Operational Plan.

Why:
This step sets the city's urban forestry operational agenda for the next 5 years, integrating it into the government's budget and administrative processes.

Who:
Internal Technical Advisory Committee

How:
The Project Team conducts a guided workshop(s) to refine suggested actions and form consensus on the final set of management actions that will constitute the first city's 5-year Operational Plan.

Note
1. These decisions must be made at the highest level of administrative authority in each department.
2. The Internal Technical Advisory Committee should be prepared to defend their rationale for the chosen actions.

Example:

Element	Performance Indicators	Objective
Canopy cover (goal 1; element e)		Total tree canopy coverage is 50% or greater
Optimal	No statistically significant net loss of canopy cover since the 2016 Urban Forest Analysis	
Good	Canopy Cover is 45% or greater	
Moderate	Canopy Cover is 40% or greater	
Low	Canopy Cover is lower than 40%	
Consensus Preferred Management Action(s) for the next 5 years 1. Design and implement a canopy cover monitoring program– Public Works, Planning Depts. 2. Prepare a digital City of 'illustrated booklet' on tree care and maintenance Best Management Practices for inclusion on urban forestry web site – Public Works Dept.		

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
								x			

Step 19(b): Prioritize and Sequence Management Actions for the 5-year Operational Plan

What:

Prioritize and sequence actions in the 5-year Operational Plan.

Why:

In setting priorities and sequencing, consider the urban forest's contribution to the city's social, economic and environmental well-being; improving efficiency and effectiveness of urban forest management; and the opportunity for success in abating types, scope and severity of threats, key enabling conditions.

Who:

Internal Technical Advisory Committee

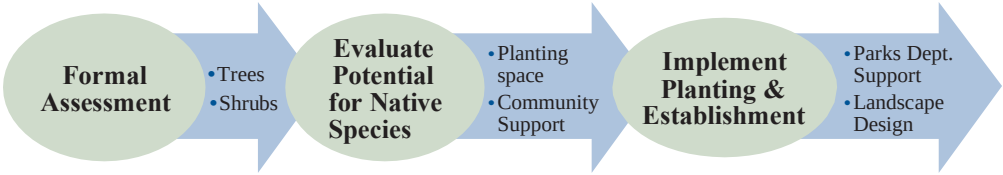
How:

Review all proposed actions for cost, impact, and need for sequencing with other management actions.

Developed Parks/Open Space

Objective: Tree and shrub diversity reflect the native forest.

Optimal Performance Indicator: Net increase of native shrub and tree diversity in developed/open space land use type.



Example: Sequencing actions to reach a Performance Indicator.

3. Plan Re-engagement and Adoption

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
								x			

Step 20(a): Develop Consensus on Internal Consistency of the 5-year Operational Plan with the Strategic Plan

What:

Form consensus on the internal consistency and continuity of the plan with regard to the social and bio-physical analyses, Vision, Goals, Guiding Principles, Elements, Objectives, Performance Indicators, and 5-year Operational Plan.

Why:

This is the initial step in bringing the Public Committee and Internal Technical Advisory Committee back together to formalize agreement on the Strategic Plan.

Who:

Public Committee, Internal Technical Advisory Committee

How:

Project Team conducts a facilitated workshop of both committees to form consensus.

Note

1. The Delphi process in conjunction with the workshop to develop final consensus can be used.
2. The strategic planning process is now reaching into the micro level.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
								x			

Step 20(b): Prepare Interim Report on the Consistency and Continuity of the Plan

What:

Prepare interim report on internal consistency and continuity of the Plan. Place it on the city's dedicated urban forest management strategic planning website, release to news and social media outlets, and workshop with City Administration and City Commission/Council.

Why:

Ensure that all government officials continue to have full and open access to the process and that the public continues to see that the strategic planning process is operating transparently on this potentially contentious topic.

Who:

Project Team

How:

This interim report should be in the form of a short briefing paper.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
									x		

Step 21: Prepare an Interim Report on the Plan

What:

Prepare an Interim Report on the Urban Forest Management Strategic Plan, including the Operational Plan for the first 5-year cycle.

Why:

The Interim Report of the Strategic Plan for the Urban Forest Management Program will be used for technical reviews and checks on internal consistency with the Vision, Goals, Guiding Principles, Elements, Objectives, Performance Indicators and Actions.

Who:

Project Team

How:

Project Team, in cooperation with municipal agencies, develop the plan's structure and use existing narratives, briefing papers, inventories and analyses to organize the content.

Workshop for city administration and city council.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
								x			

Step 22: Workshop with Public Committee, City Administration and City Commission/Council

What:

Workshop the Interim Report on the Strategic Plan for the Urban Forest Management Program with the Public Committee, Internal Technical Advisory Committee, City Administration and City Commission/Council.

Why:

These workshops are intended to facilitate any last-minute minor adjustments to the language of the Plan and provide the Public Committee an opportunity to ensure the Plan remains consistent with the Vision and Goals.

Ensure that all government officials continue to have full and open access to the process and that the public continues to see that the strategic planning process is operating transparently.

Who:

Project Team

How:

Distribute complete written and digital reports to all members. Conduct a series of presentations and discussions guided by the Project Team.

Note: Any last-minute changes to the plan, beyond clarification of language, are to be disallowed. All active participants have had numerous opportunities to express their opinions and work toward the integration of their ideas into the plan throughout the planning process.

Public workshop with city council.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
										x	

Step 23: Final Draft

What:

Produce a final draft of the Urban Forest Management Strategic Plan, including management operations for the first 5-year cycle.

Why:

Ensure that all government officials continue to have full and open access to the process and that the public continues to see that the strategic planning process is operating transparently and has opportunity to comment.

Who:

Project Team

How:

The final draft is edited by a professional editor; and graphic layout is designed by a professional familiar with formatting for print, digital media and social media.

Place on the city's dedicated urban forest management strategic planning web site, release to news and social media outlets and workshop with City Administration and City Commission/Council.

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
											x

Step 24: Formally Adopt and Execute the Plan

What:

Formally adopt the Urban Forest Management Strategic Plan as the City's urban forest management plan

Who:

City Commission/Council and City Administration

Why:

Incorporation of the Urban Forest Management Strategic Plan into the city's Comprehensive Plan ensures that strategic plan is integrated into the foundational structure of the government. The issuance of the Executive Order (Mayor, Governor, etc.) directs all government agencies to directly participate in enacting the strategic plan and its subsequent operational plans.

How:

1. City Commission/Council approves the Plan as the City's Urban Forest Management Plan.
2. The City Urban Forest Management Plan is incorporated into the City's Comprehensive Plan.
3. An Executive Order is issued to initiate implementation of the City's urban forest management plan.

4. Plan Implementation and Accountability

Step 25: Create a Permanent Advisory Committee on Natural Resources

What:

Create a permanent Natural Resources Advisory Committee (NRAC), consisting of a balanced representation of the city's public social, economic, and environmental interests.

Why:

Ensure citizen values are continually represented in the refinement and implementation of the City's cycle of 5-year urban forest management Operational Plans.

Who:

City Commission/Council and City Administration

How:

In cooperation with the Planning Department, conduct a semi-annual review of progress in implementation of the 5-year Operational Plan (implementation monitoring).

In cooperation with the Internal Technical Working Group, annually prepare a written report on the implementation of the 5-year Operational Plan for the Mayor and City Commission/Council.

Note: Consider including a member(s) of the original Public Committee to ensure continuity between the planning and implementation phases of the urban forest management plan.

Step 26: Establish a Permanent Internal Technical Working Group

What:

Establish a permanent Internal Technical Working Group comprised of appointed departmental representatives to identify issues and make recommendations associated with the successful implementation of the Plan.

Why:

Identify procedural and process issues that impact the efficient and effective implementation of the City's current 5-year Operational Plan, identify successful strategies and recommend corrective actions and strategies.

In cooperation with the Advisory Committee on Natural Resources, annually prepare written report to the Mayor and City Commission/Council on implementation of the current 5-year operational Plan.

Who:

City Administration

How:

1. The committee meets regularly to review progress, identifies issues and makes recommendations associated with the successful implementation of the Plan.
2. The Planning Division Manager or Director of Planning and Development Department shall chair the Working Group.
3. Most of the work of this committee can be accomplished through the use of a modified Delphi process, reducing the need for workshops.

Our experience suggests…

- This step is crucial to the institutionalization of the urban forest management plan.
- The Director of Planning, or equivalent, because of the broad perspective their position inherently has, is in a good position to serve as the chair the Internal Technical Working Group.

Step 27 (repeat this Step during the 4th year of each 5-year Operational Plan cycle)

What:

Validation Monitoring and Development of subsequent 5-year Operational Plans.

Why:

In response to evaluation and new conditions, revise the operational plan following the 5-year interval of social and bio-physical assessments.

Who:

Internal Technical Working Group and Advisory Committee on Natural Resources, in cooperation with technical experts

How:

1. Starting in year-4 of the 5-year cycle facilitate consensus building session using Steps 2(a) – 4(b); 6; 10(b); 16; 17 and 19(a) to guide development of the next 5-year operational Plan.
2. Prior to contracting the 5-year Ecological System (bio-physical) Analysis and Social System Survey review the scientific methods and models to be used to characterize the urban forest and citizen values. Choosing appropriate forms of analysis will be extremely valuable in supporting management decision-making.
3. Prepare the 5-year Operational Plan for review by City Administration and City Commission/Council for formal adoption.

Note: Using our example of a 20-year long-range Strategic Plan with four imbedded 5-year short range operational plans, during the last 2 years of the fourth 5-year operational cycle, a new strategic planning process should be initiated.

Appendices

Commercial district in Melbourne, Australia.

Appendix A

Example Social Survey

Urban Forest Management Plan – Resident Survey Informed Consent

This year, your city government is developing a plan for the management and conservation of the trees and woodlands within the city. Collectively the trees and woodlands are known as the city's urban forest. The very first step in the organization of the plan requires obtaining a clear understanding of how you, the city's residents, feel about your urban forest. By taking this anonymous survey you will be helping to ensure that the plan is truly citizen centered and people empowered. Thank you.

Your participation in this survey is completely voluntary. There is no risk, compensation, or other direct benefit to you for participating in the survey, other than the opportunity to make your experiences and opinions known and acted upon. All responses will be anonymous and will not be connected with your name or other identifying information. Only the researchers will have access to the information we collect. There is a minimal risk that security of any online data may be breached, but since no identifying information will be collected, and the online host uses several forms of encryption and other protections, it is unlikely that a security breach of the online data will result in any adverse consequence for you.

The survey will take approximately 10 minutes to complete.

Note that you must be 18 years or older to participate in this study. If you agree to participate in this survey, please Click Arrow

Q1. How important is the urban forest to your city?

- Not very important
- Somewhat unimportant
- Neutral
- Somewhat important
- Very important
- Don't know

Q2. How interested are you in seeing the city expand community based urban forestry projects?

- Not very important
- Somewhat unimportant
- Neutral
- Somewhat important
- Very important
- Don't know

Q3. How important do you think the urban forestry program is compared with other programs in the city?

- Not very important
- Somewhat important
- Neutral
- Somewhat important
- Very important
- Don't know

Q4. How knowledgeable are you about benefits derived from the city's urban forest?

	Not at all knowledgeable	A little knowledgeable	Somewhat knowledgeable	Very knowledgeable
Increase in property values				
Creation of wildlife habitat				
Decrease in home energy costs				
Reduction in stormwater runoff				
Improved public health and well-being				
Increase in recreational activities				
Reduced heat island effect				
Increase community pride				
Improvement in community aesthetics				
Shade				
Community livability				
Improvement in air quality				
Reduction in noise levels				

	Not at all knowledgeable	A little knowledgeable	Somewhat knowledgeable	Very knowledgeable
Decrease in soil erosion				
Improvement in water quality				
Positive impact on consumer behavior				
Reduction in crime rates				

Q5. What is the most successful way for engaging you concerning urban forest related issues?

	Not very successful	Somewhat unsuccessful	Neutral	Somewhat successful	Very successful
Holding community workshops					
Distributing pamphlets or brochures					
Organizing community events					
In person communication with city staff					
Information booths at citywide events					
Tree board/ commission meetings					
Arbor Day activities					
Urban forestry website					
Public notification through newspapers					
Public hearings – ordinances					
Social media					

	Not very successful	Somewhat unsuccessful	Neutral	Somewhat successful	Very successful
Partnerships with non-profits					
Corporate sponsorship of events					
Heritage or memorial tree programs					

Q6. Please rank the top three items that the city needs to ensure a healthy urban forest.

(Please place the number 1, 2 and 3 next to the item in order of importance, 1 being the most important)

- ____Political support
- ____Tools for community outreach and education
- ____Tree planting initiatives
- ____Best management practices for tree preservation and maintenance
- ____Training in establishing effective tree ordinances
- ____Information on the benefits of urban trees
- ____An urban forestry management plan
- ____List of suitable local tree species
- ____Sustainable funding
- ____Active community support

Q7. Please rank what you think are the top three barriers to having a healthy urban forest in the city.

(Please place the number 1, 2 and 3 next to the item in order of importance, 1 being the most important)

- ____Low public support and interest
- ____Technical assistance needs such education material or best management practices
- ____A reactive, as opposed proactive, approach to urban forest management
- ____Lack of trained personnel
- ____Lack of political support
- ____Conflicts surrounding public tree protection, maintenance and mitigation
- ____Insufficient funding for City urban forestry program
- ____Ordinance(s) related to the preservation and/or replanting of trees on development sites
- ____Poor urban forest condition/tree problems
- ____Lack of a formal plan or strategy for achieving a healthy urban forest

Q8. Please rank what you think should be the top three future priorities for urban forest management in the city.

(Please place the number 1, 2 and 3 next to the item in order of importance, 1 being the most important)

- ____Complete a full street tree hazard assessment of evacuation routes
- ____Complete assessment of natural areas and parks
- ____Development of an urban forest management plan
- ____Community-based urban forestry workshops
- ____Establish or revise tree related ordinances
- ____Increase community recreation opportunities
- ____Work toward achieving tree canopy cover goals
- ____Proclaim and celebrate an Arbor Day observance

We would like to ask a few questions about you, your background, and your past experiences. This information will be used for statistical analysis only, and all information will remain strictly confidential.

Q9. You are…

- Female
- Male
- Self-described
- Prefer not to say

Q10. Which of the following best describes your status?

- Single
- Married
- Divorced
- Widowed

Q11. How many children currently reside in your household?

- 1
- 2
- 3
- 4
- More than 4
- 0

Q12. What is the highest level of education you have completed?

- Eighth grade or less
- Some High School
- High School Graduate or GED
- Some College
- College Graduate
- Some Graduate School
- Graduate Degree or beyond

Q13. Are you presently… (Please mark all that apply)

- Employed Full Time
- Employed Part Time
- Unemployed
- Full Time Homemaker
- Retired
- Full Time Student
- Part Time Student

Q14. If employed part time, how many hours a week do you work?

Q15. What is your profession or occupation?

Q16. What year were you born?

Q17. What race or ethnic group(s) would you place yourself in? (Please mark all that apply)

- African American
- Native Hawaiian or Pacific Islander
- Hispanic or Latino
- American Indian or Alaskan Native
- Asian American
- White

Q18. What was your approximate total household income, before taxes this past year?

- Less than $10,000
- $10,001 to $19,999
- $20,000 - $29,999
- $30,000 - $39,999
- $40,000 - $49,999
- $50,000 - $59,999
- $60,000 - $69,999
- $70,000 - $79,999
- $80,000 - $89,999
- $90,000 - $99,999
- $100,000 of more

Q19. What section of the City do you live in?

- North East (1)
- North West (2)
- South East (3)
- South West (4)

Q20. Do you live in:

- An apartment
- A rented house
- Your own house
- A condominium

Q21. Please tell us if there is anything else you believe we should know.

Hearing from as many people as possible is critical to ensuring that the plan to manage the city's trees, woodlands and forest (Your Urban Forest) is truly citizen centered and people empowered.
Please copy the web link to this survey (**http://survey.social**), post it to your favorite social media site, and encourage your friends and neighbors to fill it out.

Thank you again for participating in the conservation of Your Urban Forest!

Appendix B

The Delphi Method

The Delphi Method was designed to gather input from participants without requiring them to work face to face. Often, the process is used to find consensus among experts who have differing views and perspectives. The Delphi Method enables group problem-solving using an iterative process of problem definition and discussion, feedback, and revisions. The Delphi Method described here uses email to gather information, provide feedback, and report conclusions.

1. **Preliminary Work to Be Completed by the Facilitator –** The facilitator will describe the issue to be discussed, and will act as the communications manager to send messages, collect responses, and provide summaries.
2. **Round One –** First Questionnaire: In Round One, the questionnaire defines the issue and asks each participant to list as many responses as possible. An example could be: "What aspects of urban and rural forest conservation and restoration can be improved by area specific research not currently underway or available?" You will be asked to list as many as you can, using just a few words or a phrase.
3. **Round One –** Compiling Responses: The facilitator compiles all the responses and creates the second questionnaire, with space for participants to respond to each idea.
4. **Round Two –** Second Questionnaire: The second questionnaire includes all the responses and asks participants to evaluate each idea. Participants are asked to clarify or add to ideas, comment on the feasibility of ideas, brainstorm additional strategies to implement ideas, and suggest new ideas. Participants respond anonymously.
5. **Round Two –** Compiling Responses: Again, the communications manager continues to develop the list of ideas, which now includes comments, additions, clarifications, and strategies. The communications manager develops the third questionnaire, with the additional information provided in Round Two.
6. **Round Three –** Third Questionnaire: The communications manager repeats the process of compiling information, sharing it with participants, and collecting feedback. The third questionnaire may ask respondents to rank ideas in order of importance, in order of timeliness, or other criteria such as "my willingness to work on this project."
7. **Round Three –** Compiling Responses: This is the final round of compiling responses, unless the planning committee decides that participants need additional rounds of input and feedback.
8. **Resolution and Report –** By this round, the feasible ideas have been identified, and set in priority order by participants. The communications manager responds to the group with the ideas or strategies, with details of implementation, arranged in priority order.

Appendix C

Adaptive Management and Monitoring

Adaptive Management

Performance indicators allow the City and its partners the assessment capability to use an adaptive management approach to conservation management and promote flexible decision-making. Careful monitoring of the indicators helps the County's administration adjust policies or operations as part of an iterative learning process leading to more effective decisions and enhanced benefits, while reducing tensions among staff and partners.

Adaptive Management is a scientific approach that can be used in a conservation management decision process. It promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process.

Adaptive management does not represent an end in itself, but rather a means to more effective decisions and enhanced benefits. It's true measure is in how well it helps the City meet environmental, social, and economic goals; reduces tensions among staff and partners; improves management; and increases scientific knowledge.

Using an adaptive management approach requires the consistent monitoring of all elements, objectives and performance indicators. Its use allows the City to judge if new approaches to urban forest management are effective and identifies significant trends. Its use also allows the City to adjust management actions over time as changes occur both in the bio-physical environment and in the expectations of the County's residents and partners.

Few activities suggested by this Strategic Planning Method are as important to the success of the City's urban forest management program as monitoring, but this step is often overlooked, poorly designed, and often underfunded by most cities.

Monitoring the City's urban forest uses a process very similar to those already developed for business. The basic applications have already been developed, and there is little reason to reinvent them. The Monitoring Program design should incorporate the principles of sampling design theory and experimental design. Careful consideration must be paid to the selection of Performance Indicators used inthe Monitoring Program.

Key Points Concerning Adaptive Management

- Urban forest management involves decision making in an environment of multiple management objectives, constrained management authorities

and capabilities, dynamic resource systems, and uncertain responses to management actions.

- Urban forest management increasingly involves the articulation of objectives and management options and the use of analytical techniques to identify optimal management strategies.
- Adaptive management is a structured approach to decision making that emphasizes accountability and explicitness in decision making.
- Adaptive management is useful when there is substantial uncertainty regarding the most appropriate strategy for urban forest management.

Types of Monitoring

Monitoring refers to the periodic and systematic measurement of observations of process or outcomes. The City should institute three forms of monitoring in association with the Strategic urban forest management plan: implementation, effectiveness and validation.

Implementation monitoring will determine if the plan is being implemented as designed.

It asks, “Did we do what we set out to do?”

Effectiveness monitoring determines if the action achieved the stated goal or objective.

It asks, “Did it work?”

Validation monitoring determines if assumptions and professional procedures and processes being used are valid and effective. It asks, “Are we using the best science?”

Implementation Monitoring

On an annual basis the Internal Technical Advisory Committee will review the implementation of the 5-year Management Plan’s preferred alternatives for action. They will report their findings to the Public Committee. Once a year these two committees will hold a joint session to discuss accomplishments and recommend strategies for accomplishing actions within the 5-year Action Plan. Each year these two committees will jointly publish a report on their findings to the Mayor, City Commission, Department Directors, residents and business community.

Effectiveness Monitoring

The initial Urban Forest Inventory and Analysis, and Social Surveys, serve as the beginning of the effectiveness-monitoring program and sets the baseline description

of social valuation of the urban forest and its extent, composition and condition. Subsequent social surveys and bio-physical inventory and analysis will allow for the identification of changes and trends.

The use of the elements, objectives and performance indicators allow the City to better understand and correlate the effectiveness of its urban forest management practices and policies to reaching specific outcomes.

Effectiveness monitoring should be formally set to occur at set increments. Example: Every 5 years in conjunction with the social survey prior to the development of a new 5-year Action Plan. Effectiveness monitoring should be reviewed jointly in a public meeting by the Internal Technical Advisory Committee and Public Committee. Findings should be reported out to the City's executive and legislative branches, as well as the media and public.

Validation Monitoring

Prior to contracting any bio-physical urban forest analysis or social survey the City should review the scientific methods and models to be used. Choosing appropriate forms of analysis will be extremely valuable in supporting management decision-making.

Examples

Methods for Monitoring Performance Indicators

Adoption of the Urban Forest Management Plan as the strategic plan for management of the City's urban forest.

- Formal coordination of interdepartmental/interagency processes for implementation of the urban forest plan
- Intra and Interagency cooperation and collaboration
- City Administration/City Commission are provided support and training on urban forest benefits and implementation of the City's urban forest management plan

Inventory and Analysis – bio-physical and social
(Includes formal public report on the State of the Urban Forest along with results from the social survey – 5-year cycle)

- Canopy Cover – no net loss by land use type
- Urban Forest Stormwater Function
- Tree and Shrub Suitability – all land use type except Natural Areas
- Human Health
- Air Quality
- Greenhouse Gas Sequestration
- Invasive Species – all land use type except Natural Areas
- Energy Conservation (residential ONLY)

Departmental Accounting

(Compiled for and reviewed by the Natural Resources Council and Internal Technical Working Group and submitted to the City Commission)

- Departmental Reporting of complaints, citations per year (or other cycle)
- Professional standards and ethics
- Workshops offered and attendance

Departmental Accounting

- Time and budget allocated to staff for continuing professional education
- Municipal urban forestry staff's continuing education
- Percentage of new landscape designs that contribute to water conservation
- Percentage of new commercial development that meet or exceed 'LEEDS' certification standards for energy savings.

Departmental Reports

- Children – schools, clubs, camps, 4-H
- Wildlife – percentage of new industrial/commercial/institutional sites actively implement a wildlife habitat plan
- Crime Prevention – percentage of new building/landscape designs that meet or exceed CPTED standards
- Fire Prevention – hazard rating (Wildfire Risk Assessment) of new landscape designs in Wildland Urban Interface
- Risk Damage from Trees
- General Public Outreach
- Values specific to neighborhoods and/or districts
- Resilience to fire (Natural Areas)
- Visual Access – percentage of new landscape and architectural design provide visual access to naturalistic landscapes from all workspaces

Social Survey Coupled to Bio-physical Inventory/Analysis (5-year cycle)

(Formal public report of the social survey along with the bio-physical State of theUrban Forest– 5-year cycle)

- Citywide Values Regarding the Urban Forest
- Values Specific to Neighborhoods and/or Districts (as needed prior to capital program design)
- Physical access to natural areas and nature parks
- Incorporation of citizen values into the design of utility rights-of-way along public transportation routes

Natural Areas Scientific Inventory – 10-year Cycle

- Vegetative Inventory and Monitoring Systems
- Species – Shrubs and Trees
- Standing Dead and Down Woody Material
- Abundance
- Diameter Distribution
- Invasive Species (every 5 years)
- Percent of Fire Dependent Natural Communities Managed with Prescribed Fire Program

Developed Parks/Open Spaces – 5-year cycle

- Species – shrubs and trees – percentage change in native species present, every 5 years
- Tree canopy cover – percentage of canopy cover every 5 years
- Wildlife – percentage of parks with wildlife habitat assessments
- Wildlife – percentage of new landscape plans that incorporate native plant and animal conservation and restoration
- Invasive Species – annual visual assessment
- Stormwater – demonstrate the prioritization of future parks sites that directly support watershed hydrologic integrity
- Risk – damage from trees – annual Level 1 risk assessment each year in high use areas
- Energy conservation – percentage of new landscape plans to directly incorporate the reduction of heat loading

Appendix D

Example of Consistency between Vision and Goals Set by Public Committee on Urban Forest Sustainability, the Guiding Principles, Elements, Objectives and Operational Plan

Vision for Urban Forest Sustainability

The urban forest is abundant, diverse, healthy, and benefits the community.

GOAL #1: The urban forest should predominantly reflect the diversity of the surrounding native forest.

Guiding Principles: 1. government efficiency; public – private partnerships; 2. support neighborhoods; 3. increase the social, environmental and economic benefits of the urban forest by reducing costs; and support basic tenets of the City's Comprehensive Plan.

Element: Canopy Cover

Objective: Total tree canopy coverage is 50% or greater (Citywide).

Operational Plan:

1. Design and implement a canopy cover monitoring program
2. Prepare a digital 'illustrated booklet' on tree care and maintenance Best Management Practices

Element: Species – shrubs and trees

Objective: Tree and shrub diversity predominantly reflect the native forest.

Operational Plan:

1. Develop a science-based City Tree and Shrub Matrix that describes the optimal habitat requirements of all common woody species found within the city.

Common Name	Scientific Name	Plant Family	Florida Native	Mature Spread	Mature Height	Growth Rate	pH	Drought Tolerance	Wind Resistance	Flood Tolerance	Soil Area (w/3ft depth)	Hardiness Zone
American Elderberry	Sambucus nigra subsp. canadensis	Adoxaceae	Yes	6 to 10 feet	8 to 12 feet	moderate	alkaline, acidic	LOW	N/A	EXTENDED	10' x 10'	
American Elm	Ulmus americana	Ulmaceae	Yes	50 to 70 feet	70 to 90 feet	fast	alkaline, acidic	MEDIUM	MEDIUM LOW	EXTENDED	30' x 30'	2 to 9
American Holly	Ilex opaca	Aquifoliaceae	Yes	15 to 25 feet	35 to 50 feet	slow	acidic, slightly alkaline	MEDIUM	HIGHEST	EXTENDED	20' x 20'	5b to 9
American Hophornbeam	Ostrya virginiana	Betulaceae	Yes	YES	3 to 9a							
American Hornbeam	Carpinus caroliniana	Betulaceae	Yes	20 to 30 feet	20 to 30 feet	slow	acidic, slightly alkaline	MEDIUM HIGH	OCCASIONAL	10' x 10'	3 to 9a	
Baldcypress	Taxodium distichum	Cupressaceae	Yes	25 to 35 feet	60 to 80 feet	fast	acidic, slightly alkaline	MEDIUM	HIGHEST	EXTENDED	30' x 30'	5 to 10
Bismarkia	Bismarkia nobilis	Arecaceae	No	N/A	10 to 11							
Black Cherry	Prunus serotina	Rosaceae	Yes	35 to 50 feet	60 to 90 feet	fast	alkaline, acidic	MEDIUM LOW	30' x 30'	3b to 9a		

Example: Tree Matrix (partial)

Appendix E

Example of Relationship of Elements, Performance Indicators and Objectives by Land Use – typical for small to mid-size City

The Urban Forest Management Plan Worksheet divides City's urban forest into five basic land use types and includes a separate section on citywide elements. Each land use type has particular physical characteristics and issues, provides various benefits, and serves different needs. The health and quality of the urban forest in each land use type depends on the knowledge, skills and involvement of property owners, land managers and government agencies.

Citywide

Element	Performance Indicators	Objective
Canopy cover (goal 1; element e)		Total tree canopy coverage is 50% or greater
Optimal	No statistically significant net loss of canopy cover since the 2016 Urban Forest Analysis	
Good	Canopy Cover is 45% or greater	
Moderate	Canopy Cover is 40% or greater	
Low	Canopy Cover is lower than 40%	
Consensus Action(s) 1. Design and implement a canopy cover monitoring program – PUBLIC WORKS, PLANNING, $$ 2. Prepare a digital City of 'illustrated booklet' on tree care and maintenance Best Management Practices for inclusion on urban forestry web site – PUBLIC WORKS (Comm) $		
Hydrology (goal 1; element h)	The urban forest is an integral part of a comprehensive system for water conservation/management	Prevent adverse impacts to the water quality of creeks, lakes, wetlands, floodplains, groundwater and uplands
Good	Urban forest stormwater function is 10% higher than measured in the 2016 Urban Forest Analysis	
Moderate	Urban forest stormwater function is 5% higher than measured in the 2016 Urban Forest Analysis	
Low	No net loss of urban forest stormwater function since the 2016 Urban Forest Analysis	
Consensus Action(s) 1. Design and implement an inventory and condition assessment of riparian woodland buffers and forested wetlands. - PLANNING $$		

Element	Performance Indicators	Objective
Tree and shrub species suitability (goal 2*)		Tree and shrub species are suitable for City's physical urban environment and adapted to the regional climate.[1]
Optimal	All publicly and privately planted trees and shrubs suited to the planting site, the urban environment and adapted to the regional climate (hardiness zone)	
Good	>85% of the publicly planted trees and shrubs are suited to the planting site, the urban environment and adapted to the regional climate (hardiness zone).	
Moderate	> 70% of the publicly planted trees are suited to the planting site, the urban environment and adapted t to the regional climate (hardiness zone).	
Low	Tree planting is ad hoc.	
Consensus Action(s) 1. Expand the City's Tree Matrix to include shrubs – PUBLIC WORKS, PLANNING, $		
Human health (goal 4; element a)		No net loss of human health benefits from the urban as defined by the EPA health benefits model used within the iTree analysis program
Optimal	Parks and Rec, greenways and trails with green infrastructure (trees and shrubs) exist within a 10-minute walk (0.6 mi) from any home.	
Good	Parks and Rec, greenways and trails with green infrastructure (trees and shrubs) exist within a 15-minute walk (1 mi.) from any home.	
Moderate	Parks and Rec, greenways and trails with green infrastructure (trees and shrubs) exist within a 5-minute drive from any home.	
Low	No net loss of acreage of existing Parks and Rec, greenways and trails with green infrastructure (trees and shrubs) since 2016.	

Element	Performance Indicators	Objective
Consensus Action(s) 1. Calculate the distance and travel time to Parks (Arc-GIS, spatial analyst) – Parks and Rec, $ 2. Develop Citywide strategic plan for acquisition and development of Parks and Rec, greenways and trails to ensure equitable accessibility. – Parks and Rec, PLANNING, $		
Air quality (goal 4; element g)		Ensure air quality levels comply with state and national ambient air quality standards
Optimal	No net decline in the urban forest's leaf area index^2 since 2016 Urban Forest Analysis	
Good	Net decline in the urban forest's leaf area index^2 does not exceed 10% since 2016 Urban Forest Analysis	
Moderate	Net decline in the urban forest's leaf area index^2 does not exceed 20% since 2016 Urban Forest Analysis	
Low	Net decline in the urban forest's leaf area index^2 does exceeds 20% since 2016 Urban Forest Analysis	
Consensus Action(s) 1. Continue assessment of urban forest effects on air quality using the iTree ecological analysis.		

Element	Performance Indicators	Objective
Greenhouse gas sequestration (goal 4; element h)		No net loss of the ability of the urban forest to sequester and store atmospheric carbon
Optimal	No net decline in the urban forest's leaf area index2 since the 2016 Urban Forest Analysis	
Good	Net decline in the urban forest's leaf area index2 does not exceed 10% since 2016 Urban Forest Analysis	
Moderate	Net decline in the urban forest's leaf area index2 does not exceed 20% since 2016 Urban Forest Analysis	
Low	Net decline in the urban forest's leaf area index2 does exceeds 20% since 2016 Urban Forest Analysis	
Consensus Action(s) 1. Continue assessment of urban forest effects on greenhouse gas sequestration using the iTree ecological analysis.		
Private professional arborists, landscape architects, engineers, etc. (goal 5; element c)		Through formal training and municipal workshops, the landscape and arboriculture industries operate with high professional standards and ethics, and commit to the goals as stated in the City's urban forest management plan
Optimal	Professional associations formally share the City's vision and goals for the urban forest	
Good	Specific cooperative arrangements with City	
Moderate	General cooperation among nurseries, tree care companies etc.	
Low	No cooperation among segments of the green industry. No adherence to professional standards and ethics.	
Consensus Action(s) 1. Develop and implement an inter-agency strategic plan for tree acquisition, planting, establishment and long-term care. – PLANNING, Parks and Rec, PUBLIC WORKS, $		

Element	Performance Indicators	Objective
Municipal urban forestry staff (goal 5; element d)		Professional urban forestry staff are provided ongoing training and education to coordinate and implement management of the City's urban forest system.
Optimal	Urban forestry staff are provided budget and time to attend at least one national conference or workshop each year to develop of effective skills in critical thinking, communication, planning and social and bio-physical assessments to coordinate and implement management of the City's urban forest system, and support their professional organizations.	
Good	Urban Forestry staff (City Arborist, inspectors, environmental coordinator, horticulturalist, tree crew leader) are provided a training budget and time to attend education programs that lead advanced certifications that benefit City operations.	
Moderate	Urban Forestry staff (City Arborist, inspectors, environmental coordinator, horticulturalist, tree crew leader) are provided a training budget and time to attend continuing education programs to maintain City required professional certifications.	
Low	Training budgets and time are allocated on an ad hoc basis.	
Consensus Action(s) 1. Establish an internal City continuing education policy to support the continued development of professional expertise needed to meet the challenge of implementing the UFMP in an expanding and dynamic City. – City Mgr., HR, PLANNING, PUBLIC WORKS, UTILITY CO, $$		

Element	Performance Indicators	Objective
Government agencies and Commission (goal 5; element e)		Departments (including UTILITY CO) and City Commission are provided support and training on urban forest benefits and implementation of the City's urban forest management plan
Optimal	Formal coordination of interdepartmental/interagency processes for the implementation of the urban forest plan are directed through a central interdisciplinary committee.	
Good	Municipal standards, including utility standards, are in place for implementing the urban forest management plan by interdepartmental/interagency processes on all municipal projects.	
Moderate	Interdepartmental/interagency coordination for the implementation of the urban forest plan occurs through informal and ad hoc decision-making processes.	
Low	No coordination of interdepartmental/interagency processes to support implementation of the urban forest plan.	
Consensus Action(s) 1. Prepare a draft resolution, for City Commission consideration, that recognizes the UFMP as the strategic plan for the management of the City's urban forest. - City Attorney's Office, PLANNING, $		

Element	Performance Indicators	Objective
Other governments and organizations (goal 5; element f)		Training and workshops support the collaboration and interaction among planning agencies and governments concerning forest sustainability within the Oklawaha and Santa Fe River Basins
Optimal	Watershed, natural resources and comprehensive land use plans are developed through cooperation and interaction among neighboring regional planning agencies and governments.	
Good	Regional planning for forest sustainability occurs on an ad hoc basis.	
Moderate	Government and planning agencies share similar policy vehicles.	
Low	No cooperation between City and regional planning agencies and governments regarding land use. All operate independently.	
Consensus Action(s) 1. Host a summit on forest sustainability that includes all relevant federal, state, regional and local government agencies and NGO's operating within the greater metropolitan region. - PLANNING, PUBLIC WORKS, $		

Element	Performance Indicators	Objective
Children – schools, clubs, camps, 4-H (goal 5; element b)		Through education children understand the contribution of the urban forest to the social, economic and ecological well-being of the community
Optimal	The role of the urban forest in supporting the social, economic and ecological well-being of the community is formally included in all school, club and camp curriculums.	
Good	The role of the urban forest in supporting the social, economic and ecological well-being of the community is formally included in ≥ 50% of school, club and camp curriculums.	
Moderate	The role of the urban forest in supporting the social, economic and ecological well-being of the community is formally included in <26 - 50% of school, club and camp curriculums.	
Low	The role of the urban forest in supporting the social, economic and ecological well-being of the community is not formally included in school, club and camp curriculums.	

Consensus Action(s)

1. Incorporate urban forest curriculum into Park summer programs and Earth academy. – Parks and Rec, $

Element	Performance Indicators	Objective
Citywide values regarding the urban forest (goal 7; element a)		Priorities for each 5-year management cycle reflect the values of the City's citizens are determined through a science based social survey.
Optimal	Citizen values are assessed for all capital improvement projects that impact urban forest canopy cover, leaf area index or open space accessibility objectives of the urban forest management plan.	
Good	Assessment of citizens values and reflects a strong correlation to demographics of citizens at time of survey.	
Moderate	Assessment of citizens values completed since 2019.	
Low	No assessment or survey since 2019	
Consensus Action(s) 1. Incorporate a social survey and assessment of citizen interest in urban forest management into the iTree ecological analysis – PUBLIC WORKS, Communications, $$		

Residential Land Use Type

Element	Performance Indicators	Objective
Species – shrubs and trees (goal 1; element a)		Tree and shrub diversity predominantly reflect the native forest as described by the Florida Natural Areas Inventory (FNAI).
Optimal	Net increase of native shrub and tree diversity, in residential land use type, since the 2016 urban forest analysis.	
Good	No net loss of native shrub and tree diversity, in residential land use type, since the 2016 urban forest analysis.	
Moderate	Net loss of native shrub and tree diversity, in residential land use type, since the 2016 urban forest analysis is <10%	
Low	Net loss of native shrub and tree diversity, in residential land use type, since the 2016 urban forest analysis is ≥ 10%	
Consensus Action(s) 1. Expand the City's Tree Matrix to include shrubs – PUBLIC WORKS, PLANNING, $		
Canopy cover (goal 1; element e)		Tree canopy cover is no less than 45%
Optimal	No absolute net loss of canopy cover since the 2016 urban forest analysis.	
Good	Net loss of canopy cover, in residential land use type, since the 2016 urban forest analysis is <10%	
Moderate	Net loss of canopy cover, in residential land use type, since the 2016 urban forest analysis is <15%	
Low	Net loss of canopy cover, in residential land use type, since the 2016 urban forest analysis is >15%	
Consensus Action(s) 1. Organize and present at least one workshop on urban wildlife management per Commission District every 4 years – Parks and Rec, $		

Element	Performance Indicators	Objective
Wildlife (goal 1; element g)		Property owners/residents are knowledgeable about wildlife that may occur on their property
Optimal	All commission districts have received City sponsored workshop/training about urban wildlife once per 5-year period.	
Good	50 % of commission districts have received City sponsored workshop/training about urban wildlife once per 5-year period	
Moderate	25 - 50% of commission districts have received City sponsored workshop/training about urban wildlife once per 5-year period	
Low	No workshops given to residents.	
Consensus Action(s) 1. Organize and present at least one workshop on urban wildlife management per District every 4 years – Parks and Rec, $		

Element	Performance Indicators	Objective
Hydrology (goal 1; element h)		No adverse impacts to the water quality of creeks, lakes, wetlands, floodplains, groundwater and uplands.
Optimal	Urban forest stormwater function is >10% higher on residential land than in the 2016 Urban Forest Analysis as measured by avoided runoff.	
Good	Urban forest stormwater function is 10% higher on residential land than in the 2016 Urban Forest Analysis as measured by avoided runoff.	
Moderate	Urban forest stormwater function is 5% higher on residential land than in the 2016 Urban Forest Analysis as measured by avoided runoff.	
Low	No net loss of urban forest stormwater function on residential land since the 2016 Urban Forest Analysis as measured by avoided runoff.	
Consensus Action(s) 1. Develop and implement an inter-departmental strategic plan for incorporation of green infrastructure into City's stormwater and water conservation programs – PUBLIC WORKS, PLANNING, UTILITY CO, $		

Element	Performance Indicators	Objective
Invasive species (goal 2; element g)		Property owners/residents eliminate invasive plant species.
Optimal	All residential land is free of invasive plant species.	
Good	Net decrease in the abundance and diversity of invasive plant species on residential land.	
Moderate	City-wide formal assessment of invasive species.	
Low	No formal assessment of invasive species.	
Consensus Action(s) 1. Continue to conduct an invasive species assessment on residential lands as part of the iTree ecological analysis. – PUBLIC WORKS, $$		
Tree and shrub species suitability (goal 2*)		Tree and shrub species are suitable for City's physical urban environment and adapted to the regional climate.
Optimal	All publicly mandated planted trees and shrubs are suited to the planting site, the urban environment and adapted to the regional climate (hardiness zone) according to the Tree Matrix.	
Good	>75% of publicly mandated planted trees and shrubs are suited to the planting site, the urban environment and adapted t to the regional climate (hardiness zone) according to the City's Tree Matrix.	
Moderate	Publicly mandated tree plantings are evaluated using the City's Tree Matrix for planting site suitability, use in the urban environment and adapted to the regional climate (hardiness zone).	
Low	Tree planting is ad hoc.	
Consensus Action(s) 1. Expand the City of City's Tree Matrix to include shrubs – PUBLIC WORKS, PLANNING, $		

Element	Performance Indicators	Objective
Risk – damage from trees (goal 4; element f)		Risk of property damage or personal injury is reduced to as low as reasonably practical.
Optimal	All trees within the residential land use are managed to reduce risk to as low as reasonably practical.	
Good	Tree risk management is based upon 'standard of care' described in 'ANSI 3000: Tree Risk Assessment a. Tree Failure.'	
Moderate	Level 1 tree risk assessment (ANSI 3000) is available to all residential landowners.	
Low	Tree risk is managed on an ad hoc basis.	
Consensus Action(s) 1. None		
Energy conservation (goal 4; element i)		Heat loading of residential buildings is reduced by shade produced from tree and shrub canopy.
Optimal	Net 10% increase in energy savings since the 2016 Urban Forest Analysis.	
Good	Net 5% increase in energy savings since the 2016 Urban Forest Analysis.	
Moderate	No net loss in energy savings since the 2016 Urban Forest Analysis.	
Low	5% loss in energy saving since the 2016 Urban Forest Analysis.	
Consensus Action(s) 1. Provide homeowners with training and information concerning the proper placement of trees around their home to reduce heat loading. – UTILITY CO, $		

Element	Performance Indicators	Objective
Crime prevention (goal 4; element j)		The City's urban forest supports a safe environment for residents and visitors.
Optimal	CPTED design standards are in place within all residential neighborhoods	
Good	CPTED design standards are in place on all new residential neighborhoods	
Moderate	CPTED design standards are in place within at least 50% of new residential neighborhoods	
Low	CPTED design standards are in place within less than 50% of all new residential neighborhoods	
Consensus Action(s) 1. Develop and implement an MOU, between the Police Dept and PLANNING, that requires the review all new development plans for compliance with CPTED standards – Police Dept, PLANNING, $$		

Element	Performance Indicators	Objective
Fire prevention (goal 4; element k)		Property owners/residents implement landscape designs and fire prevention techniques that reduce forest fuel fire hazard.
Optimal	All residential landscapes in Wildland Urban Interface meet Low Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <50). **https://www.fdacs.gov/content/download/4794/file/hazard_wf_risk_scoresheet.pdf**	
Good	All residential landscapes in Wildland Urban Interface meet at least Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Moderate	Some residential landscapes in Wildland Urban Interface meet Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Low	Residents in Wildland Urban Interface do not assess landscapes for Wildfire Risk.	
Consensus Action(s) 1. Map the Wildland Urban Interface, as defined by the U.S. Forest Service, within the City. – PLANNING, $		

Element	Performance Indicators	Objective
General public outreach (goal 5; element a)	Urban forestry staff collaborate with aligned organizations to provide technical tree and shrub care information and training for property owners/residents.	Property owners/residents have access to information, training and assistance on tree and shrub care.
Good	Technical tree and shrub care information and training for property owners/residents is designed, organized and presented by the City.	
Moderate	Technical tree and shrub care information and training for property owners/residents is actively supported by the City on an ad hoc basis.	
Low	Technical tree and shrub care information and training for property owners/residents is not actively supported by the City.	
Consensus Action(s) 1. Community arborist program – mimic Master Gardeners Program		

Element	Performance Indicators	Objective
Values specific to neighborhoods and/or districts (goal 7; element b)		Urban forest conservation practices are defined at the neighborhood scale.
Optimal	All capital improvement projects focused at the neighborhood scale are vetted for urban forest conservation concerns before final design.	
Good	Capital improvement projects focused at the neighborhood scale are planned and designed with the active involvement of the City's urban forestry program or neighborhood residents.	
Moderate	Capital improvement projects focused at the neighborhood scale are planned without active involvement of the City's urban forestry program or neighborhood residents.	
Low	Capital improvement projects focused at the neighborhood scale are planned, designed and implemented without the active involvement of the City's urban forestry program or neighborhood residents.	

Consensus Action(s)

1. Prepare a Land Development Code (LDC) code amendment that requires the use of certified arborists (ISA, ASCA) on all publicly financed Capital Improvement Projects (CIP) and other projects that impact existing urban forest resources. - PUBLIC WORKS, $

Nature Parks and Rec/Woodlands/ Natural Areas

Element	Performance Indicators	Objective
Species – shrubs and trees (goal 1; element a)		Tree and shrub diversity reflect the native forest as described by the FNAI.
Optimal	All forest stands in the system contain the complete regionally appropriate 'FNAI character set of species' for each specific natural community.	
Good	Greater than 85% of all forest stands in the system contain the complete regionally appropriate 'FNAI character set of species' for each specific natural community.	
Moderate	Greater than 75% of all forest stands in the system contain the complete regionally appropriate 'FNAI character set of species' for each specific natural community.	
Low	Less than 75% of all forest stands in the system contain the complete regionally appropriate 'FNAI character set of species' for each specific natural community.	
Consensus Action(s) 1. Prepare natural resource management plans that identify criteria and quantifiable performance objectives for City-owned natural areas. – Parks and Rec, $$		

Element	Performance Indicators	Objective
Standing dead and down woody material (goal 1; element c)		Standing dead and downed woody material is consistent with native forest communities described by FNAI.
Optimal	Dead standing and downed woody material are conserved as a functional part of the natural forest ecosystem, if not posing a risk to visitors.	
Good	Dead standing and downed woody material are conserved to meet the minimum levels described by the FNAI.	
Moderate	All standing dead trees are cut to ≤12 feet in height to reduce risk to visitors along active trails and visitor facilities.	
Low	All standing dead and downed trees are removed from natural forest ecosystems.	
Consensus Action(s) 1. Initiate vegetative inventory and monitoring systems (dead woody material) on 50% of the nature park area every 5 years. – Parks and Rec, $$		
Abundance (goal 1; element d)		Native plant abundance is consistent with native forest communities as described by the FNAI.
Optimal	Parks and Rec/Woodlands/NA are assessed every 5 years and scored similar to the appropriate FNAI plant community reference site.	
Good	Native plant abundance is assessed every 10 years.	
Moderate	Native plant abundance is not systematically assessed.	
Low	Native plant abundance is unknown.	
Consensus Action(s) 1. Initiate vegetative inventory and monitoring systems (plant abundance) on 50% of the nature park area every 5 years. – Parks and Rec, $$		

Element	Performance Indicators	Objective
Canopy cover (goal 1; element e)		Tree canopy cover of no less than 70% in non-fire- adapted natural communities in nature Parks and Rec land use type.
Optimal	No absolute net loss of canopy cover in non-fire-adapted natural communities in the nature Parks and Rec land use type, since the 2016 urban forest analysis.	
Good	Net loss of canopy cover in non-fire-adapted natural communities in the nature Parks and Rec land use type, since the 2016 urban forest analysis is <10%	
Moderate	Net loss of canopy cover in non-fire-adapted natural communities in the nature Parks and Rec land use type, since the 2016 urban forest analysis is <15%	
Low	Net loss of canopy cover in non-fire-adapted natural communities in the nature Parks and Rec land use type, since the 2016 urban forest analysis is >15%	
Consensus Action(s) 1. Initiate vegetative inventory and monitoring systems (plant abundance) on 50% of the nature park area every 5 years. – Parks and Rec, $$		
Diameter distribution (goal 1; element f)		Size class distribution for native tree species is consistent with native forest communities described by FNAI.
Optimal	Diameter size distribution by species approximates a 'reversed J' shape when graphed.	
Good	Diameter size distribution by species approximates a 'reversed J' shaped curve when graphed but does not extend to the highest size class potentials of a species.	
Moderate	All stands have a formal assessment.	
Low	No formal assessment.	
Consensus Action(s) 1. Initiate vegetative inventory and monitoring systems (tree diameter distribution) on 50% of the nature park area every 5 years. – Parks and Rec, $$		

Element	Performance Indicators	Objective
Hydrology (goal 1; element h)		Prevent adverse impacts to water bodies and conserve aquatic and terrestrial habitat. Ref. – Art VIII obj. 15 and
Optimal	Forest uplands, wetlands, floodplains and riparian stream corridors are actively managed to increase water infiltration; stabilize banks; serve as conservation corridors; and provide aquatic and terrestrial habitat.	
Good	Forests and woodlands have management plans prepared that identify specific outcomes for enhancement of watershed function, aquatic and terrestrial habitat.	
Moderate	Forests and woodlands are systematically assessed for potential contribution to enhancement of watershed function, aquatic and terrestrial habitat.[X]	
Low	Ad hoc manipulation of forests and woodlands to support existing watershed function or aquatic and terrestrial habitat.	
Consensus Action(s) 1. Incorporate specific and measurable outcomes for water quality in all Nature Park management plans – Parks and Rec, PUBLIC WORKS, PLANNING, $		

Element	Performance Indicators	Objective
Resilient to fire (goal 2; element c)		Maintain publicly owned fire adapted habitats in a healthy condition
Optimal	An active prescribed fire program, as identified by the FNAI, is used to maintain all fire adapted habitats within the nature park land use type.	
Good	>80% of fire-dependent natural communities have characteristic structure and species composition (FNAI) and are maintained with an appropriate fire return interval as identified by FNAI.	
Moderate	60 - 80% of fire-dependent natural communities have characteristic structure and species composition (FNAI), and are maintained with an appropriate fire return interval as identified by FNAI.	
Low	<60% of fire-dependent natural communities have characteristic structure and species composition (FNAI) and are maintained with an appropriate fire return interval as identified by FNAI.	
Consensus Action(s) 1. Develop and implement a Prescribed Fire Program and a Fire Management Program for all Nature Parks and Rec. – Parks and Rec, $$		

Element	Performance Indicators	Objective
Invasive species (goal 2; element g)		Invasive plant and animal species are eliminated.
Optimal	All non-native invasive species are monitored and treated with appropriate science-based management practices to maintain invasive plant cover at <10% over all nature park acreage.	
Good	At least 80% of nature park acreage is maintained at <10% invasive plant cover	
Moderate	50-80% of nature park acreage is maintained at <10% cover of invasive plants	
Low	<50% of nature park acreage has <10% cover of invasive plants	
Consensus Action(s) 1. Design and conduct an invasive species inventory and assessment every 5-years. Parks and Rec, $$		
Risk – damage from trees (goal 4; element f)		Risk of property damage or personal injury is reduced to as low as reasonably practical within high visitor use areas.
Optimal	Risk in all trees reduced to as low as reasonably practical within high visitor use areas.	
Good	Tree risk management is based upon 'standard of care' described in 'ANSI 3000: Tree Risk Assessment a. Tree Failure.'	
Moderate	Level 1 tree risk assessment (ANSI 3000) on a documented frequency.	
Low	Tree risk is managed on an ad hoc basis.	
Consensus Action(s) 1. Conduct Level 1 tree risk assessment (ANSI 3000) of all trees in high use areas. – Parks and Rec, $		

Element	Performance Indicators	Objective
Crime prevention (goal 4; element j)		The City supports a safe environment within its woodlands/ natural/nature Parks and Rec.
Optimal	CPTED design standards are in place within all high visitor use areas	
Good	CPTED design standards are practiced in all high visitor use areas	
Moderate	CPTED design standards are considered in all high visitor use areas	
Low	CPTED design standards are not practiced in all high visitor use areas	
Consensus Action(s) 1. Prepare an MOU, between the Police Dept and PLANNING, that requires the review all new development plans for compliance with CPTED standards – Police Dept, PLANNING		
Fire prevention (goal 4; element k)		Forest fuels are managed to eliminate risk of wildfire.
Optimal	Fire regimes are aligned with natural plant communities as described by FNAI, and the 12-foot-wide fire breaks and management to reduce flammable vegetation along the zone where structures and other human development abut fire-type vegetation in natureParks and Rec.	
Good	12-foot-wide fire breaks and management to reduce flammable vegetation along the zone where structures and other human development abut fire-type vegetation in natural areas.	
Moderate	12-foot-wide fire breaks in all areas where human development abuts fire-type vegetation in nature Parks and Rec.	
Low	Fire breaks in some areas where human development abuts fire-type vegetation in nature Parks and Rec.	

Element	Performance Indicators	Objective
Consensus Action(s) 1. Develop and implement a Prescribed Fire Program and a Fire Management Program for all Nature Parks and Rec. – Parks and Rec, $$		
Physical access (goal 6; element b)		Public nature Parks and Rec/ natural areas offer a safe and welcoming experience.
Optimal	The City's park and open space system ensures the visibility of, preservation of, and access to environmentally significant open spaces.	
Good	City nature Parks and Rec actively address the most significant perceptions of security and welcomeness.	
Moderate	City has a formally assessed awareness of residents' perceptions of security and welcomeness at nature Parks and Rec.	
Low	City has limited understanding of residents' perceptions of security and welcomeness at nature Parks and Rec.	
Consensus Action(s) 1. Cooperate with social science experts in the design of a social survey to assess City resident perceptions of security and welcomeness at nature Parks and Rec. – Parks and Rec, $$		

Transportation (Corridors)

Element	Performance Indicators	Objective
Species – shrubs and trees (goal 1; element a)		Urban forest tree and shrub species are suitable to City's physical urban environment and regional climate.
Optimal	Net increase of native shrub and tree diversity, in transportation land use type, since the 2016 urban forest analysis.	
Good	No net loss of native shrub and tree diversity, in transportation land use type, since the 2016 urban forest analysis.	
Moderate	Net loss of native shrub and tree diversity, in transportation land use type, since the 2016 urban forest analysis is <10%	
Low	Net loss of native shrub and tree diversity, in transportation land use type, since the 2016 urban forest analysis is ≥ 10%	
Consensus Action(s) 1. Prepare a Land Development Code (LDC) code amendment to require the use of the City of City's Tree Matrix as a reference document for all tree planting projects required through code or through use of public funds. – PLANNING, PUBLIC WORKS, Parks and Rec, $ 2. Expand the City's Tree Matrix to include shrubs – PUBLIC WORKS, PLANNING, $		
Canopy cover (goal 1; element e)		Tree canopy cover no less than 35%. Ref. – Strategic Framework – 4 (c)
Optimal	No absolute canopy cover loss, in the transportation land use type, since the 2016 urban forest analysis.	
Good	Canopy Cover is 30% or greater	
Moderate	Canopy Cover is 25% or greater	
Low	Canopy Cover is lower than 25%	
Consensus Action(s) 1. Design and implement a canopy cover monitoring program– PUBLIC WORKS, PLANNING, $$		

Element	Performance Indicators	Objective
Health (goal 2; element a)		All publicly managed trees within rights-of way are maintained to maximize current and future benefits, tree health and condition.
Optimal	All trees within the transportation land use type are rated in very good to excellent health and condition.	
Good	1 - 5% of the trees within the transportation land use type are rated in poor or dead health and condition according to procedures used in the City's 2016 Urban Forest Analysis.	
Moderate	5 - 10% of the trees within the transportation land use type are rated in poor to dead health and condition according to procedures used in the City's Urban Forest Analysis.	
Low	>10% the trees within the transportation land use type are rated in poor to dead health and condition according to procedures used in the City's 2016 Urban Forest Analysis procedures.	

Consensus Action(s)

1. Utilize systematic rapid (mobile) risk assessment surveys to identify 'hazardous' trees and prioritize their removal, with emphasis on emergency and evacuation routes. – PUBLIC WORKS, $

Element	Performance Indicators	Objective
Invasive species (goal 2; element g)		Management eliminates invasive plant species.
Optimal	Invasive species are monitored and treated with appropriate science-based cultural practice, following the City's formal invasive species management strategy along all transportation corridors.	
Good	The City has a formal invasive species management strategy for some transportation corridors.	
Moderate	Assessment invasive species and treatment on an ad hoc basis.	
Low	No assessment.	
Consensus Action(s) 1. Conduct a rapid invasive species inventory and assessment along all City rights-of-way on an annual basis. - TRANSPORTATION, $ 2. Develop a strategic plan for invasive species management within the City's transportation corridors. – TRANSPORTATION, $		
Stormwater (goal 4; element b)		Trees and shrubs are an integral part of a Complete - Green street design for urban water conservation.

Element	Performance Indicators	Objective
Optimal	15% gain in avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Good	10% gain in avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Moderate	5% net gain in avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Low	No net loss of avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Consensus Action(s) 1. Target tree planting in areas of high impervious surface within Transportation Corridors. – TRANSPORTATION, PUBLIC WORKS, UTILITY CO, $		
Utility rights-of-way (goal 4; element c)		Provide a safe and reliable utility infrastructure.

Element	Performance Indicators	Objective
Optimal	Tree pruning within utility rights-of-way along public transportation routes is consistent with ANSI standards[1] and incorporates citizen values into strategic decision making.	
Good	Tree pruning within utility rights-of-way along public transportation routes is consistent with ANSI standards[1] and industry standards for line clearance.	
Moderate	Tree pruning within utility rights-of-way along public transportation routes is consistent with ANSI standards.	
Low	Tree pruning within utility rights-of-way along public transportation routes is inconsistent with ANSI pruning standards and/or industry standards for line clearance.	

Consensus Action(s)

1. Conduct social surveys once every 5 years to determine citizen values concerning vegetative management within utility rights-of-way. – UTILITY CO, PUBLIC WORKS, $$

Element	Performance Indicators	Objective
Multi-modal transportation (goal 4; element d)		The urban forest supports the choice of pedestrian travel within the City's multi-modal transportation network Ref. – Comprehensive Plan – Mobility, goal 2; policy 2.1.6 and Strategic Framework – Community; (a) (b)
Optimal	100% of the miles within the multi-modal transportation network support tree lined streetscapes designed and maintained to provide a sense of place/community space and shade that promotes pedestrian travel.	
Good	75% of the miles within the multi-modal transportation network are actively designed to support tree lined streetscapes.	
Moderate	50% of the miles within the multi-modal transportation network are actively designed to support tree lined streetscapes.	
Low	Tree lined streetscapes are not considered when designing pedestrian use of the multi-modal transportation network.	
Consensus Action(s) 1. Following the City of City's Tree Matrix implement design standards for the multi-modal transportation network to support healthy trees that provide at least 40% shade cover. – TRANSPORTATION, $		

Element	Performance Indicators	Objective
Risk – damage from trees (goal 4; element f)		Risk of property damage or personal injury is reduced to as low as reasonably practical.
Optimal	Publicly managed trees are monitored, and then maintained, through a 3 – year cycle of inventories that identify structural, disease and insect problems.	
Good	Publicly managed trees are monitored, and then maintained, through a 4 – year cycle of inventories that identify structural, disease and insect problems.	
Moderate	Publicly managed trees are monitored, and then maintained, through a 5 – year cycle of inventories that identify structural, disease and insect problems.	
Low	Publicly managed trees are monitored, and then maintained, through a >5 – year cycle of inventories that identify structural, disease and insect problems.	
Consensus Action(s) 1. Maintain 2020 internal policy and procedures regarding tree inspection and 3-year pruning cycle within the City's Transportation Corridors. – PUBLIC WORKS, TRANSPORTATION, $		

Element	Performance Indicators	Objective
Energy conservation (goal 4; element i)		Heat loading of buildings and paved transportation surfaces is reduced by shade produced from tree and shrub canopy. Ref. – Art. VIII obj. 1 Strategic Framework – Env; (a)
Optimal	Tree lined streetscapes are designed to support 40% shading of buildings, sidewalks and roads.	
Good	Tree lined streetscapes are designed to support shading of buildings, sidewalks and roads.	
Moderate	Formal assessment.	
Low	No assessment.	
Consensus Action(s) 1. Assess the City's Transportation Corridors for tree and shrub shade. - TRANSPORTATION		
Visual access to nature (goal 6; element a)		Exemplary tree streetscapes occur within historic areas, along major thoroughfares, and throughout highly visible locations.
Optimal	Contiguous tree lined streets are designed to support pedestrian travel and access to visually diverse naturalistic landscapes.	
Good	Multi-modal tree lined streets are used for informal gathering and recreation.	
Moderate	Pedestrian use of tree lined streets increases (statistical significance).	
Low	Pedestrian use of tree lined streets remains unchanged.	
Consensus Action(s) 1. Monitor pedestrian use of shaded vs non-shaded streets. – TRANSPORTATION, $$		

Commercial/Industrial/Institutional

Element	Performance Indicators	Objective
Species – shrubs and trees (goal 1; element a)		Tree and shrub diversity predominantly reflect the native forest as described by the Florida Natural Areas Inventory (FNAI).
Optimal	No net loss of native shrub and tree diversity, in residential land use type, since the 2016 urban forest analysis.	
Good	Net loss of native shrub and tree diversity, in Commercial/ Industrial/Institutional land use type, since the 2016 urban forest analysis is <10%	
Moderate	Net loss of native shrub and tree diversity, in Commercial/ Industrial/Institutional land use type, since the 2016 urban forest analysis is <30%	
Low	Net loss of native shrub and tree diversity, in Commercial/ Industrial/Institutional land use type, since the 2016 urban forest analysis is >30%	
Consensus Action(s) 1. Continue to conduct tree and shrub diversity assessment within the iTree ecological analysis. - PUBLIC WORKS, $$		
Canopy cover (goal 1; element e)		Tree canopy cover not less than 35%.
Optimal	No net loss of canopy cover since the 2016 urban forest analysis.	
Good	Canopy cover is greater than 30%.	
Moderate	Canopy cover is greater than 25%	
Low	Canopy cover is less than 25%	
Consensus Action(s) 1. Design and implement a canopy cover monitoring program– PUBLIC WORKS, PLANNING, $$		

Element	Performance Indicators	Objective
Hydrology (goal 1; element h)		No adverse impacts to the water quality of creeks, lakes, wetlands, floodplains, groundwater and uplands. Ref. – Article VIII 28 and Comp Plan Conservation Goal 2
Optimal	Property owners implement landscape designs that contribute to 15% gain in water conservation.	
Good	10% gain in avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Moderate	5% net gain in avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Low	No net loss of avoided stormwater runoff based upon the 2016 Urban Forest Analysis.	
Consensus Action(s) 1. Develop and implement an inter-departmental strategic plan for incorporation of green infrastructure into City's stormwater and water conservation programs – PUBLIC WORKS, PLANNING, UTILITY CO, $		
Invasive species (goal 2; element g)		Invasive plant and animal species are eliminated.
Optimal	All Commercial/Industrial/ Institutional land is free of invasive plant species.	
Good	Net decrease in the abundance and diversity of invasive plant species on Commercial/Industrial/ Institutional land.	
Moderate	City-wide formal assessment of invasive species.	
Low	No formal assessment of invasive species.	
Consensus Action(s) 1. Conduct invasive species assessments on the commercial/industrial/institutional lands type as part of the iTree ecological analysis. - PLANNING, $$		

Element	Performance Indicators	Objective
Risk – damage from trees (goal 4; element f)		Risk of property damage or personal injury is reduced to as low as reasonably practical.
Optimal	Risk in all trees within the Commercial/Industrial/Institutional land use type is reduced to as low as reasonably practical.	
Good	Tree risk management is based upon 'standard of care' described in 'ANSI 3000: Tree Risk Assessment a. Tree Failure.'	
Moderate	Level 1 tree risk assessment (ANSI 3000) is available to all Commercial/Industrial/ Institutional landowners.	
Low	Tree risk is managed on an ad hoc basis.	
Consensus Action(s) 1. Notify commercial, industrial and institutional landowners of the City's ability to provide level 1 tree risk assessment. – PUBLIC WORKS, $		
Energy conservation (goal 4; element i)		Heat loading of buildings and pavement reduced by shade produced from tree and shrub canopy.
Optimal	Designed tree lined streetscapes are optimized for shading of buildings, sidewalks, roads and parking lots.	
Good	Published sun azimuth and atmospheric data along with tree structure descriptions are used to design tree lined streetscapes and landscapes that reduce heat loading within the Commercial/ Industrial/Institutional land use type.	
Moderate	Consideration of published sun azimuth and atmospheric data are incorporated into guidelines for the design of streetscapes.	
Low	Streetscapes are designed and implemented without explicit energy saving consideration.	
Consensus Action(s) 1. Prepare a Land Development Code (LDC) code amendment to require all new landscape designs meet LEEDS 'Certification' standards. – PLANNING, $		

Element	Performance Indicators	Objective
Crime prevention (goal 4; element j)		The City's urban forest supports a safe environment for businesses and workers.
Optimal	CPTED design standards are in place on all Commercial/ Industrial/Institutional properties.	
Good	CPTED design standards are in place on all new Commercial/ Industrial/Institutional properties.	
Moderate	CPTED design standards are in place within at least 50% of new Commercial/Industrial/ Institutional properties	
Low	No assessment of the use CPTED design standards on new Commercial/Industrial/ Institutional properties	

Consensus Action(s)

1. Develop and implement an MOU, between the Police Dept and PLANNING, that requires the review all new development plans for compliance with CPTED standards. – Police Dept, PLANNING, $

Element	Performance Indicators	Objective
Fire prevention (goal 4; element k)		Prevention of structure fires through directed manipulation of the urban forest.
Optimal	All Commercial/Industrial/ Institutional landscapes meet Low Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <50). **https://www.fdacs.gov/content/download/4794/file/hazard_wf_risk_scoresheet.pdf**	
Good	All Commercial/Industrial/ Institutional landscapes in Wildland Urban Interface meet at least Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Moderate	Some Commercial/Industrial/ Institutional landscapes in Wildland Urban Interface meet Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Low	Commercial/Industrial/ Institutional properties within Wildland Urban Interface are not assessed for Wildfire Risk.	
Consensus Action(s) 1. Map the Wildland Urban Interface, as defined by the U.S. Forest Service, within the City. – PLANNING, $		

Element	Performance Indicators	Objective
Wildlife habitat (goal 4; element l)		Conservation and management of wildlife habitat.
Optimal	All new industrial sites, commercial Parks and Rec and institutional lands actively implement a wildlife habitat plan prepared by a certified wildlife biologist - CWB® or active involvement of the Florida Fish and Wildlife Commission/Florida Forest Service.	
Good	New industrial sites, commercial Parks and Rec and institutional lands implement wildlife habitat conservation practices on an ad hoc basis.	
Moderate	On all new industrial sites, commercial Parks and Rec and institutional lands wildlife habitat values are identified through a science – based assessment on conserved open space.	
Low	All new industrial sites, commercial Parks and Rec and institutional lands conserve open space for habit values.	

Consensus Action(s)

1. In cooperation with state universities and Florida Fish and Wildlife Conservation Commission develop a methodology for rapid assessment of wildlife habitat within the City. – Parks and Rec, PLANNING, $$
2. Prepare a Land Development Code (LDC) code amendment that requires the use of the rapid assessment of wildlife habitat and habitat conservation on all new commercial/industrial/institutional Parks and Rec 1. over 10 acres in size; or 2. considered to be of strategic value in the protection of native plants and animals; or 3. aquatic habitat. – PLANNING, $

Element	Performance Indicators	Objective
Visual access (goal 6; element a)		Workers within buildings on industrial sites, commercial Parks and Rec and institutional lands have visual access to naturalistic landscapes.
Optimal	Landscape and architectural design provide visual access of naturalistic landscapes from all workspaces within the building.	
Good	All new industrial sites, commercial Parks and Rec and institutional lands incorporate landscape and architectural design to support partial visual access of naturalistic landscapes from within buildings.	
Moderate	All new industrial sites, commercial Parks and Rec and institutional lands design naturalistic landscapes that support visual access from within buildings.	
Low	All new industrial sites, commercial Parks and Rec and institutional lands do not incorporate naturalistic landscape design that considers visual access to nature from within buildings.	
Consensus Action(s) 1. Prepare a Land Development Code (LDC) code amendment that requires landscape designs incorporate native plant species. – PLANNING, $		

Developed Parks and Rec/Open Spaces

Element	Optimal – Performance Indicator	Objective
Species – shrubs and trees (goal 1; element a)		Tree and shrub diversity reflect the native forest as described by the FNAI.
Optimal	Net increase of native shrub and tree diversity, in developed/open space land use type.	
Good	No net loss of native shrub and tree diversity, in developed/open space land use type.	
Moderate	Formal assessments.	
Low	No assessment.	
Consensus Action(s) 1. Create and implement a vegetative assessment tool for use in Developed Parks and Rec. – Parks and Rec, $		
Standing dead and down woody material (goal 1; element c)		Standing dead and downed woody material are left in place when not posing a risk to visitors or infrastructure.
Optimal	Dead standing and downed trees are conserved as a functional part of the natural forest ecosystem, if not posing a risk to visitors.	
Good	Dead standing and downed trees are inspected annually and managed to reduce risk toas low as is reasonably practical for visitors and property.	
Moderate	All dead standing and downed trees are removed from only high use areas (i.e.. playgrounds, picnic tables, etc.)	
Low	All dead standing and downed trees are removed.	
Consensus Action(s) 1. Incorporate the conservation of standing dead and down woody material into landscape maintenance policies and procedures within developed Parks and Rec. – Parks and Rec, $ 2. Maintain at least one Parks and Rec, Recreation and Cultural Affairs staff member as an ISA Cert Arborist and TRAQ certified. – Parks and Rec, $$		

Element	Optimal – Performance Indicator	Objective
Tree canopy cover (goal 1; element e)		Tree canopy cover not less than 45%.
Optimal	No absolute net loss of canopy cover since the 2016 urban forest analysis.	
Good	Canopy cover greater than 40%	
Moderate	Canopy cover greater than 35%	
Low	Canopy cover greater than 30%	
Consensus Action(s) 1. Design and conduct tree and shrub canopy cover assessment every 5-years. – Parks and Rec, $		
Wildlife (goal 1; element g)		Park design and management support the conservation of native plants and animals.
Optimal	Formal landscape plans that incorporate native plant and animal conservation and restoration guide active management and monitoring on all developed Parks and Rec/open spaces.	
Good	Formal landscape plans incorporate native plant and animal conservation and restoration on all developed Parks and Rec/open spaces.	
Moderate	Native plants and animals suited to developed park/open space sites are identified through a science – based assessment on an ad hoc basis.	
Low	No assessment.	
Consensus Action(s) 1. In cooperation with state universities and Florida Fish and Wildlife Conservation Commission, develop a methodology for rapid assessment of wildlife habitat within the City. – Parks and Rec, PLANNING, $$		

Element	Optimal – Performance Indicator	Objective
Natural community types (goal 1; element i)		Landscape design reflects the structure and composition of native forest communities.
Optimal	Native trees, shrubs and non-woody plants suitable for City's physical urban environment and adapted to the regional climate[1] are central to all landscape designs.	
Good	New landscape design incorporate native plant associations and vegetative structure supported by site conditions.	
Moderate	Assessment of vegetation site conditions occurs on all developed Parks and Rec/open spaces.	
Low	Vegetation site condition assessments are conducted on an ad hoc basis.	
Consensus Action(s) 1. Design and implement vegetative inventories and assessments on a 5-year basis. – Parks and Rec, $		
Invasive species (goal 2; element g)		Invasive plant and animals are eliminated.
Optimal	Invasive species are monitored and treated with appropriate science-based cultural practice, following the City's formal invasive species management strategy on all developed Parks and Rec/open space.	
Good	The City has a formal invasive species management strategy for some developed Parks and Rec/ open space.	
Moderate	Assessment of invasive species and controlled on an ad hoc basis.	
Low	No assessment.	
Consensus Action(s) 1. Conduct a visual assessment of invasive species in all Developed Parks and Rec annually. – Parks and Rec, $		

Element	Optimal – Performance Indicator	Objective
Stormwater (goal 4; element b)		Prevent adverse impacts to the water quality of creeks, lakes, wetlands, floodplains, groundwater and uplands
Optimal	Forested floodplains and riparian forest stream corridors are managed to encourage infiltration as part of a comprehensive water conservation/stormwater management system.	
Good	Urban forest stormwater function is 10% higher on developed park/ open space land use type as measured by avoided runoff since the 2016 Urban Forest Analysis	
Moderate	Urban forest stormwater function is 5% higher on developed park/ open space land use type as measured by avoided runoff since the 2016 Urban Forest Analysis	
Low	No net loss of urban forest stormwater function on developed park/open space land use type as measured by avoided runoff since the 2016 Urban Forest Analysis.	
Consensus Action(s) 1. Prioritize the acquisition of Developed Parks and Rec/Open Space sites that directly support watershed hydrologic integrity. Parks and Rec, PLANNING, $		

Element	Optimal – Performance Indicator	Objective
Risk – damage from trees (goal 4; element f)		Risk of property damage or personal injury is reduced to as low as reasonably practical.
Optimal	Risk in all trees within high use areas of the developed park land use type is reduced to as low as reasonably practical.	
Good	Tree risk management is based upon 'standard of care' described in 'ANSI 3000: Tree Risk Assessment a. Tree Failure.'	
Moderate	Level 1 tree risk assessment (ANSI 3000) is conducted annually.	
Low	Tree risk is managed on an ad hoc basis.	
Consensus Action(s) 1. Conduct a Level 1 tree risk assessment (ANSI 3000) in high use areas each year. – PUBLIC WORKS, Parks and Rec, $$		
Energy conservation (goal 4; element i)		Heat loading of buildings and pavement is reduced by shade produced from tree and shrub canopy.
Optimal	Published sun azimuth and atmospheric data are used in the design and implementation of landscapes to mitigate urban heat island effects on all developed Parks and Rec/open spaces.	
Good	Published sun azimuth and atmospheric data are used in the design and implementation of landscapes on all new developed Parks and Rec/open spaces to reduce urban heat island effects.	
Moderate	Landscapes are designed and implemented with consideration of urban heat island effects.	
Low	Landscapes are designed and implemented without consideration of urban heat island effects.	
Consensus Action(s) 1. Prepare a Land Development Code (LDC) code amendment that requires that all RFP's for landscape designs on public Parks include an element that addresses the reduction of urban heat loading. – Parks and Rec, $		

Element	Optimal – Performance Indicator	Objective
Crime prevention (goal 4; element j)		The City supports a safe environment within its developed Parks and Rec/open spaces.
Optimal	CPTED design standards are in place within all high visitor use areas	
Good	CPTED design standards are practiced in all high visitor use areas	
Moderate	CPTED design standards are considered in all high visitor use areas	
Low	CPTED design standards are not considered in all high visitor use areas	
Consensus Action(s) 1. Map high use zones 2. Prepare a MOU to require Police Dept review all Developed Parks and Rec for CPTEC compliance in high use zones. – Parks and Rec, Police Dept, $		

Element	Optimal – Performance Indicator	Objective
Fire prevention (goal 4; element k)		Prevention of structure fires and wildfire associated with the urban forest through directed manipulation of the urban forest structure.
Optimal	All structures in developed Parks and Rec/open space meet Low Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <50). **https://www.fdacs.gov/content/download/4794/file/hazard_wf_risk_scoresheet.pdf**	
Good	All structures in developed Parks and Rec/open space in Wildland Urban Interface meet at least Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Moderate	Some structures in developed Parks and Rec/open spaces in Wildland Urban Interface meet Moderate Hazard Rating from the Florida Wildfire Risk Assessment Worksheet (Score <74).	
Low	Structures in developed Parks and Rec/open space in Wildland Urban Interface are not assessed for Wildfire Risk.	
Consensus Action(s) 1. Map the Wildland Urban Interface within the City of. – PLANNING, $		

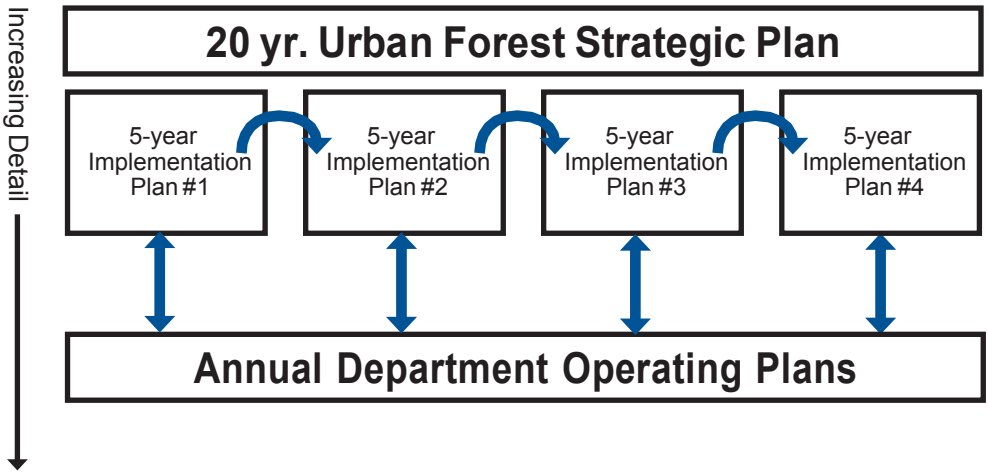
Element	Optimal – Performance Indicator	Objective
Visual and physical access (goal 6; elements a/b)		Visual and physical access to nature to support human health and well-being.
Optimal	>90% of all developed Parks and Rec/open spaces contain landscaping that reflects the native forest, are ADA compliant and provide opportunity of active recreation/exercise.	
Good	75 to 90% of all developed Parks and Rec/open spaces contain landscaping that reflects the native forest, are ADA compliant and provide opportunity of active recreation/exercise.	
Moderate	25 to 75% of all developed Parks and Rec/open spaces contain landscaping that reflects the native forest, are ADA compliant and provide opportunity of active recreation/exercise.	
Low	<25% of all developed Parks and Rec/open spaces contain landscaping that reflects the native forest, are ADA compliant and provide opportunity of active recreation/exercise.	
Consensus Action(s) 1. None		

Appendix F

Example of 5-year Implementation Plan by Management Type

The first 5-year Implementation Plan represents the initial set of actions, identified by the City's Internal Technical Advisory Committee, needed to lay the foundation for an inclusive and comprehensive urban forest management program. Actions chosen for 5-year Implementation Plan are intended to lead to long-term efficiencies in operational or capital costs. These actions address internal processes, procedures, public policy and education to support the institutional, community and technical capacities needed for management of the City's urban forest.

Actions for the 5-year Implementation Plan are arranged by category. The responsible or lead City departments are indicated.



Public Policy

- Prepare a draft resolution, for City Commission consideration, that recognizes the UFMP as the strategic plan for the management of the City's urban forest. - City Attorney's Office, PLANNING
- Prepare a Land Development Code (LDC) code amendment that requires the use of certified arborists (ISA, ASCA) on all publicly financed Capital Improvement Projects (CIP) and other projects that impact existing urban forest resources. – PLANNING, PUBLIC WORKS
- Prepare a Land Development Code (LDC) code amendment to require the use of the City's Tree Matrix as a reference document for all tree planting projects required through code or through use of public funds. – PLANNING, PUBLIC WORKS, PARKS, TRANSPORTATION
- Prepare a Land Development Code (LDC) code amendment to require all new landscape designs meet LEEDS 'Certification' standards. – PLANNING

- Prepare a Land Development Code (LDC) code amendment that requires landscape designs incorporate native plant species. – PLANNING
- Prepare a Land Development Code (LDC) code amendment that requires that all RFP's for landscape designs on all Developed Public Parks include an element that addresses the reduction of urban heat loading. – PLANNING, PARKS
- Prepare a Land Development Code (LDC) code amendment that requires the use of the rapid assessment of wildlife habitat and habitat conservation on all new commercial/industrial/institutional parks 1. over 10 acres in size; or 2. considered to be of strategic value in the protection of native plants and animals; or 3. aquatic habitat. – PLANNING

Monitoring the Urban Forest

- Incorporate a social survey and assessment of citizen interest in urban forest management into the iTree ecological analysis – PUBLIC WORKS, Strategic Initiatives, Communication officer
- Conduct social surveys once every 5 years to determine citizen values concerning vegetative management within utility rights-of-way. – UTILITY CO., PUBLIC WORKS
- Continue iTree urban forest ecological analysis on 5-year cycle to include measurement of:
  - » air quality
  - » greenhouse gas sequestration
  - » invasive species assessment on residential lands
- tree and shrub diversity assessment
- Design and implement a tree canopy cover monitoring program. – PUBLIC WORKS, PLANNING, TRANSPORTATION
- Map the Wildland Urban Interface, as defined by the U.S. Forest Service, within the City – PLANNING
- Design and implement an inventory and condition assessment of riparian woodland buffers and forested wetlands. - PLANNING
- Monitor pedestrian use of shaded vs non-shaded streets. – TRANSPORTATION
- Design and conduct tree and shrub canopy cover assessment in Developed Parks every 5-years. – PARKS
- Conduct a visual assessment of invasive species in all Developed Parks annually. – PARKS
- Conduct a rapid invasive species inventory and assessment along all City rights-of-way on an annual basis. – TRANSPORTATION

Education

- Provide homeowners with training and information concerning the proper placement of trees around their home to reduce heat loading. – UTILITY CO.
- Develop and Implement a Community Arborist Program – Use Extension Master Gardeners Program as a model. – PUBLIC WORKS

- Prepare a digital City 'illustrated booklet' on tree care and maintenance Best Management Practices for inclusion on urban forestry web site – PUBLIC WORKS
- Incorporate urban forest curriculum into Park summer programs and Earth academy. – PARKS
- Organize and present at least one workshop on urban wildlife management per Commission District every 4 years. – PARKS

Staff Enhancement

- Establish an internal City continuing education policy to support the continued development of professional expertise needed to meet the challenge of implementing the UFMP in an expanding and dynamic City. – City Mgr., HR, PLANNING, PUBLIC WORKS, UTILITY CO., TRANSPORTATION

Inter and Intra-agency Cooperation

- Develop and implement an inter-departmental strategic plan for incorporation of green infrastructure into City's stormwater and water conservation programs – PUBLIC WORKS, PLANNING, UTILITY CO., TRANSPORTATION
- Develop and implement an inter-agency strategic plan for tree acquisition, planting, establishment and long-term care. – PLANNING, PARKS, PUBLIC WORKS
- Develop and implement an MOU, between the Police Dept and PLANNING, that requires the review all new development plans for compliance with CPTED standards – Police Dept, PLANNING
- Prepare a MOU to require Police Dept review all Developed Parks for CPTEC compliance in high use zones. – PARKS, Police Dept
- Expand the City' Tree Matrix to include shrubs – PUBLIC WORKS, PLANNING
- In cooperation with state universities and the state Fish and Wildlife Conservation Commission, develop a methodology for rapid assessment of wildlife habitat within the City. – PARKS, PLANNING
- Host a summit on forest sustainability that includes all relevant federal, state, regional and local government agencies and NGO's operating within the greater Metropolitan region. - PLANNING, Strategic Initiatives, PUBLIC WORKS

Public Lands and Publicly Administered Rights-of-Way

Stewardship - Nature Parks

- Initiate vegetative inventory and monitoring systems on 50% of the Nature Parks every 5 years. – PARKS
  - » dead woody material
  - » plant abundance
  - » plant diversity
  - » tree diameter distribution
  - » invasive species inventory and assessment

- Prepare natural resource management plans that identify criteria and quantifiable performance objectives for City-owned Natural Parks. – PARKS
- Cooperate with social science experts in the design of a social survey to assess City resident perceptions of security and welcomeness at Nature Parks. – PARKS
- Incorporate specific and measurable outcomes for water quality in all Nature Parks management plans – PARKS, PUBLIC WORKS, PLANNING
- Develop and implement a Prescribed Fire Program and a Fire Management Program for all Nature Parks. – PARKS

Stewardship - Developed Parks

- Calculate the distance and travel time to parks (Arc-GIS, spatial analyst) – PARKS
- Develop Citywide strategic plan for acquisition and development of parks, greenways and trails to ensure equitable accessibility. – PARKS, PLANNING
- Prioritize the acquisition of Developed Parks/Open Space sites that directly support watershed hydrologic integrity. PARKS, PLANNING
- Maintain at least one PARKS, Recreation and Cultural Affairs staff member as an ISA Cert Arborist and TRAQ certified. – PARKS
- Map high use zones in Developed Parks. – PARKS
- Conduct Level 1 tree risk assessment (ANSI 3000) of all trees in high use areas of Developed and Nature Parks. – PARKS
- Create and implement a vegetative assessment tool for use in Developed Parks. – PARKS
- Incorporate the conservation of standing dead and down woody material into landscape maintenance policies and procedures within Developed Parks. – PARKS

Transportation Rights-of-Way

- Utilize systematic rapid (mobile) risk assessment surveys to identify 'hazardous' trees and prioritize their removal, with emphasis on emergency and evacuation routes. – PUBLIC WORKS, TRANSPORTATION
- Maintain 2020 internal policy and procedures regarding tree inspection and 3-year pruning cycle within the City's Transportation Corridors. – PUBLIC WORKS, TRANSPORTATION
- Target tree planting in areas of high impervious surface within Transportation Corridors. – TRANSPORTATION, PUBLIC WORKS, UTILITY CO.
- Develop a strategic plan for invasive species management within the City's transportation corridors. – TRANSPORTATION

Appendix G

Example of Cost – Benefit Analysis of Urban Trees

(from USDA Forest Service for the central region of Florida)

Calculating Benefits

Note* Benefits are realized at four geographic scales: parcel, neighborhood, community and global.

Annual benefits are calculated as:
B = E + AQ + CO2 + H + A

Where:
E = value of net annual energy savings (cooling and heating)
AQ = value of annual air-quality improvement (pollutant uptake, avoided powerplant emissions, and BVOC emissions)
CO2 = value of annual CO2 reductions (sequestration, avoided emissions, release from tree care and decomposition)
H = value of annual stormwater-runoff reductions
A = value of annual aesthetics and other benefits
Annual costs (C) are the sum of costs for residential yard trees (CY) and public trees (CP) where: CY = P + T + R + D + I + S + Cl + L
CP = P + T + R + D + I + S + Cl + L + A

Where:
P = cost of tree and planting
T = average annual tree pruning cost
R = annualized tree and stump removal and disposal cost
D = average annual pest and disease control cost
I = annual irrigation cost
S = average annual cost to repair/mitigate infrastructure damage
Cl = annual litter and storm cleanup cost
L = average annual cost for litigation and settlements from tree=related claims
A = annual program administration, inspection and other costs

Net benefits are calculated as the difference between total benefits and costs:
Net benefits = B – C

Benefit – cost ratios (BCR) are calculated as the ratio of benefits to costs: BCR = B ÷ C

Case Study: U.S. Forest Service, Central Florida

The U.S. Forest Service conducted a research project to determine benefits and costs of urban forests in Central Florida using Orlando, Florida field data and other information drawn from across the region including St. Petersburg, City of Tampa and Dunedin (Peper et al. 2010).

The outcome of their work is a process for the quantification of benefits and costs for representative small, medium and large broadleaf trees and a conifer in the

Central Florida region, which can be used as a starting point for more specific benefit cost analysis for your city.

Small broadleaf – crape myrtle
Medium broadleaf – southern magnolia Large broadleaf – live oak
Conifer – slash pine

The analysis distinguished between “yard trees” (those planted in residential sites) and “public trees” (those planted on streets or in parks). Benefits were calculated based on tree growth curves and numerical models that consider regional climate, building characteristics, air pollutant concentrations, and prices. Tree care costs and mortality rates were based on results from a survey of municipal and commercial arborists. A 60-percent survival rate was assumed over a 40-year timeframe.

General outcomes from the U.S. Forest Service research project:

- Large trees provide the most benefits.
- Average annual benefits over 40 years increase with mature tree size and differ based on tree location.
- Except for conifers, the lowest values were for public trees and the highest values were for yard trees on the western side of houses.

Benefits range as follows (40 years after planting):
$23 to $30 for a small tree (24 ft tall)
$59 to $74 for a medium tree (46 ft tall)
$127 to $149 for a large tree (56 ft tall)
$32 to $34 for a conifer (67 ft tall)
*Benefits associated with reduced levels of stormwater runoff and increased property values accounted for the largest proportion of total benefits in this region. Energy savings, reduced levels of air pollutants and CO2 in the air were the next most important benefits.
*Energy conservation benefits differ with tree location as well as size. Trees located opposite west-facing walls provided the greatest net cooling energy savings.
The benefits of trees were offset by the costs of caring for them. Based surveys of municipal and commercial arborists from throughout the region, the average annual cost for tree care over 40 years ranges from $20 to $31 per tree.

Annual costs for yard and public trees, respectively:
$20 and $22 for a small tree
$23 and $27 for a medium tree
$25 and $31 for a large tree
$23 and $27 for a conifer

*Planting costs, annualized over 40 years, were the greatest expense for yard trees ($11 per tree per year); planting costs for public trees were significantly lower ($6 per tree per year).

*For public trees, pruning ($7 to $11 per tree per year) and removal and disposal expenses ($4 to $6 per tree per year) were the greatest costs.
*Public trees also incur administrative costs, including inspections ($2 to $4 per tree per year).

Average annual net benefits (benefits minus costs) per tree for a 40-year period were calculated:
$1 for a small public tree to $10 for a small yard tree on the west side of a house
$32 for a medium public tree to $51 for a medium yard tree on the west side of a house
$96 for a large public tree to $123 for a large yard tree on the west side of a house
$7 for a public conifer to $9 for a yard conifer in a windbreak
*Environmental benefits alone, including energy savings, stormwater runoff reduction, improved air quality, and reduced atmospheric CO2, were greater than tree care costs for medium and large trees.

Net benefits for a yard tree opposite a west wall and a public tree were substantial when summed over the entire 40- year period:
$403 (yard) and $23 (public) for a small tree
$2,039 (yard) and $1,266 (public) for a medium tree
$4,939 (yard) and $3,859 (public) for a large tree
$344 (yard) and $296 (public) for a conifer

*Private trees produce higher net benefits than public trees. Survey results indicated that this was primarily due to higher maintenance costs for street and park trees. The standard of care is often higher for public trees because municipalities need to manage risk, maintain required clearances for pedestrians and vehicles, remove tree debris after hurricanes, and repair damage to sidewalks and curbing caused by tree roots.

Appendix H Gannt Charts

TASK	Year 1											
	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Step 1. Appoint Project Team	x											
Step 2. Community Engagement	x	x	x									
Step 2b. Inventory/Analysis		x	x	x	x	x	x	x				
Step 3. Report Survey/ Inventory				x					x			
Step 4. Guiding Principles					x							
Step 5. Announcement					x							
Step 6: Appoint a Public Committee						x	x					
Step 7: Workshop with Public Committee								x				
Step 8a: Development of the Vision									x			
Step 8b: Development of the Goals										x		
Step 9: Report Vision/Goal										x		
Step 10a: Appoint ITAC											x	x
Step 10b: Workshop ITAC												x
Step 11: Develop Elements												
Step 12: Geographic Scale												
Step 13: Develop Objects												
Step 14a: Consistency												
Step 14b: Consistency										x	x	x
Step 15: Perf Indicators												
Step 16: Present State												
Step17: Monitoring Indicators												
Step 18: Actions												
Step 19a: Consensus Actions												
Step 19b: Prioritize Actions												
Step 20a: Plan Consensus												
Step20b: Interim Report												
Step 21: Interim Plan												
Step 22: Workshop Interim Plan												
Step 23: Final Draft												
Step 24: Adopt and Execute												

2-year Preparation of the Strategic Plan

Year 2											
Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
x	x										
	x										
		x	x								
			x								
x	x	x	x								
				x	x	x					
						x					
						x	x				
						x	x				
							x				
								x			
								x			
								x			
									x		
										x	
										x	
											x

5-year Adaptive Operation Plan

TASK	Year 1												Year 2											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Appoint Advisory Comm Natural Resources	x																							
Appoint Internal Tech Working Group	x																							
Advisory Comm Meetings	x					x						x						x						x
Working Group Meetings	x		x			x			x			x			x			x			x			x
Annual Assessment											x												x	
Joint Annual Assessment Report												x												x
5-yr Bio-Phys Assessment																								
5-yr Social Assessment																								
Prepare Next 5-yr Operational Plan																								
Adopt 5-yr Operational Plan																								

Year 3												Year 4												Year 5											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		x			x			x			x			x			x			x			x			x			x			x			x
										x												x												x	
											x												x												x
																								x	x	x	x	x	x	x					
																								x	x	x	x	x	x	x					
																															x	x	x	x	x	
																																			x

Glossary

Abundance: The number of organisms in a population, combining "intensity" (density within inhabited areas) and "prevalence" (number and size of inhabited areas).

Active recreation parks: Public lands that support outdoor recreational activities, such as organized sports, playground activities, that require extensive facilities or development, or that have considerable environmental impact.

Adaptable: Ability of an organism to change in form or behavior during its life as a response to environmental stimuli.

Adaptive management: An intentional approach to making decisions and adjustments in response to new information and changes in context.

Air pollutants: Any substance in air that could, in high enough concentration, harm animals, humans, vegetation, and/or materials. Such pollutants may be present as solid particles, liquid droplets, or gases.

Air quality: Pertains to the degree to which the air is clean, clear, and free from pollutants such as smoke, dust, and smog, among other gaseous impurities.

Biological diversity: The variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, among species, and of ecosystems.

Canopy cover: The percentage of the ground covered by a vertical projection of the outermost perimeter of the natural spread of the foliage of plants. Cannot exceed 100 percent (also called crown closure or crown cover).

Climate change: The long-term alteration of temperature and normal weather patterns in a place.

Collaboration: The process of two or more people, entities, or organizations working together to complete a task or achieve a goal.

Consensus: A group decision-making process in which participants develop and decide on proposals with the aim, or requirement, of acceptance by all. The focus on avoiding negative opinion differentiates consensus from unanimity, which requires all participants to positively support a decision.

Delphi technique: The purpose of the Delphi technique is to elicit information and judgments from participants to facilitate problem-solving, planning, and decision-making. It does so without physically assembling the contributors. Instead, information is exchanged via mail, FAX, or email. This technique is designed to take advantage of participants' creativity as well as the facilitating effects of group involvement and interaction. It is structured to capitalize on the merits of group problem-solving and minimize the liabilities of group problem-solving.

Energy conservation: Reduction in the amount of energy consumed in a process or system, or by an organization or society, through economy, elimination of waste, and rational use.

Facilitation: The act of helping other people to deal with a process or reach an agreement or solution without getting directly involved in the process, discussion, etc. yourself.

Forest: An ecosystem characterized by more or less dense and extensive tree cover usually consisting of stands varying in characteristics such as species, structure, composition, age class, and commonly including streams, fish, and wildlife.

Forest health: The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects or disease, and resilience to disturbance.

Forest structure: The horizontal and vertical distribution of layers in a forest including the trees, shrubs, and ground cover (which includes vegetation and dead and down woody material.

Green Infrastructure: Green infrastructure is a cost-effective, resilient approach to managing wet weather impacts that provides many community benefits. While single-purpose gray stormwater infrastructure—conventional piped drainage and water treatment systems—is designed to move urban stormwater away from the built environment, green infrastructure reduces and treats stormwater at its source while delivering environmental, social, and economic benefits.

Greenhouse gas sequestration: The process of capturing and storing atmospheric gases associated with global climate change.

Greenhouse gas storage: The semi-permanent storage of atmospheric gases, including carbon dioxide (CO2), that lead to atmospheric warming within the urban forest's vegetation and soils.

Habitat: The environment of an organism; the place where it is usually found.

Hazardous trees: Unstable trees, in whole or part, that are within striking distance of people or property (a target). Hazard trees have the potential to cause property damage, personal injury or fatality in the event of a failure.

Historic or veteran trees: Trees that are of interest biologically, aesthetically or culturally because of their age; in the ancient stage of their life; or that are old relative to others of the same species.

Human health: The state of complete physical, mental and social well-being; and not merely the absence of disease or infirmity.

Hydrology: The branch of science concerned with the properties of the earth's water, and especially its movement in relation to land.

Invasive species: A species that is (1) nonnative to a given geographic area, (2) introduced by humans (intentionally or unintentionally), and (3) that does or can cause environmental or economic harm or harm to humans.

Landscape connectivity: The degree to which the landscape facilitates or impedes movement between resources patches.

Managed forest natural areas: A forest area managed to retain its historic physical features and species. Development and maintenance are limited to that required for health and safety.

Managed pine plantations: Forest stands established by planting or/and seeding in the process of afforestation or reforestation, and further managed for the production of raw wood products.

Multi-modal transportation: The combination of two or more modes of movement.

Native forest: Forestland consisting of forest plant communities and associated animals historically found in the region.

Natural area: A geographical area having a physical and cultural individuality developed through natural growth rather than design or planning.

Natural community types: A distinct and recurring assemblage of populations of plants, animals, fungi and microorganisms naturally associated with each other and their physical environment.

Open woodlands: An open canopy allows full sunlight to enter the woodland, limiting shade and moisture. These woodlands are often transition zones between different ecosystems, such as grasslands and true forests.

Predominantly: Constituting a minimum of 75 percent. (CP G# OBJ 3.1, POL 3.1.1)

Private woodlands: Woodlands owned by private citizens, communities, private cooperatives, businesses and other private institutions.

Production forest: Forest area designated primarily for production of wood, fiber, bio-energy and/or Non-wood forest products.

Public woodlands: Woodlands owned by governments; or by institutions or corporations owned by the public administration.

Resilient to drought: Capable of rapid recovery to its former condition after it has been disturbed drought.

Resilient to fire: Capable of rapid recovery to its former condition after it has been disturbed fire.

Resilient to flooding: Capable of rapid recovery to its former condition after it has been disturbed flooding.

Resilient to strong storms: Capable of rapid recovery to its former condition after it has been disturbed strong storms.

Resistant to insect infestation and diseases: The ability of a urban forest to avoid significant alteration of displacement from its present state by an insect infestation or disease.

Road traffic safety: The methods and measures used to prevent road users from being killed or seriously injured. Typical road users include: pedestrians, cyclists, motorists, vehicle passengers, horse-riders and passengers of on-road public transport (mainly buses and trams).

Shrub: A woody plant no more than 16 feet in height at maturity and without a definite crown. It can have several stems and is smaller than most trees.

Species: A group of organisms whose members have the same structural traits and who can interbreed with each other.

Species distribution: The manner in which a biological taxon is spatially arranged.

Standing dead and down woody material: The dead twigs, branches, stems, boles of trees, and brush that have fallen and lie on or above the ground.

Stormwater: All of the water that doesn't infiltrate flows over the ground, over roofs and through gutters on buildings, into storm drains, and into the nearest waterway.

Tree: A perennial woody plant with an elongated stem, or trunk, supporting branches and leaves. In the case of coppice with several stems, having a more or less definite crown.

Tree diameter distribution: Range and frequency of 2" tree diameter classes.

Tree lined streets: City streets buffered by any sized trees.

Understory: The underlying layer of vegetation in a forest, especially the trees and shrubs growing between the forest canopy and the forest floor. Plants in the understory comprise an assortment of seedlings and saplings of canopy trees together with specialist understory shrubs and herbs.

Urban forest: Urban parks, street trees, landscaped boulevards, gardens, river and coastal promenades, greenways, river corridors, wetlands, nature preserves, shelter belts of trees, and working trees at former industrial sites.

Utility rights-of-way: Legally defined shared use areas on private and public property for the placement and maintenance of above and below ground utilities, i.e.electric, water, sewer, etc.

Vertical structure: The arrangement of vegetation in layers; largely according to the different heights to which trees and non-woody plants grow.

Wildlife: The native fauna (and sometimes flora) of a region.

Wildlife habitat: The environment of an organism; the place where it is usually found

Bibliography

Governance

Abbey, D.G. 2012. Greening Tree Ordinances Building Sustainability into Local Green Laws. Louisiana State University, Baton Rouge, Louisiana. **https://fufc.org/downloads/Greening_Tree_OrdinancesV4_Abbey.pdf**

American Public Works Association. 2006. Urban Forestry Best Management Practices for Public Works Managers.

After an extensive literature review, interviews with public works managers and municipal arborists across the country, and guidance from a multi-disciplinary steering committee, it was clear to the American Public Works Association that information on four key urban forestry program components was critical to get into the hands of public works managers.

1. Budgeting and Funding **https://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-1.pdf**
2. Staffing **https://icma.org/sites/default/files/306728_UrbanForestryStaffing.pdf**
3. Ordinances, Regulations and Public Policies **http://www2.apwa.net/Documents/About/CoopAgreements/UrbanForestry/UrbanForestry-3.pdf**
4. Urban Forest Management Plan. **http://www2.apwa.net/documents/About/CoopAgreements/UrbanForestry/UrbanForestry-4.pdf**

Swiecki, T.J., and E.A. Bernhardt. Guidelines for Developing and Evaluating Tree Ordinances. Phytosphere Research, Vacaville, CA. **http://phytosphere.com/treeord/index.htm**

This site provides a variety of tools and resources for citizens and local governments interested in developing, revising, or evaluating local tree ordinances. Rather than using a “model ordinance” approach, they describe how tree ordinance development can be integrated with an overall community tree management program. The site includes annotated examples of effective tree ordinance provisions used throughout the country. They also provide detailed descriptions of practical methods used to monitor community tree resources, tree management activities, and community attitudes.

Health

Arantesa, B.L., T. Mauadb and D.A. Silva Filhoa. 2019. Urban forests, air quality and health: a systematic review. *International Forestry Review* 21(2): 167-181. **https://doi.org/10.1505/146554819826606559**

Cities are complex systems where many factors interconnect, therefore multidisciplinary research is crucial to understand their functional capacity and to improve the quality of life that these spaces offer. This research provides a decade of scientific literature review (2006 to 2016) about urban forest, air quality and health.

Coutts, C., and M. Hahn. 2015. Green Infrastructure, Ecosystem Services, and Human Health. *Int. J. Environ. Res. Public Health* 2015, 12(8): 9768-9798. **https://doi.org/10.3390/ijerph120809768**

This survey of the literature provides a comprehensive picture—in the form of a primer—of the many simultaneously interacting health co-benefits of green infrastructure.

Faber Taylor, A., M. Kuo, and W. Sullivan. 2001. Coping with ADD: The surprising connection to green play settings. *Environment and Behavior* 33(1): 54-77. **https://journals.sagepub.com/doi/10.1177/00139160121972864**

Attention Restoration Theory suggests that contact with nature supports attentional functioning, and a number of studies have found contact with everyday nature to be related to attention in adults. Results indicate that children function better than usual after activities in green settings and that the "greener" a child's play area, the less severe his or her attention deficit symptoms. Thus, contact with nature may support attentional functioning in a population of children who desperately need attentional support.

Kuo, F.E. 2003. The role of arboriculture in a healthy social ecology. *Journal of Arboriculture*, 29(3): 148-155. **https://www.nrs.fs.fed.us/pubs/jrnl/2003/nc_2003_kuo_001.pdf**

In urban communities, arboriculture clearly contributes to the health of the biological ecosystem; does it contribute to the health of the social ecosystem as well? Evidence from studies in inner-city Chicago suggests so. In a series of studies involving over 1,300 person-space observations, 400 interviews, housing authority records, and 2 years of police crime reports, tree and grass cover were systematically linked to a wide range of social ecosystem indicators. These indicators included stronger ties among neighbors, greater sense of safety and adjustment, more supervision of children in outdoor spaces, healthier patterns of children's play, more use of neighborhood common spaces, fewer incivilities, fewer property crimes, and fewer violent crimes. The link between arboriculture and a healthier social ecosystem turns out to be surprisingly simple to explain. In residential areas, barren, treeless spaces often become "no man's lands," which discourage resident interaction

and invite crime. The presence of trees and well-maintained grass can transform these no man's lands into pleasant, welcoming, well-used spaces. Vital, well used neighborhood common spaces serve to both strengthen ties among residents and deter crime, thereby creating healthier, safer neighborhoods.

van den Bosch, M., and M. Nieuwenhuijsen. 2017. No time to lose – Green the cities now. *Environment International*. 99: 343-350. **https://doi.org/10.1016/j.envint.2016.11.025**

Contemporary health issues are increasingly determined by social and environmental context. In a rapidly urbanizing world this calls for urban planners and public health workers to collaborate for creating healthy city environments.

In this paper we review and evaluate existing knowledge on health impacts of urban natural spaces and make a case for increased investments in such, concluding a high probability for benefits outweighing any harmful consequences. We also discuss potential explanations for poor transfer of science to policy and practice, including cognitive bias, lack of and uncertainty in evidence, incommensurability between disciplines and sectors, vested interests and economic constraints. Based on the existing literature, we suggest that the escalating urbanization, especially in developing countries, and the epidemic of NCDs and contemporary environmental threats justify urgent inclusion of natural space considerations in public health policies and actions, also in the absence of gold standard evidence, as long as the risk for harmful effects is evaluated as low and the cost-efficiency likely to be high.

van den Bosch, M., and W. Bird (eds). 2018. *Oxford Textbook of Nature and Public Health – the role of nature in improving the health of a population.* Oxford University Press. 338 pp.

This book analyses the complexity of our human interaction with nature and includes sections on, for example, epigenetics, stress physiology, and impact assessments. These topics are all interconnected and fundamental for reaching a full understanding of the role of nature in public health and wellbeing.

Wolf, K.L., and A.S.T. Robbins. 2015. Metro Nature, Environmental Health, and Economic Value. *Environmental Health Perspectives*. 123 (5): 390-398. **https://ehp.niehs.nih.gov/doi/pdf/10.1289/ehp.1408216**

Metro nature provides diverse and substantial benefits to human populations in cities. In this review, the authors begin to address the need for development of valuation methodologies and new approaches to understanding the potential economic outcomes of these benefits.

Urban Growth and Land Use Change

Carr, M.H., and P.D. Zwick. 2016. *Florida 2070 – Technical Report*. University of Florida. **http://1000friendsofflorida.org/water2070/wp-content/uploads/2016/09/florida2070technicalreportfinal.pdf**

The *Florida 2070* analysis clearly shows, if Florida continues present forms urban expansion that more than a third of the state will be paved over by 2070. Millions of acres of agricultural and natural lands–essential to maintaining our quality of life, jobs, water supply and more–will be lost. This report provides a brief overview of *Florida 2070* and *Water 2070*, including recommendations to promote a more sustainable future.

Zipperer, W.C., R.J. Northrop, and M.G. Andreu. 2020. Urban Development and Environmental Degradation. *Oxford Research Encyclopedia of Environmental Science.* Oxford University Press. **https://www.srs.fs.usda.gov/pubs/ja/2020/ja_2020_zipperer_004.pdf**

Parks

Chiesura, A. 2004. The role of urban parks for the sustainable city. *Landscape and Urban Planning* 68(1): 129-138. **https://doi.org/10.1016/j.landurbplan.2003.08.003**

Results from this study confirm that the experience of nature in urban environment is source of positive feelings and beneficial services, which fulfill important immaterial and non-consumptive human needs. Implications for the sustainability of the city are analyzed and discussed.

Ekkel, E.D., and S. de Vries. 2017. Nearby green space and human health: Evaluating accessibility metrics. *Landscape and Urban Planning* 157, 214-220. **https://doi.org/10.1016/j.landurbplan.2016.06.008**

There is growing scientific recognition that contact with nature in general, and contact with urban green more specific, have the potential to positively contribute to human health. For the purpose of developing healthy urban neighborhoods, this raises the question how to take scientific evidence about these health benefits into account. Accessibility metrics that are well substantiated by empirical evidence are needed. This paper reviews the quantitative and qualitative aspects relevant for accessibility metrics and empirical studies addressing these aspects in relation to health. Studies comparing different types of green space indicators suggest that cumulative opportunities are more consistently positively related to health. In contrast to residential proximity indicators, cumulative opportunities indicators take all the green space within a certain distance into account.

Giles-Corti, B., M.H. Broomhall, et al. 2005. Increasing walking: How important is distance to, attractiveness, and size of public open space? *American Journal of Preventive Medicine* 28(2, Supplement 2): 169-176. **https://doi.org/10.1016/j.amepre.2004.10.018**

Well-designed public open space that encourages physical activity is a community asset that could potentially contribute to the health of local residents. Those with very good access to large, attractive public open space were 50% more likely to achieve high levels of walking. The observational study showed that after matching public open space for size and location, 70% of public open space users observed visited attractive public open space. To increase walking, thoughtful design (and redesign) of public open space is required that creates large, attractive public open space with facilities that encourage active use by multiple users (e.g., walkers, sports participants, picnickers).

Konijnendijk, C., M. Annerstedt, A. Busse Nielsen, and S. Maruthaveeran. 2013. *Benefits of urban parks: A systematic review.* International Federation of Parks & Recreation Associations. University of Copenhagen and Swedish University of Agricultural Sciences, Copenhagen and Alnarp. **http://www.ifpra.org/images/park-benefits.pdf**

Many scientific studies on urban green space start with stressing the multiple benefits of parks and other green areas. There is general agreement, at least within the green space sector, that urban parks are essential for livable and sustainable cities and towns. In order to provide a more qualified base for the International Federation of Parks and Recreation Administration's activities in terms of promoting urban parks and their benefits, this systematic review set out to answer the question: *What is the scientific evidence for different benefits of urban parks?*

Energy Conservation

Donovan, G.H., and D.T. Butry. 2009. The value of shade: Estimating the effect of urban trees on summertime electricity use. *Energy and Buildings* 41(6): 662-668. **https://doi.org/10.1016/j.enbuild.2009.01.002**

Results from this study show that trees in Sacramento CA on the west and south sides of a house reduce summertime electricity use, whereas trees on the north side of a house increase summertime electricity use. The current level of tree cover on the west and south sides of houses in the sample reduced summertime electricity use by 185 kWh (5.2%), whereas north-side trees increased electricity use by 55 kWh (1.5%). Results also show that a London plane tree, planted on the west side of a house, can reduce carbon emissions from summertime electricity use by an average of 31% over 100 years.

eXtension – A Part of the Cooperative Extension System. Trees for Energy Conservation. **https://trees-energy-conservation.extension.org/urban-forests-understanding-associated-costs/**

The National Urban and Community Forestry Advisory Council sponsored the development of this comprehensive, online urban forestry and energy conservation informational *eXtension* page, Trees for Energy Conservation. Site visitors can locate research-based information from a network of national urban forestry, energy conservation, and community development experts. Explore the Trees for Energy Conservation page for multi-media educational resources on urban tree management practices that maximize the energy-saving aspects of trees.

Urban Forest Planning

California Urban Forest Council, CAL FIRE, & USDA Forest Service. Urban Forest Management Plan Toolkit. **https://ufmptoolkit.net**

This website provides a "how-to" approach to development of an Urban Forest Management Plan (UFMP). The toolkit leads the user through a traditional urban forest bio-physically orientated planning process. The main steps include understanding the local vision, creating an inventory of the current state of the urban forest, proposing a strategic plan, initiating an implementation plan, and starting a monitoring plan. In addition, it ensures that the final management plan includes an adaptive management perspective to keep updating the workplan with new input.

Clark, J.R., N.P. Matheny, G. Cross, and V. Wake, V. 1997. A model of urban forest sustainability. *Journal of Arboriculture* 23(1): 17-30. **https://www.researchgate.net/publication/254202799_A_model_of_urban_forest_sustainability**

The authors present one of the first models for the development of a sustainable urban forestry program. The model applies general principles of sustainability to urban trees and forests. The central tenet of the model is that sustainable urban forests require a healthy tree and forest resource, community-wide support and a comprehensive management approach.

Kenney, W.A., P.J.E. van Wassenaer, and A.L. Satel. 2011. Criteria and indicators for strategic urban forest planning and management. *Arboriculture and Urban Forestry* 37(3): 108-117. **https://www.researchgate.net/publication/286817960_Criteria_and_indicators_for_strategic_urban_forest_planning_and_management**

The success of urban forest management is frequently predicated upon achieving absolute canopy cover targets. This two-dimensional view of the urban forest does not provide a comprehensive assessment of urban forest stewardship in a community and does not account for an area's potential to support a forest canopy. A comprehensive set of performance-based criteria and indicators concerning the community's vegetation resource, community framework and resource management approach is described in this manuscript. This set of broadly based measures

provides a more useful tool for the evaluation of urban forest management success and strategic management planning.

Mincey, S.K., M. Schmitt-Harsh, and R. Thurau. 2013. Zoning, land use, and urban tree canopy cover: the importance of scale. *Urban Forestry & Urban Greening* 12(2): 191-199. **https://doi.org/10.1016/j.ufug.2012.12.005**

Declining urban tree canopy cover in the United States underscores the importance of elucidating factors that influence the distribution of urban trees. This is particularly relevant as most urban trees are located on private property while their canopies maintain ecosystem services that constitute public goods. Results demonstrate an important exception to the oft-cited theory that residential lands have higher canopy cover, a conclusion that our data supports only at the scale of an aggregated interpretation of zoning. At a disaggregated scale, residential high-density zones are significantly different than all other residential zones and more akin to commercial zones in terms of all canopy metrics. For urban forest managers and urban planners, this suggests the relevance of fine-scale variation in land-use policies and related canopy cover policies.

Hydrology

Cappiella, K., T. Schueler, and T. Wright. 2005. Urban Watershed Forestry Manual, Part 1: Methods for increasing Forest Cover in a Watershed. USDA Forest Service, Cener for Watershed Protection **https://www.fs.usda.gov/naspf/publications/urban-watershed-forestry-manual-part-1-methods-increasing-forest-cover-watershed**

These manuals introduce the emerging topic of urban watershed forestry and presents new methods for systematically measuring watershed forest cover and techniques for maintaining or increasing this cover. These methods are based on extensive review of the latest research and input from experts in a wide range of related fields. This manual is part of a three-part manual series on using trees to protect and restore urban watersheds; a brief description of each is provided below.

____. Urban Watershed Forestry Manual, Part 2: Conserving and Planting Trees at Development Sites. **https://www.fs.usda.gov/naspf/publications/urban-watershed-forestry-manual-part-2-conserving-and-planting-trees-development-site-0**

____. Urban Watershed Forestry Manual, Part 3: Urban Tree Planting Guide. **https://www.fs.usda.gov/naspf/publications/urban-watershed-forestry-manual-part-3-urban-tree-planting-guide**

Delphi Technique

Cline, A. 2001. *Prioritization Process Using Delphi Technique*. Carolla Development. **http://158.132.155.107/posh97/private/research/methods-delphi/wp-delph.htm**

Critical Thinking

Cornell University Library. Critically Analyzing Information Sources. **https://olinuris.library.cornell.edu/content/critically-analyzing-information-sources**

You can begin evaluating a physical information source (a book or an article for instance) even before you have the physical item in hand. Appraise a source by first examining the bibliographic citation. The bibliographic citation is the written description of a book, journal article, essay, or some other published material that appears in a catalog or index. Bibliographic citations characteristically have three main components: author, title, and publication information. These components can help you determine the usefulness of this source for your project.

Municipal Arboriculture

Costello, L.R., E.G. McPherson, D.W. Burger, and L.L. Dodge (Eds.). Strategies to Reduce Infrastructure Damage by Tree Roots. In *Proceedings of a Symposium for Researchers and Practitioners*. Western Chapter ISA, Cohasset, CA.

For information about ordering this publication contact: Western Chapter of the International Society of Arboriculture (WCISA), 235 Hollow Oak Drive, Cohasset, CA 95973 (530) 892-1118.

Duryea, M. L., E. Kampf, and R. C. Littell. 2007. Hurricanes and the urban forest: I. Effects on southeastern U.S. coastal plain tree species. *Arboriculture and Urban Forestry* 33(2): 83-97. **https://sfyl.ifas.ufl.edu/media/sfylifasufledu/miami-dade/documents/disaster-preparation/hurricane-and-disaster/Hurricane-and-the-Urban-Forest-Effects-on-SE-Coastal-Plain-Tree-Species.pdf**

Several hurricanes struck Florida in 2004 and 2005 causing widespread damage to urban and rural areas. Impacts to urban trees from these 5 hurricanes and 4 earlier hurricanes were evaluated to determine coastal plain tree species specific wind resistance.

See also: **https://edis.ifas.ufl.edu/publication/FR174**

Duryea, M. L., E. Kampf, and R. C. Littell. 2007. Hurricanes and the urban forest: II. Effects on tropical and sub-tropical trees. *Arboriculture and Urban Forestry*, 33(2): 98-112. **https://www.researchgate.net/publication/228750693_Hurricanes_and_the_urban_forest_II_Effects_on_tropical_and_subtropical_tree_species**

Starting with 1992's Hurricane Andrew in southern Florida impacts to urban trees were evaluated to determine tropical and subtropical tree species specific wind resistance.

See also: **https://edis.ifas.ufl.edu/publication/FR175**

Matheny, N., and J.R. Clark. 1998. *Trees and Development: A Technical Guide to Preservation of Trees During Land Development*. 184 pp.

Ecosystem Management

Ecological Society of America. 1995. *The scientific basis for ecosystem management.* Ecological Society of America, Assessment. **https://www.esa.org/pao/policyStatements/Papers/ReportOfSBEM.php**

The Ecological Society of America's important publication concerning the influence of contemporary ecology on natural resource management (including urban forestry). The report defines Ecosystem Management as management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem composition, structure, and function.

Florida Natural Resource Guides

Florida Fish and Wildlife Conservation Commission. 2019. *Wildlife 2060: What's at stake for Florida?* **https://myfwc.com/media/5478/fwc2060.pdf**

This state of Florida report investigates the changes that may occur in Florida's fish and wildlife—and in our own lifestyles—if the state's population doubles. It suggests that in the years to come, leaving the work of conservation and management to just a few won't be enough. Fresh, effective strategies, including smart growth initiatives and green infrastructure planning, will be needed to direct and shape the growth that is projected.

Hamel, P. 1992. *Land Manager's Guide to the Birds of the South.* The Nature Conservancy. **https://www.srs.fs.usda.gov/pubs/gtr/gtr_se022.pdf**

Forested habitats and their suitability for bird species in the South are described. For each species, a summary of biological knowledge regarding status, distribution, and habitat requirements is presented. General and specific habitat requirements for each species are given in the form of habitat relationship matrices. This information is designed to be used by land managers as a guide for evaluating and prescribing land management practices

Kale, H. W., II, B. Pranty, B. M. Stith, and C. W. Biggs. 1992. *The atlas of the breeding birds of Florida.* Final Report. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida. **https://myfwc.com/wildlifehabitats/wildlife/bba/**

The Atlas project attempted to record the breeding distributions of all bird species in the state during 1986-1991. The Atlas project was a collaborative effort of Audubon of Florida, the Florida Ornithological Society, and the Florida Fish & Wildlife Conservation Commission. More than 1,880 participants, most of them volunteers, were involved in conducting surveys and compiling data. 196 species were confirmed breeding, and another 19 species were found to be probable or possible breeders in the state.

Krysko, K.L., K.M. Enge, and P.E. Moler. 2011. *Atlas of Amphibians and Reptiles in Florida*. Final Report, Project Agreement 08013, Florida Fish and Wildlife Conservation Commission, Tallahassee, FL. 524 pp. **https://www.floridamuseum.ufl.edu/wp-content/uploads/sites/108/2021/01/herp_atlas_high.pdf**

Maps for each species are accompanied by the species current scientific and common names, a brief discussion of its geographic distribution (including the number of vouchered records and counties in which it has been found, potential counties of occurrence, and/or identification errors), earliest known voucher, and taxonomy (if changed recently). Discussion of the physiography, climate, river drainages, biogeography, habitats, and ecoregions of Florida provides context for understanding patterns of distribution of the Florida herpetofauna.

Trani, M.K., W.M. Ford, and B.R. Chapman. 2007. *The Land Manager's Guide to Mammals of the South*. USDA Forest Service and The Nature Conservancy. **https://www.nrs.fs.fed.us/pubs/jrnl/2007/nrs_2007_trani-lndmgr-full_009.pdf**

The guide is designed to provide land managers with the ecological information necessary for assessing the influence of management and environmental change

Myers, R.L., and J.J. Ewel (eds). 1990. *Ecosystems of Florida*. University of Central Florida Press. 468 pp.

This enduring publication is an introduction to the ecology of Florida's natural landscape that is technically sound and up-to-date, and yet accessible to the much larger non-scientific audience interested in the state's environments.

USDA Forest Service. 1990. Silvics of North America. Vol.1 conifers, vol.2 hardwoods. Ag. Handbook 654. **https://www.srs.fs.usda.gov/pubs/misc/ag_654/table_of_contents.htm**

Urban Forest Management

Ferrini, F., C. C. Konijnendijk van den Bosch and A. Fini (eds). 2017. *Routledge Handbook of Urban Forestry*. Routledge-Earthscan. 547 pp.

This comprehensive handbook provides a global overview of the state of the art and science of urban forestry. The book describes the multiple roles and benefits of urban green areas in general and the specific role of trees, including for issues such as air quality, human well-being and stormwater management. It reviews the various stresses experienced by trees in cities and tolerance mechanisms, as well as cultural techniques for either pre-conditioning or alleviating stress after planting. It sets out sound planning, design, species selection, establishment and management of urban trees. It shows that close interactions with the local urban communities who benefit from trees are key to success.

By drawing upon international state-of-art knowledge on arboriculture and urban forestry, the book provides a definitive overview of the field and is an essential reference text for students, researchers and practitioners.

Long, A.J., and C.K. Randall. 2004. *Wildfire Risk Assessment Guide for Homeowners in the Southern United States*. University of Florida. Jacksonville, FL: The Drummond Press. **https://urbanforestrysouth.org/resources/publications/wildfire-risk-assessment-guide-for-homeowners-in-the-southern-united-states/**

Wildfires are an important and necessary occurrence in many natural areas of the southern United States, but they also present a risk to homes constructed in, or next to, such areas. Risk assessment allows homeowners to evaluate their potential exposure to fire as well as the critical factors that increase their risk. The guide provides instruction on how to determine homeowner risk and how to reduce it.

Miller, R.W., R.J. Hauer, and L.P. Werner. 2015. *Urban Forestry: Planning and Managing Urban Greenspaces,* 3rd Edition. Waveland Press, Inc.

This 3rd Edition of Urban Forestry addresses current issues in planning, establishing, and managing trees, forests, and other elements of nature in urban and community ecosystems. The authors discuss why we have trees in cities and how we use them, clarify the appraisal and inventory of urban vegetation, and extensively delve into the planning and management of public as well as private trees.

Trees and Local Business

Joye, Y., K. Willems, M. Brengman, and K. Wolf. 2010. The effects of urban retail greenery on consumer experience: Reviewing the evidence from a restorative perspective. *Urban Forestry and Urban Greening* 9(1): 57-64. **https://doi.org/10.1016/j.ufug.2009.10.001**

The central aim of this paper is to demonstrate that the reluctance of certain retail stakeholders to integrate greening practices like BSD is unjustified. Two lines of

evidence in support of this claim are discussed. On the one hand, the authors sketch a conceptual framework which supports the view that BSD can have restorative effects for those implemented in store environments. On the other hand, they review Kate Wolf's multi-study research program on the effects of urban greening on consumer behavior, attitudes, and perceptions. These two lines of evidence demonstrate that commercial activities and urban greening are not to be considered as antagonistic but as mutually reinforcing practices.

Wolf, K. L. 2004. Trees and business district preferences: A case study of Athens, Georgia, U.S. *Journal of Arboriculture* 30(6): 336-346. **https://www.researchgate.net/publication/279583355_Trees_and_businees_district_preferences_A_case_study_of_Athens_Georgia_US**

As a National Main Street program participant, Athens, Georgia, U.S., has included streetscape tree plantings in economic development efforts. This study utilized an on-site survey to elicit preference and perceptual response from visitors of the Athens central business district. The presence of a full-canopy forest was found to be associated with higher visual quality ratings of the retail district. District visitors also perceived the streetscape canopy to be an integral amenity of the city's shopping environment. Quantitative and qualitative research outcomes are reported.

Social System Surveys

Lohr, V., C. Pearson-Mims, J. Tarnal, and D.A. Dillman. 2004. How urban residents rank the benefits and problems associated with trees in cities. *Journal of Arboriculture* 30(1): 28-35. **https://www.researchgate.net/publication/262450083_How_urban_residents_rate_and_rank_the_benefits_and_problems_associated_with_trees_in_cities**

Residents of the largest metropolitan areas in the continental United States were surveyed about the benefits and problems of trees in urban areas. The public rated the social, environmental, and practical benefits of trees highly. The ability of trees to shade and cool surroundings was the highest-ranked benefit. Their potential to help people feel calmer was ranked second highest. Potential problems with trees were not considered to be reasons not to use trees.

Kellert, S.R., D.J. Case, D. Escher, D.J. Witter, J.M. Mikels-Carrasco, and P.T. Seng. 2017. The *Nature of Americans – Disconnection and Recommendations for Reconnection – Florida Report.* DJ Case & Associates 364 pp. **https://natureofamericans.org/sites/default/files/reports/Nature-of-Americans_Florida_Report_1.3_4-26-17.pdf**

The relationship between Floridians and nature is changing. Adults and children alike spend evermore time indoors, participation in traditional activities like hunting and fishing is stagnant or declining, and shifts in social expectations treat engagement with nature as a mere amenity. These trends pose a problem, since overwhelming

evidence shows the physical, psychological, and social wellbeing of humans depends on contact with nature. The authors' research distills into eight major findings that reveal a profound interest–action gap in Floridians' relationships with nature.

Ecosystem Services

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being.* Island Press, Washington DC. **https://www.millenniumassessment.org/documents/document.356.aspx.pdf**

Coordinated by the United Nations Environment Program, this synthesis is organized around the core questions originally posed to the assessment: How have ecosystems and their services changed? What has caused these changes? How have these changes affected human well-being? How might ecosystems change in the future and what are the implications for human well-being? And what options exist to enhance the conservation of ecosystems and their contribution to human well-being?

Ecological System (bio-physical) Inventory and Analysis

Nowak, D.J. 2020. Understanding i-Tree: Summary of Programs and Methods. USDA Forest Service, Gen. Tech. Report NRS-200. **https://doi.org/10.2737/NRS-GTR-200**

i-Tree is a suite of computer software tools developed through a collaborative public private partnership. These tools are designed to assess and value the urban forest resource, understand forest risk, and develop sustainable forest management plans to improve environmental quality and human health. This report provides details about the underlying methods and calculations of these tools, as well their potential limitations. Also discussed are the history of i-Tree, its future goals, and opportunities to facilitate new science and international collaboration.

Urban Natural Area Management

U.S. Fish and Wildlife Service. 2019. Standards of Excellence for Urban Wildlife Refuges. **https://www.fws.gov/urban/soe.php**

The Standards of Excellence is the framework for Urban Wildlife Conservation Program. The standards give guidelines and objectives for urban refuges and urban partnerships to plan for the future, to measure success, and to take advantage of extraordinary opportunities to build a conservation constituency with their immediate neighbors.

About the Authors

Rob Northrop is an extension forester with the University of Florida. The focus of his work is providing conservation planning assistance to local and state governments; and applied research into the changing character and ecological function of urban and urbanizing forests.

Michael Andreu is an associate professor of forest systems and extension specialist at the University of Florida School of Forest, Fisheries and Geomatics Sciences. He has worked in the field of forest management for 30+ years and has been involved in urban forest management for the last 20+ years. His research, teaching and extension programming focus on applying a systems thinking approach to ecological problems including, invasive species, climate change and, forest conservation.

Wayne Zipperer is a research forester with the USDA Forest Service who has been studying the structure and function of urban and urbanizing landscapes for the past 30+ years. He has received awards for his research on ecosystem services and shrub flammability. He is currently working on urban adaptability to catastrophic events.

The authors recognize that urban regions differ geographically, ecologically, historically and culturally. Due to the tremendous variation found among and within urban regions this primer serves as a general guide to the process of establishing a long lasting strategy for urban forest management and does not include all the nuances that may exist for inventorying and monitoring, performance indicators and local and regional conditions. Supplemental sources are provided to give additional information and insights for the reader.

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