Forestry and Natural Resources

INTRODUCTION TO URBAN FORESTRY

Urban forestry is a program that invests in the future of the community. Considerations for planning and protecting trees should consider biological, management and community needs to establish the best policies and practices. This section will provide a survey of the basic tools and concepts to help your community with protecting and enhancing urban trees. Topics and examples will include creating and implementing a management plan, low-impact design strategies, ordinance administration and establishing minimum canopy coverage.

URBAN FORESTRY COMPREHENSIVE PLANNING GUIDE

Lindsey Purcell, author

Urban forestry is a program that invests in the future of the community. Your final plan should consider the biological, management and community needs in order to establish the best policies.

Trees provide many benefits to communities. These can include aesthetic qualities, such as the beauty of flowers and fall colors, or functional benefits, including shade, storm water management and filtering pollution for cleaner air and water. All of these qualities combined are called ecosystem services.

Unfortunately, Indiana ranks low in air and water quality compared to other states, *but trees can help reverse this situation*. They serve many vital functions important to us, including air cleaners, water purifiers, woodland resources, social assets and economic generators.

Scientific understanding of how urban trees benefit people has increased significantly in recent years. One important benefit that is often overlooked is the economic values trees provide. Businesses are more competitive with consumer demand when trees help create an improved environment that is more attractive and welcoming to customers. Surveys indicate that the public prefers to patronize establishments where trees and landscaping are established. Consumers both stay longer and spend more money in business districts with green areas. Research also indicates that consumers are willing to pay more in these tree-lined shopping areas.

A process for strategic planning is needed in order to protect and expand the urban forest. In this section, we will provide a helpful list of considerations, examples of urban forest management and resources for creating a customized plan for your community. Future generations rely on informed decision-making today to improve the canopy and influence the ecosystem services provided by the urban forest.

An Urban Forestry Management Plan (UFMP) is a roadmap that creates a shared vision for the future of the tree canopy. It's a tailored plan that guides urban forestry professionals to proactively and effectively manage and provide for maximum long-term benefits to the community. The UFMP provides recommendations based on the analysis of detailed inventories and includes additional components or documents, such as budgets, implementation schedules, policy and procedure manuals, standards and specifications, public education and monitoring plans and existing ordinances. Annual work plans and budgets can then be developed based on the long-term UFMP.

In general, an effective UFMP will include:

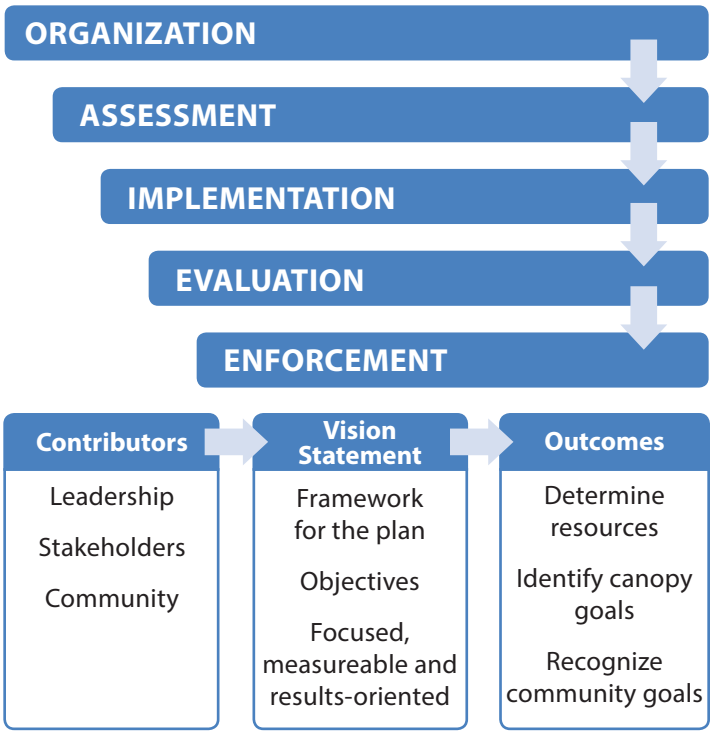
- A **shared vision** for the urban forest
- Inventories and assessments of the current status of the urban forest
- A **strategic plan** that includes goals, objectives and actions based on identified needs
- An **implementation plan** with specific dates and assigned responsibilities of care
- A **monitoring and evaluation** plan with a system or matrix to check effectiveness and revise the UFMP as needed

FIGURE 1: URBAN FOREST REQUIREMENTS

The basic requirements for a healthy, sustainable urban forest are an inventory, management plan and an ordinance. These are critical attributes to the overall urban forestry management plan. It's as simple as measuring existing trees, creating a plan to manage those trees and an ordinance to protect those assets.

- A **means of enforcement** of the plan to protect the urban forest and maintain canopy goals

FIVE STEPS FOR CREATING A UFMP



STEP ONE: ORGANIZATION

Contributors

Establish a broad-based community working group or team. A neutral meeting facilitator is often needed to ensure that everyone is heard and that all concerns are identified. The group should meet periodically and consistently to maintain cohesiveness and effectiveness. The working group could consist of, but is not limited to, the participants listed below:

- Tree care professionals
- Representatives of DMD, DPW and DPR
- Emergency management services
- Public Information Officers (PIOs)
- Local utility service providers
- Local NPOs and NGOs, including neighborhood organizations
- Business, health care and other civic leadership

There will likely be trade-offs related to tree care, emergency management, fiscal issues and other considerations. These need to be assessed by the more specialized members of the working group (e.g., tree care specialists) then reviewed and accepted by the community.

Vision statement

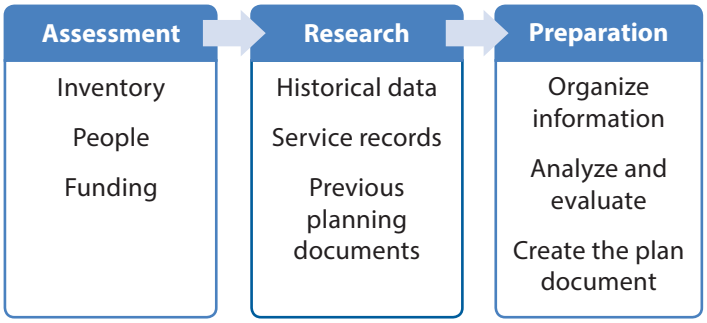
To be effective, the vision statement and well-defined goals and objectives should be a community activity. Some ways of increasing community participation include discussing the plan with friends and neighbors, organizing outreach activities such as news releases and public meetings and developing educational programs for schools and other community groups.

When there is participation, the UFMP has the potential for greater success. It will help identify and develop alternative management options. The team will discover new information relevant to the community and urban forest and have a better understanding of challenges and opportunities. Be sure to demonstrate fairness across community demographics by representing environmental justice in the process.

The following should be accomplished during step one:

- Organize existing resources and determine the value to the planning process
- Get the issues recorded so they can be used to gather support and be critiqued within the community
- Create the vision statement and a broad list of goals and objectives
- Identify the stakeholders, planning team, scale of the project and partnerships
- Recognize the financial obligations and identify funding sources

STEP TWO: ASSESSMENT AND PREPARATION



Most communities will need information to help develop the vision, goals and objectives into a management plan. Some key questions this information should answer include what the urban forest should provide for community, what funding is available to help move the plan forward and whether the community has the necessary resources available to set the plan in action.

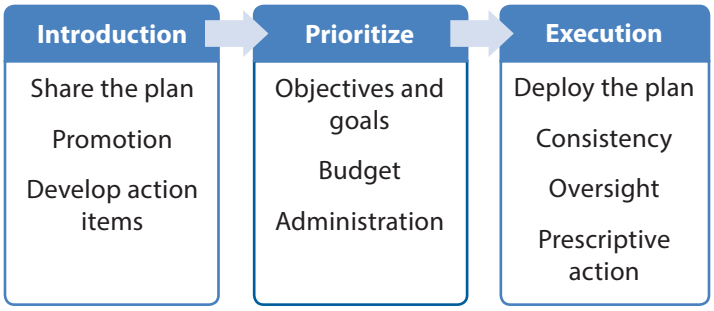
A resource analysis is critical to determine people, funding and inventory, including a reliable tree inventory for all streets and public spaces. The information needed for your plan can come from several sources. A systematic tree inventory is particularly useful for assessing your tree resource and establishing and measuring your goals and objectives.

Keep in mind that data collection is expensive and measure only what is needed, based on previously determined objectives. Reviewing current practices (such as tree planting, pruning and removal) and plans (such as street tree management, emergency response plans, ordinances, etc.) can also identify common objectives and explore ways to plan effectively. If funding is a critical issue, the team might want to apply for an urban community forestry grant to help offset costs. Similarly, if personnel are a critical issue, the team may want to hire a consulting firm specializing in urban forestry to do the inventory and data synthesis.

The following should be accomplished during step two:

- Community consensus of goals and objectives
- The scope of work and the project timeline for the plan
- Identify potential funding opportunities to support the plan
- Data from your resource analysis that supports goals and objectives in the form of:
  - Maps
  - Planting sites and their attributes (location, size, utility conflicts, soil volume, etc.)
  - Stocking levels
  - Risk trees present
  - Trees requiring plant health care, such as pruning
  - List of potential resources (community volunteers, government and private technical assistance, grants, etc.)
- Prepare and create the plan

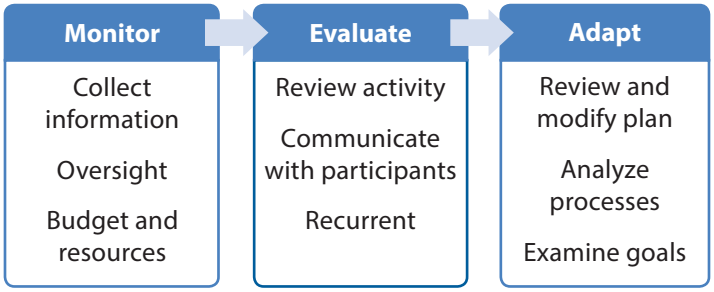
STEP THREE: IMPLEMENTATION



Once the plan is complete, share the excitement with stakeholders, community and staff. Transparency is important. Provide details of the scope and intent of the plan. Prioritize objectives and develop action items that support the established goals and outcomes. Be realistic with the action items, prioritizing based on needs and risk management protocols. Some objectives can be achieved easily and quickly, but budget is an important consideration. Be certain financial support is consistent with both short-term and long-term objectives. Working with the financial principal will be critical to implementation.

Be sure to consider how the community and staff might respond to these changes. All of the planning and building of consensus up to this point will help to ensure that the UFMP will run as smoothly as possible. However, you should approach this step as a learning experience and anticipate the need for contingency planning. Some objectives can be achieved within a certain timeline, but this process needs to be updated regularly because your community, environment, resources and urban forest will change over time. Updates are important for keeping your planning team and staff aware of priorities and progress.

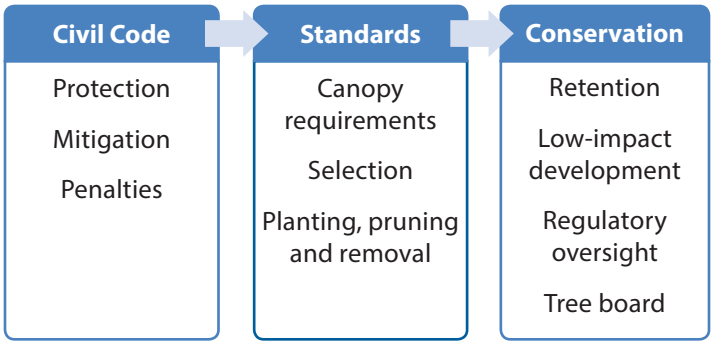
STEP FOUR: MONITOR AND EVALUATE



In most existing management scenarios, monitoring and evaluating the impact of the plan is the most neglected step. Yet, it is one of the most critical elements of any plan because it will determine if the plan's goals and objectives are realistic and actually being met. Monitor and evaluate the impact information as a team, learn from other team members and modify or improve goals if necessary. The culture, politics, budgets and constraints of every community are different and balancing the community's needs with urban forest management is challenging and complex. However, changing and adapting your objectives should serve as learning experiences and not as failures. Consistent evaluation will also provide feedback on how to improve your plan.

A plan and its vision should not have a shelf life; they should be dynamic, flexible management instruments. If the ecological, economic or social assumptions that directed the initial plan change or become questionable, then the plan needs to be adjusted to meet the new realities. In the aftermath of a weather event, the impact on the urban forest is about the last thing on anyone's mind. Trees will be secondary to ensuring public safety, mitigating risk to people and property, cleaning debris and restoring public services and utilities. In fair weather, however, the urban forest should be a primary community concern. Careful planning for the allocation of resources to the urban forest will provide a community with a healthy, strong, resistant forest.

STEP FIVE: ENFORCEMENT



Tree ordinances are among the tools used by communities striving to attain a healthy, vigorous and well-managed community forest. By themselves, however, tree ordinances cannot ensure that the trees will be improved or even maintained. Tree ordinances provide authorization and standards for present and future management activities. If these activities are not integrated into an overall management strategy, problems might arise.

TYPES OF TREE ORDINANCES

Tree ordinances fall into one of three basic categories.

- *Street tree ordinances* primarily cover the planting and removal of trees within public rights-of-way. Recommended species, locations and permits are a part of the ordinance. They often contain provisions governing maintenance or removal of private trees that pose a hazard to the public. Also included in this category are ordinances with tree planting requirements, such as those requiring tree planting in parking lots.
- *Tree protection ordinances* are primarily directed at providing protection for native trees or trees with historical significance. They usually require that a permit be obtained before protected trees can be removed, encroached upon or, in some cases, pruned. They can also include specific protocols related to construction activities near trees.
- *Ordinances* can be a combination of any or all of the above examples. It is entirely dependent on the UFMP goals and objectives.

A clear vision, community participation, monitoring and the ability to adapt your plan to adversity will ensure the sustainability of the urban forest and its services. Conservation and planning is not a discrete event, but a long-term process. Success will require all individuals of a community to cooperate.

SIMPLIFIED URBAN FOREST MANAGEMENT PLAN

These are suggestions for creating a management plan for your community. The statements listed below would require details and features that reflect the needs of the community and results from the inventory.

Vision: To sustain a healthy, safe and appealing public street and park tree population in the community.

Goal: To effectively manage the urban and community forest in an effective manner through sound fiscal, personnel and operational management, utilizing internal and contracted services and building a team of effective proponents for the trees in the community.

SHORT-TERM ACTION ITEMS

- Remove risk trees on rights-of-way and green spaces that could threaten the public.
- Properly prune trees to improve safety and sight lines for key areas such as traffic signals and signs, street lights, pedestrian and vehicular traffic and buildings.
- Perform timely, systematic tree inspections, looking for defects and initiating the proper mitigation strategy.
- Install new street trees to maintain designated canopy goals. This includes replacing those damaged by weather events or in decline from subsequent maintenance operations due to necessary improvements.
- Planning with trees to improve species diversity to better protect the urban forest from pest issues.
- Establish a routine, systematic pruning cycles for all trees along the community rights-of-way, parks and public green spaces.
- Identify potential partners for urban and community forestry programs and initiatives in the community.
- Inform the public of ongoing efforts and long-term strategies to improve engagement and inclusion.

LONG-TERM ACTION ITEMS

- Development of a Street Tree Ordinance for the community.
- Increase public education and involvement in the planning, care and maintenance of the community trees and urban forest.

- Development of a community Tree Board to help provide guidance and recommendations to the community for care and maintenance of the community forest.
- Create a fiscal budget that matches the needs of urban and community forestry operations.
- Develop working partnerships with local and regional utilities, agencies and non-profit organizations to improve effectiveness and efficiency of urban and community forestry operations.
- Plan responsibly to increase the number of trees planted on public lands and along the streets.
- Develop and maintain a current inventory of all street and park trees.
- Develop a comprehensive set of specifications for plant health care applying to internal and contracted service professionals.
- Develop and implement training to internal personnel on all aspects of urban and community tree care.
- Maintain communication and collaboration with all community departments, state highway and transportation agencies on developing standards and criteria for care of trees growing on state roadways.

RESOURCES

City of Indianapolis Municipal Forest Resource Analysis https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=9740c568270f9ccdc66be55e75cf0ada2b9bd494

Indiana Department of Natural Resources Community and Urban Forestry Publications www.in.gov/dnr/forestry/8337.htm

Indiana Street Tree Benefits Summary www.in.gov/dnr/forestry/files/fo-benefits.pdf

Purdue Education Store https://mdc.itap.purdue.edu/

Purdue University Department of Forestry and Natural Resources, Urban Forestry ag.purdue.edu/fnr/Pages/UrbanForestry.aspx

Tree City USA www.arborday.org/programs/treecityusa/

USDA US Forest Service Urban and Community Forestry https://www.fs.usda.gov/managing-land/urban-forests/ucf

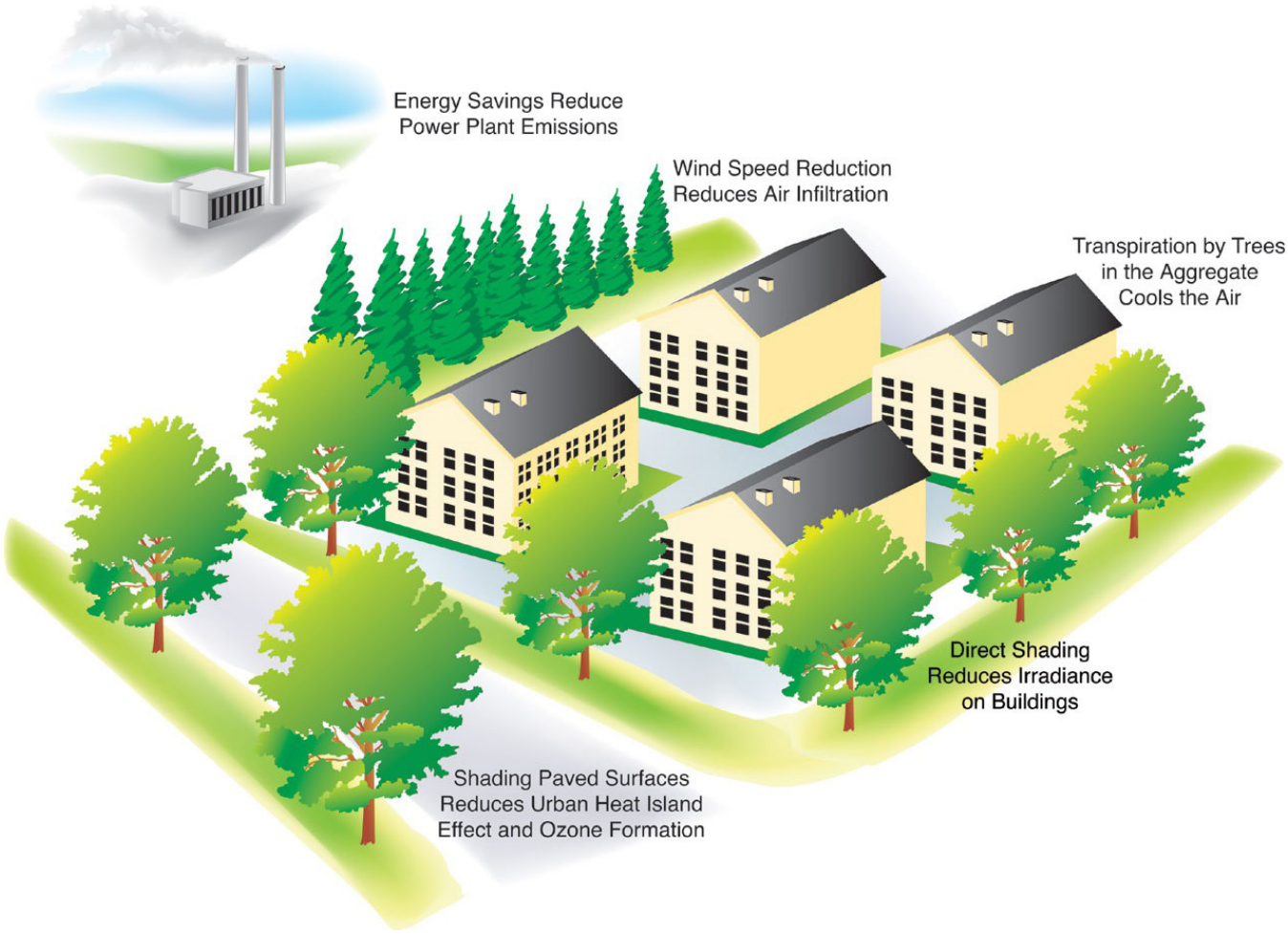
WHAT DO WE HAVE?

Indicators of a Sustainable Community Forest		Assessed Conditions or Performance		
		Low	Moderate	Good
The Trees	Urban Tree Canopy Level (All Trees)			
	Canopy Location/Distribution (All Trees)			
	Condition (Public Trees)			
	Size/Age Distribution (Public Trees)			
	Species Diversity (Public Trees)			
	Species Suitability (Public Trees)			
Stakeholders	Public Awareness			
	City Department/Agency Cooperation			
	Neighborhood Action			
	Large Private Landholder Involvement			
	Utility Engagement			
	Green Industry Involvement			
	Regional Collaboration			
	Funder Engagement			
The Management Approach	Tree Inventory Data			
	Overall Canopy Data			
	Management Plan			
	Risk Management Program			
	Maintenance Program – Public Trees			
	Planting Program			
	Tree Protection Policy			
	City Staffing and Equipment			
	Funding			
	Totals			

The following resources will give you more information on assessing the sustainability of your community forest and forest management program:

- Sustainable Urban Forest Management Planning Using Criteria and Indicators
  - digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1047&context=cate
- The Sustainable Urban Forest Guide – A Step-By-Step Approach
  - www.itreetools.org/resources/content/Sustainable_Urban_Forest_Guide_14Nov2016.pdf

TREE VALUATION: WHAT'S MY TREE WORTH?



Trees and other living plants are valuable. They beautify our surroundings, purify our air, manufacture precious oxygen, act as sound barriers and help us save energy through their cooling shade in summer and their wind reduction in winter.

Many people don't realize, however, that plants have a dollar value of their own that can be measured by skilled plant appraisers. If your trees are damaged or destroyed, you may be able to recapture your loss through an insurance claim or as a deduction from your federal income tax.

Street trees and urban woodlands provide a number of environmental and social benefits, including contributing to climate change adaptation and mitigation and providing urban green space.

However, measuring the benefits or ecosystem services that trees provide to a community is equally as important. Benefit-based tree valuation provides alternative estimates of the fair and reasonable value of trees while illustrating the relative contribution of different benefit types. This is an important tool for enhancing urban forestry programs by providing monetary value on natural resources as a capital asset. Today, we are able to put a dollar value on many of the ecosystem services that trees provide, such as stormwater management, carbon storage, cooling effects and many others.

This website can help you calculate tree values:
mytree.itreetools.org

TREE ORDINANCE AND CANOPY COVERAGE POLICY

A tree ordinance is a tool to help protect and manage a community's trees. It can be designed to regulate various aspects of tree planting, removal and maintenance on public and private property within a municipality. By protecting trees, a well-planned, written and implemented ordinance can enhance a community's beauty, reduce air pollution, lower air conditioning costs and increase biodiversity.

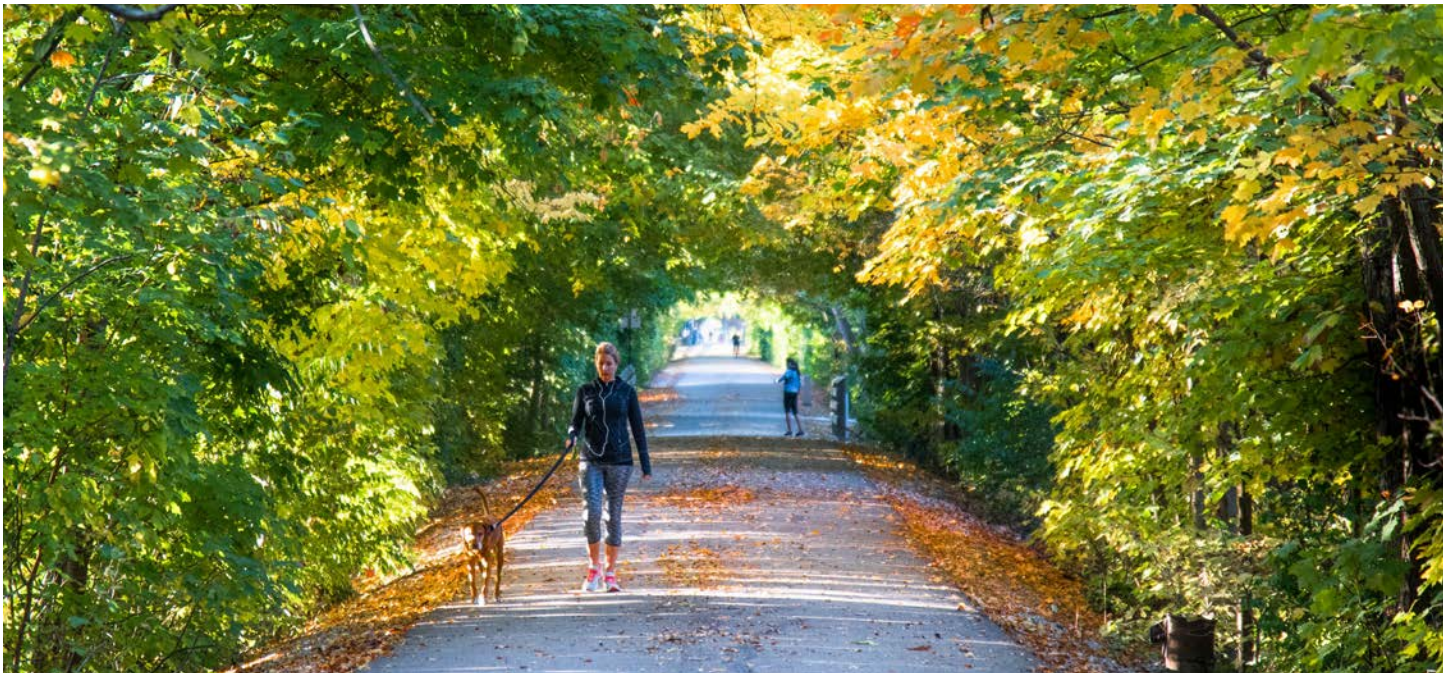
To evaluate the necessity and feasibility of an ordinance, a community should create a working group to assess the municipality's needs and wants, resources and existing ordinances. In the beginning, the group should develop rules governing information sharing, decision making and conflict resolution.

An ideal group is composed of people who mirror the demographics of the community. It should include experts on relevant topics such as forestry and public works, as well as people from other fields. A sample group could include a realtor, developer, garden club member, arborist, planner, environmental group representative, landscape architect, forest landowner, public works official, business owner, lawyer and interested citizen.

The International Society of Arboriculture categorizes arboriculture-focused tree ordinances, which relate to maintaining trees for aesthetic and environmental benefits, into three main categories:

- *Street and public tree ordinances* regulate the planting, removal and maintenance of trees in parks or along public rights-of-way, including private trees that could endanger the public. These ordinances can include tree planting specifications (e.g., requiring tree planting in parking lots) and tree care standards (e.g., standards for pruning and removal).
- *Tree and woodlot protection ordinances* protect specific tree species, trees of a certain circumference or height or trees with historical significance on public and private property. These ordinances usually stipulate that permits are required to remove, encroach upon or prune such trees. They also provide for the replacement of removed trees.

As part of the ordinance, conservation strategies may be imposed to protect and maintain desired canopy levels and goals. Researchers estimate that tree canopy cover in urban and metropolitan areas across the U.S. averages only 27 percent and 33 percent, respectively (Dwyer and Nowak, 2000). Additionally, the trees that are present are subject to a wide variety of stressors, which significantly shortens their lifespan. As such, it is important for urban communities to take steps to protect and enhance their urban forests through urban tree canopy (UTC) goal setting processes.



In order to set UTC goals, communities must first have an idea of how much current canopy is present. The process for conducting UTC assessments and goal setting generally includes the following steps:

1. *Measure current UTC*
   - Remote sensing or inventories to measure existing urban tree canopy.
   - Identify the different types of forest in the community, including public (street trees, riparian corridors, parks, etc.) and private (residential, commercial, industrial areas, etc.).
2. *Estimate potential UTC*
   - Use remote sensing imagery and geographic information systems analyses to identify locations with potential for reforestation to improve UTC.
   - Identify priority locations where UTC increases will support identified community needs (e.g., water quality, air quality, stormwater management).
3. *Adopt a UTC goal*
   - Determine a goal based on the results of the assessments and specify a timeframe.
   - Formal adoption of the goal is preferable to ensure that the goal comes to fruition (e.g., institutionalize UTC goals in local ordinance, regulations and comprehensive planning efforts).
   - Create a metric to measure inputs and manage the goal.

Once the assessment and goal-setting process is complete, the next logical step is to develop a plan. In general, a UTC plan identifies the UTC goal and timeline, describes the relationship of canopy goals to local ordinances, regulations, and the community's comprehensive plan and outlines the specific strategies for achieving UTC goals, including identifying a timeline and responsible party. Each community must develop an approach to achieve UTC goals that considers their internal capacity and resources, political climate and stakeholder needs. The range of strategies to achieve UTC goals includes:

- Permanently protect priority forest tracts through acquisition, conservation easements or another method.
- Prevent forest loss during development by adopting or amending site development regulations (e.g., forest conservation regulations, open space design, low-impact design and zoning).
- Maintain existing forest canopy by adopting regulations that restrict tree removal.
- Increase tree planting during development by adopting or revising site development regulations such as landscaping and parking lot shading.
- Reforest public lands, beginning with priority sites.
- Encourage reforestation of private land by developing education, stewardship and incentive programs.

An example might be:
In order to balance environmental goals and planned density goals, the community has shifted its approach of tree retention from regulating individual trees to the conservation of the overall urban forest canopy. Recognizing the functional importance of a mixed-age, mixed-species urban tree canopy, regulations are adopted to treat urban residential sites without tree canopy the same as urban residential sites with tree canopy.

TREE CANOPY AND SIGNIFICANT TREES

Tree canopy shall include all evergreen and deciduous trees six feet in height or greater, excluding invasive species or noxious weeds as designated in the tree ordinance. Significant tree means a tree with a caliper of at least 10 inches. Dogwoods and other small, understory trees are significant trees if they have a caliper of at least six inches. For multiple-stem trees, such as serviceberry, the caliper of the individual stems shall be added together to determine if a tree meets the minimum caliper for a significant tree.

Exemptions to tree canopy requirements

- Removal of any hazardous, dead or diseased trees, and as necessary to remedy an immediate threat to person, property or activity as determined by an arborist.
- Construction of a single-family dwelling, duplex, accessory or non-accessory storage structure on an individual lot created prior to implementation date.
- Construction or maintenance of public or private road network elements and public or private utilities including utility easements not related to development.
- Construction or maintenance of public parks and trails when located within an urban residential zone.

Tree canopy coverage requirements

A minimum healthy tree canopy cover shall be preserved or established on each lot subject to these requirements. Tree canopy cover shall be calculated based on the trees' expected mature canopy in the urban environment.

Table A lists the mature tree canopy to be credited for a newly planted or immature tree of the indicated size category. The size category shall be as indicated on the Approved Tree Species List.

TABLE A

Mature Canopy Cover	
Size Category of Tree	**Expected Mature Canopy Cover (square feet)**
Large	1,600
Medium	900
Small	400
Very small	150

Table B lists the minimum required tree canopy coverage by zoning district.

TABLE B

Required Tree Canopy	
Zoning District	**Minimum Tree Canopy Coverage**
Residential	30% for a subdivision; 20% per residential lot
Central Business District	15%
Commercial	20%
Light Industrial	15%
Planned Redevelopment Area (PRA)	Use canopy requirement for the zoning designation assigned by the administration based on approved use.
Planned Unit Development	40% for the development; 20% per residential lot
Planned Business Development	30% for the development; 15% per lot

Calculation of tree cover

The following areas shall not be included in the site area for purposes of calculating minimum required canopy coverage: water bodies and public street rights-of-way owned by a government agency.

- All healthy trees on the development site may be included in the tree canopy coverage for purposes of meeting the minimum requirement, including but not limited to trees planted or retained to meet landscaping, buffer yard and forest conservation.
- Evergreen trees and tree species identified as very small by the Tree Species List shall generally not be used to meet canopy requirements. They may be used if site characteristics render deciduous or larger trees impractical.
- The canopy of a preserved tree or group of trees may be calculated by measuring the actual canopy, using recent surveys, aerial photographs, satellite images or other means, or may be estimated by multiplying the diameter of the crown at its widest point by the diameter of the crown perpendicular to the first measurement.
- An existing tree determined by the Zoning Administrator to be in poor condition shall not be credited toward required canopy coverage. The Zoning Administrator may rely upon the advice of an ISA certified arborist retained by the community.

Canopy cover calculations for preserved trees
The canopy of preserved trees shall be calculated as indicated in **Table C**.

TABLE C

Canopy Credit for Healthy Preserved Trees	
Tree Location	**Canopy Cover Credit**
Trunk entirely on development site and at least 6 inches' DBH	1.5 times the current, measured canopy cover or 1.5 times the canopy cover area assigned in **Table A**
Trunk entirely on development site and smaller than 6 inches' DBH	The current, measured canopy cover or the canopy cover area assigned in **Table A** for the tree species
Adjacent trees with overlapping crowns, trunks entirely on development site	1.5 times the current, measured canopy that they collectively project onto the development site
Trunk directly on property line	The current, measured canopy cover that falls onto the development site or half the canopy cover area assigned in **Table A**
Street trees, trunk on adjacent street right-of-way on the same side of the street as the development site	The current, measured canopy cover that falls onto the development site or half the canopy cover area assigned in **Table A**
Trunk on adjacent lot or parcel	No credit for canopy cover, even if branches overhang the development site

The Planning and Zoning Commission shall consider the following guidelines when reviewing site plans and subdivision plans requiring tree canopy:

- To the extent possible, required canopy shall be provided through protection of existing trees utilizing the guidelines provided by the Tree Board.
- Where applicable, trees shall be planted and protected where they will be most beneficial in the enhancement of water quality and preservation of environmentally sensitive areas.

LOW-IMPACT DEVELOPMENT (LID) STRATEGIES FOR STORMWATER MANAGEMENT AND LAND CONSERVATION

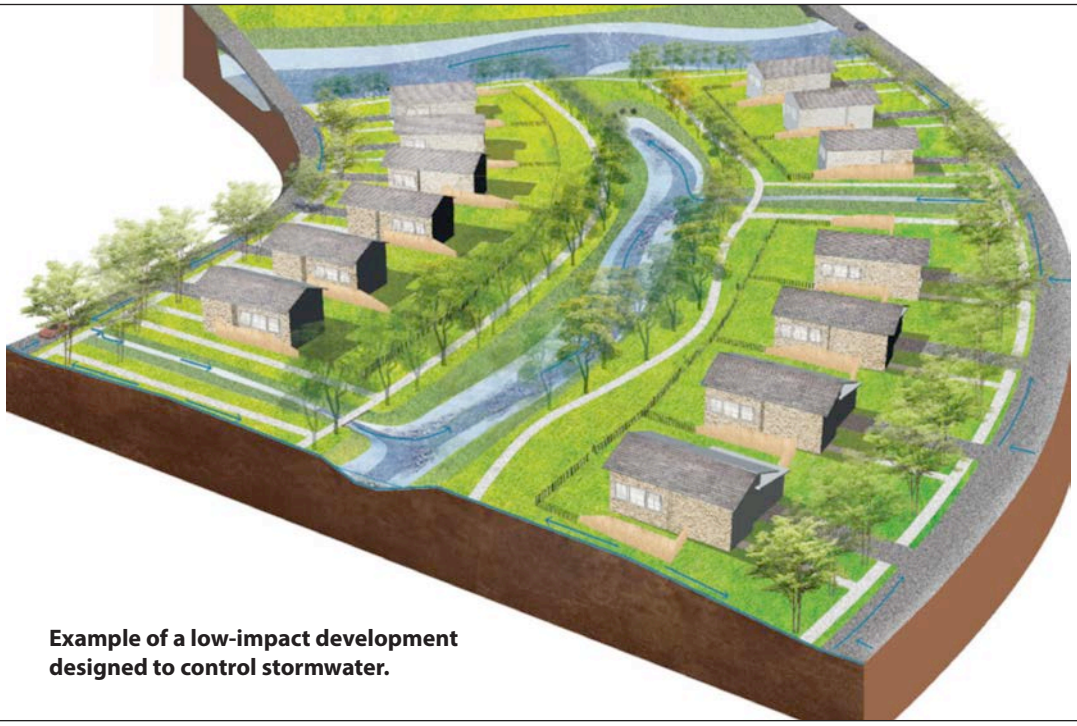
Building and development significantly alters the natural features and hydrology of a landscape, typically by creating impervious surfaces such as parking lots, sidewalks, roadways and commercial and residential buildings. Compaction, caused by heavy equipment and construction activity, destroys soil texture. This reduces tree canopy, affects urban forest health and prevents rain from soaking into the ground, allowing stormwater to sheet across parking lots and streets, collecting used motor oil, pesticides, fertilizers and other pollutants, moving them into riparian areas.

In most cities, a complex system of piping usually feeds contaminated stormwater flows directly into streams and coastal waters. More recently, stormwater control structures such as retention ponds have been installed, mainly in new developments, to intercept stormwater on its way to surface waters. Historically, the goal of stormwater planning has been to prevent localized flooding by moving large amounts of water offsite as quickly as possible. However, experience has shown that traditional stormwater management has many limitations and it is very expensive to install and maintain.

Efforts to address stormwater problems resulting from traditional development methods have produced a number of innovative alternatives. One such method reduces stormwater runoff by conserving forests and green spaces and protecting stream buffers. Yet another technique diminishes impervious surfaces, narrows road and sidewalk widths, reduces parking lot sizes, minimizes or removes cul-de-sacs and replaces traditional paving materials with pervious hard surfaces.

Development strategies like low-impact development (LID) seek to control stormwater at its source. Rather than moving stormwater offsite though a conveyance system, the goal of LID is to restore the natural ability of an urban site to absorb stormwater. Green spaces, sustainable landscaping and a variety of innovative bioretention techniques capture and manage stormwater on-site. LID reduces peak runoff by allowing rainwater to soak into the ground, evaporate into the air or collect in storage containers for irrigation

CONCEPTUAL DESIGN FOR RESIDENTIAL STORMWATER



Example of a low-impact development designed to control stormwater.

and other beneficial uses. In areas with slow drainage or infiltration, LID captures the first flush before excess stormwater is diverted into traditional storm conveyance systems.

The result is development that more closely maintains pre-development hydrology. Furthermore, LID has been shown to be cost effective and, in many cases, cheaper than using traditional stormwater management systems.

Similar to LID strategies, conservation development tries to mitigate the effects of urbanization, but it places additional emphasis on protecting aquatic habitat and other natural resources. Better site design to reduce impervious cover and capture stormwater on-site should be the goal of any new development. Conservation development subdivisions are characterized by compact, clustered lots surrounding a common open space. Conservation development's goal is to disturb as little land area as possible while simultaneously allowing for the maximum number of residences permitted under zoning laws.

Prior to new construction, conservation developers evaluate natural topography, natural drainage patterns, soils and vegetation. They deploy stormwater best management practices to help prevent flooding and protect natural hydrology. By maintaining natural hydrological processes, Conservation Development creates conditions that slow, absorb and filter stormwater runoff on-site. Because future development threatens valuable natural ecosystems, conservation development provides specific provisions for long-term and permanent resource protection. Conservation easements, transfer of development rights and other "in perpetuity" mechanisms ensure that protective measures are more than just temporary.

The damaging effects of stormwater runoff can be mitigated if urban planners use development plans that reduce the "footprint" of impervious structures. Traditional stormwater approaches, with their emphasis on collection, conveyance, storage and discharge, cannot address the environmental problems caused by urban sprawl. Furthermore, with rapid development occurring beyond metropolitan regions, urban stormwater is jeopardizing water quality. New land and stormwater management strategies take a more holistic approach. Communities employing conservation development techniques have found that natural features such as undeveloped land, vegetation and buffer zones effectively reduce and filter stormwater flow. There are also other benefits, such as recreation, wildlife habitat, and increased property values.

PURDUE EXTENSION

ID-464-W

Commercial Greenhouse and Nursery Production

Alternative Options for Invasive Landscape Plants

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Ornamental plants provide many environmental and ecological benefits to landscapes and urban areas. They can be aesthetically pleasing, reduce stormwater runoff, lower carbon dioxide and pollutants, alleviate the urban "heat island" effect, and provide habitats to pollinators, birds, and mammals. And in the last 20 years, consumers and the general public have become much more aware of these benefits.

The urban environment is different than most locations in a plant's native range. It is an ecosystem unlike any other due to extreme environmental pressures. So landscapers and homeowners must use a wide range of plant material that will survive in these unique and often harsh environments. Horticulturalists have continued to discover and introduce plants to broaden the plant palette. Unfortunately, a few of these landscape species can escape into wild areas and create ecological problems in unintended areas such as forests and woodlands. In Indiana, a few frequently used landscape plant species have invaded these natural areas and are displacing native species.

Figure 1. *Many callery pears can produce abundant fruit that are widely distributed by birds.*

Figure 2. *After their seeds are disseminated, callery pears can invade natural and disturbed areas. The callery pear's ability to grow in a wide range of conditions and their fast growth rate enable them to effectively compete with other vegetation.*

For these reasons, the green industry must begin to produce and use different landscape plants that can replace the invasive species. This publication lists potential alternatives to some of the most notorious and damaging invasive plants in Indiana.

Unlike the many lists available from many resources, we have included native and non-native species. This is an important difference for several reasons, but the two main reasons are:

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Invasive plant brochure sample

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2 ***Table 1. Common ornamental plants that are at high-risk of becoming invasive or are currently invasive and their potential replacements[1].***

Indiana Invasive Species				
Scientific Name	**Common Name**	**Invasive Rank[2]**	**Size Group**	**Growth Rate[3]**
Acer platanoides	Norway maple	high	large tree: >30-50 feet	fast
Alnus glutinosa	black alder			
Phellodendron amurense	amur cork tree			
Potential Replacement Species				
Scientific Name	**Common Name**	**Native (Y or N)**	**Special Characteristics**	**Growth Rate[3]**
Acer rubrum	red maple	Y	Susceptible to manganese deficiency. Has vibrant fall color.	fast
Acer saccharum	sugar maple	Y	Not good for compacted, confined soils. Has vibrant fall color	medium
Acer x Fremanii	freeman maple	N	Numerous cultivars vary in fall color and performance.	fast
Aesculus glabra	Ohio buckeye	Y	Prefers moist, deep soils.	slow
Betula nigra	river birch	Y	Prefers wet soils. Generally weak-wooded, Suscecptible to bronze birch borer	fast
Cladrastis kentuckea	yellowood	Y	pH-tolerant, prefers well-drained soils. Has white fragrant flowers.	medium
Diospyros virginiana	persimmon	Y	pH-tolerant, prefers moist, well-drained soils. Difficult to transplant.	slow
Fagus grandifolia	American beech	Y	Prefers moist, well-drained acid soils. Does not tolerate compacted soils.	slow
Fagus sylvatica	European beech	N	More tolerant of alkaline soil than *Fagus grandifolia*. Numerous cultivars available.	slow/ medium
Ginkgo biloba	ginkgo	N	Suitable for urban/poor soils. Widely adaptable.	medium
Gymnocladus dioicus	Kentucky coffee tree	Y	Widely adaptable. Can be messy — drops pods, leaves.	medium
Quercus bicolor	swamp white oak	Y	Tolerates urban conditions. Prefers wet soils.	medium
Quercus macrocarpa	bur oak	Y	Drought-tolerant. Tolerates clay soils.	slow
Quercus robur	English oak,	N	pH-tolerant. Prefers well-drained soils.	fast
Quercus rubra	red oak	Y	Prefers sandy, well-drained soils, but is adapatable.	fast
Quercus shumardii	Shumard oak	Y	pH- and drought-adaptable.	fast
Sassafras albidum	sassafras	Y	Difficult to transplant. Prefers moist, well-drained soils.	medium
Styphnolobium japonicum	Japanese pagoda	N	Suitable in urban/poor soils. Flowers in summer. Can be messy.	medium/fast
Tilia cordata	littleleaf linden	N	Widely adaptable. Has fragrant flowers in early summer.	medium
Tilia tomentosa	silver linden	N	Tolerates urban conditions.	medium
Ulmus parvifolia	lacebark elm	N	Suitable in urban/poor soils. Has beautiful mottled bark. Do not confuse with Siberian elm, *U. pumila*.	medium
Ulmus spp.	many cultivars	N	Suitable in urban/poor soils.	fast
Zelkova serrata	zelkova	N	Suitable in urban/poor soils.	medium

Continued on page 3.

Table 1. Continued from page 2.

Indiana Invasive Species				
Scientific Name	**Common Name**	**Invasive Rank[2]**	**Size Group**	**Growth Rate[3]**
Pyrus calleryana	callery pear	high	medium tree: >15-30 feet.	fast
Potential Replacement Species				
Scientific Name	**Common Name**	**Native (Y or N)**	**Special Characteristics**	**Growth Rate[3]**
Acer griseum	paperbark maple	N	Suitable in urban/poor soils. Has outstanding cinnamon-brown, peeling bark.	slow
Acer japonicum, A. palmatum	Japanese maple	N	There are many cultivars, some with excellent fall color. Grows best in light shade.	slow
Amelanchier spp.	serviceberry	Y	Prefers moist, well-drained, acid soils. Not good in high-stress environments.	medium
Carpinus betulus	European hornbeam	N	pH-tolerant. Prefers well-drained soils.	slow
Carpinus caroliniana	American hornbeam	Y	Prefers slightly acidic, rich, moist soils.	slow
Cercidiphyllum japonicum	katsura tree	N	pH adaptable. Prefers, moist, well-drained soils.	medium
Cercis canadensis	redbud	Y	pH adaptable. Prefers, moist, well-drained soils.	medium
Chionanthus virginicus	fringetree	Y	Adaptable, but prefers moist, acidic soils. May be susceptible to emerald ash borer.	medium
Cornus alternifolia	pagoda dogwood	N	Prefers moist, well-drained, acidic soils and partial shade. Self seeds.	slow
Cornus kousa	kousa dogwood	N	Prefers moist, well-drained, acidic soils.	Slow
Cornus mas	corneliancherry	N	pH adaptable. Prefers, moist, well-drained soils.	medium
Cotinus coggygria	common smoketree	N	Widely adaptable but prefers well-drained soils.	medium
Cotinus obovatus	American smoketree	Y	Widely adaptable, but is particularly good on alkaline soils.	medium
Crataegus phaenopyrum	Washington hawthorn	Y	Has outstanding fruit display.	medium
Crataegus viridis	green hawthorn	Y	'Winter King' has larger fruits. Is somewhat resistant to rust. Has compact habit.	medium
Halesia carolina	silverbell	Y	Prefers moist, well-drained, acidic soils. Best grown as container rather than balled and bundled.	medium
Maackia amurensis	amur maackia	N	pH-tolerant. Prefers well-drained soils.	slow
Malus sp.	crabapple	N	Widely adaptable, but intolerant of poor drainage. There are numerous cultivars.	fast
Ostrya virginiana	hophornbeam	Y	Prefers moist, well-drained soils, sun or partial shade.	slow
Stewartia spp.	stewartia	Y	Prefers moist, well-drained, acid soils. Afternoon sun is ideal.	slow
Syringa reticulata	Japanese tree lilac	N	Widely adaptable. Flowers best in full sun. Has white flowers in summer.	fast
Ulmus spp.	many cultivars		Suitable in urban/poor soils.	fast

Continued on page 4.

Table 1. Continued from page 3.

Indiana Invasive Species				
Scientific Name	**Common Name**	**Invasive Rank[2]**	**Size Group**	
Euonymus fortunei	wintercreeper	high	GC	fast
Potential Replacement Species				
Scientific Name	**Common Name**	**Native (Y or N)**	**Special Characteristics**	**Growth Rate[3]**
Asarum canadense	wild ginger	Y	ph adaptable but prefers moist, well-drained, acidic soils Shade-tolerant.	medium
Cotoneaster apiculatus	cranberry cotoneaster	N	pH adaptable. Salt-tolerant.	slow
Cotoneaster horzontalis	rockspray cotoneaster	N	pH adaptable. Prefers full sun or light shade. Good in poor soils.	medium
Parthenocissus quinquefolia	virginia creeper	Y	Widely adaptable. Shade- and salt-tolerant. Adheres to walls. Can be difficult to remove.	fast
Carex spp.	sedge	Y	Low growing. Numerous species and varieties. Suitable for wet, dry, or shady areas. Has attractive seed heads.	medium

[1]*Table sources:*
Alvey, A.A. 2013. Finding alternatives to invasive ornamental plants in New York. Cornell University Cooperative Extension. 134 pgs.
Dirr, M.A. 1998. Manual of woody landscape plants. Stipes Publishing. 1187 pgs.
Gilman, E.F. 1997. Trees for urban and suburban landscapes. Delmar Publishers. 662 pgs.

[2]*Indiana Invasive Species Council (www.entm.purdue.edu/iisc/plants.php) ratings.*

[3]*The growth rates listed are general. A plant's growth rate is environmentally sensitive relative to urban, suburban, and rural growth conditions. Rates are faster and sizes larger in areas with less stress and disturbed soils.*

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1. In some situations, a native plant is not the best choice due to environmental conditions, size, fruit characteristics, etc.
2. Some native plants are more difficult to cultivate than a similar non-native.

This publication was reviewed by representatives from Purdue University, Indiana Nursery and Landscape Association, Indiana Arborist Association, The Nature Conservancy of Indiana, Indiana Department of Natural Resources, and Indiana Native Plant and Wildflower Society.

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