USDA Southeast Climate Hub

Updated Silvics of North America Project (USNAP)

CHAPTER OUTLINE

December 2023 (v3)

Disclaimer:
This chapter outline displays the organization and content that all newly authored chapters for the Silvics of North America should follow. This outline is subject to change based on feedback from users, authors, and project staff. To ensure you are using the most up-to-date version, please download the most recent chapter outline from the project website, which is accessible via the QR code on the cover page. Alternatively, you can access the project website at **www.tinyurl.com/USNAPinfo.**

Acknowledgments:
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DETAILED OUTLINE

SPECIES

Author Guidance: *Use this space to list all relevant names of the species including the scientific name, common name(s), and regional name(s).*

AUTHORS

Author Guidance: *Use this space to indicate the Lead Author and all Co-authors.*

1. INTRODUCTION

Author Guidance: *Summarize noteworthy highlights and unique challenges regarding the species. You may include information related to its environmental, economic, and cultural history and present state.*

Figures 1.1–1.5: *Provide up to 5 photos clearly depicting the species to display unique characteristics or assist with identification. Supplied by Author.*

2. DISTRIBUTION AND ENVIRONMENTAL ASSOCIATIONS

Distribution

CURRENT DISTRIBUTION

Author Guidance: *Describe patterns in maps of current habitat. Where available, provide information from the literature on links to other map products and recent/historical changes in distribution. For exotic and invasive species, clarify the introduced range.*

Figure 2.1: *Map of current relative abundance overlaid by the original Little's range map. A modeled distribution will be used if quality is reasonable; otherwise, relative abundance estimates from forest inventory plots at 20 km resolution will be shown. Supplied by Distribution and Environmental Associations Section Team.*

PROJECTED DISTRIBUTION AND MIGRATION POTENTIAL

Author Guidance: *Describe patterns in maps of future habitat and migration potential. Where available, provide information from the literature on links to other map products, migration rates, dispersal barriers, and climate change refugia.*

Figure 2.2a: *Map showing future habitat suitability and migration potential under a moderate emissions scenario. Supplied by Distribution and Environmental Associations Section Team.*

Figure 2.2b: *Map showing future habitat suitability and migration potential under a high emissions scenario. Supplied by Distribution and Environmental Associations Section Team.*

Environmental Associations

CLIMATE AND ELEVATION

Author Guidance: *Describe patterns in table summarizing temperature, precipitation, and elevation across species range. Where available, provide information from the literature on climate and elevation controls on distribution limits.*

Table 2.1: *Table showing various quantiles for temperature, precipitation, and elevation variables across the range of the species. Data is supplied by Distribution and Environmental Associations Section Team. Authors should arrange data in table as appropriate.*

SOILS AND GEOLOGY

Author Guidance: *Describe soil and geology conditions across species range. Where available, provide information from the literature on soil and geologic controls on distribution limits.*

3. LIFE HISTORY TRAITS, REPRODUCTION, AND EARLY GROWTH

Author Guidance: *When differentiating between seedling, sapling, poletimber, and sawtimber class sizes please use USDA Forest Service FIA standards as a baseline. When needed you may reference other species-specific literature. In all cases, please provide the numerical values in your chapter that you are using to delineate between class sizes.*

Sexual Reproduction

FLOWERS, POLLINATION, AND FRUIT

Author Guidance: *Please address where relevant:*

1. ***Monoecious or dioecious***
2. ***Phenology***
3. ***Maturation***

SEED PRODUCTION AND DISSEMINATION

Author Guidance: *Please address where relevant:*

1. ***Tree age of earliest and peak viability***
    a. *Viability rates*
    b. *Abiotic interaction on production and maturation*
2. ***Seed dispersal/seed fall***
    a. *Mechanism(s)*
    b. *Phenology*

GERMINATION REQUIREMENTS

Author Guidance: *Please address where relevant:*

1. ***Scarification of seed*** *– Chemical, mechanical, heat, moisture*
2. ***With and without natural disturbance(s)*** *– Intensity, frequency, type, severity*
3. ***Tolerances*** *– Light, soil moisture, temperature, relative humidity, evaporative demand, flood, etc.*
4. ***Edaphic characteristics***

a. *Texture, nutrient availability, organic matter, etc.*
b. *Rooting habit (tap, central, lateral roots, mycorrhizae, grafting, etc.)*

5. ***Growth rates from germination to seedling***
   a. *Time from germination to seedling to sapling stage*
   b. *Tolerances – Abiotic factors influencing growth rates (water, light availability)*

Asexual Reproduction

VEGETATIVE TYPES

Author Guidance: *Please address where relevant:*

1. ***Sprouting*** *– Stump and seedling*
2. ***Root-suckering***
3. ***Lignotubers***
4. ***Layering*** *(adventitious buds)*

VEGETATIVE REGENERATION REQUIREMENTS

Author Guidance: *Please address where relevant:*

1. ***With and without disturbance***
   a. *Mother tree age of earliest and peak viability*
   b. *Phenology or seasonality*
   c. *Intensity, frequency, type, severity of disturbance*
   d. *Subsequent disturbance(s)*
2. ***Tolerances*** *– Light, soil moisture, temperature, relative humidity, evaporative demand, flood, etc.*
3. ***Edaphic characteristics***
   a. *Texture, nutrient availability, organic matter, etc.*
   b. *Rooting habit (tap, central, lateral roots, mycorrhizae, grafting, etc.)*
4. ***Growth rates*** *– Time to reach seedling and sapling stage*

4. TREE GROWTH AND STAND DYNAMICS

Author Guidance: *When differentiating between seedling, sapling, poletimber, and sawtimber class sizes please use USDA Forest Service FIA standards as a baseline. When needed you may reference other species-specific literature. In all cases, please provide the numerical values in your chapter that you are using to delineate between class sizes.*

Plant Associations and Site Conditions

Author Guidance: *Please address where relevant:*

1. ***Plant associations*** *– Habitat types or SAF cover types, or both*
2. ***Site productivity*** *– Site Index*

Successional Stages and Structural Development

Author Guidance: *Please address where relevant:*

1. ***Age and size of structural stages*** *– Saplings, poles, maturity*
2. ***Tolerances***
   a. *Light, soil moisture, temperature, relative humidity, evaporative demand, flood, etc.*
   b. *Tolerance changes with tree and stand age and structural development*

Growth Rates and Yield Across Stages

Author Guidance: *Please address where relevant:*

1. ***Ranges of aboveground and belowground biomass volume*** *(optimum, minimum, maximum)*
2. ***Stocking parameters***

5. MANAGEMENT

Management with Natural Regeneration

SILVICULTURAL SYSTEMS

Author Guidance: *Please address where relevant:*

1. ***Even-age system***
2. ***Two-age system***
3. ***Uneven-age system***
4. ***Variable Retention System*** *(regional description)*

SILVICULTURAL OPTIONS AND CONSIDERATIONS

Author Guidance: *Please address where relevant:*

1. ***Clearcutting with and without reserves***
2. ***Seed tree with and without reserves***
3. ***Shelterwood with and without reserves***
4. ***Irregular shelterwood with and without reserves***
5. ***Single-tree selection***
6. ***Group selection***
7. ***Patch cuts***
8. ***Coppice with and without reserves***
9. ***Variable retention*** *(harvest) – Requires a regional statement*
10. ***Advance regeneration*** *– Considerations related to protection, release, precommercial thinning, site preparation, layout*

SITE PREPARATION

Author Guidance: *Please address where relevant:*

1. ***Logging slash***
2. ***Seedbed*** *(chemical, mechanical, fire, etc.)*
3. ***Vegetation management*** *(chemical, mechanical, fire, etc.)*

Management with Planted Regeneration

PLANTING STRATEGIES

Author Guidance: *Please address where relevant:*

1. ***Seedling composition or mixed-species***
2. ***Planting patterns and density***
3. ***Underplanting***
4. ***Direct seeding***

SILVICULTURAL OPTIONS AND CONSIDERATIONS

Author Guidance: *Please address where relevant:*

1. ***Timing*** *(seasonality; rainfall)*
2. ***Microsite*** *(see shade, DDW)*
3. ***Protection*** *(herbivory)*
4. ***Seed collection***
5. ***Stock-type selection:***
    a. *Substrate – planting material*
        i. *Nutrient loading*
        ii. *Inoculation – mycorrhizal*
    b. *Seedling size (e.g., 2-0; bare-root, nursery)*
    c. *Genetics*
    d. *Propagation*

SITE PREPARATION

Author Guidance: *Please address where relevant:*

1. ***Logging slash***
2. ***Seedbed*** *(chemical, mechanical, fire, etc.)*
3. ***Vegetation management*** *(chemical, mechanical, fire, etc.)*

Tending or Intermediate Management

Author Guidance: *The following subheadings should consider:*

1. *Management for composition and structure not regeneration*
2. *International and regional regulations that impact where chemical control is permitted*

SEEDLING AND SAPLING STAGE

Author Guidance: *Please address the following items related to release treatments where relevant:*

1. *Physical*
2. *Chemical*
3. *Rx fire*
4. *Biological (biocontrol, cover crops, grazing)*
5. *Consider best outcomes and feasibility*

POLE AND MATURE STANDS

Author Guidance: *Please address where relevant:*

1. ***Considerations and options*** *(schedule, method[s], stocking regulation, wood quality, insects and diseases)*
2. ***Thinning***
    a. *Precommercial (nonmerchantable)*
        i. *Single-tree*
        ii. *Stump–sprout clumps*
    b. *Commercial (merchantable)*
        i. *Low or thinning from below*
        ii. *Crown or thinning from above*
        iii. *Selection thinning*
        iv. *Geometric thinning*
        v. *Free thinning*

PRUNING

SANITATION
SALVAGE

6. GENETICS

Taxonomy

Author Guidance: *Discuss subspecies, varieties, races, clones. Include information from population genetics studies where relevant.*

Genetic Variation

VARIATION WITHIN AND AMONG POPULATIONS

Author Guidance: *The goal of this subheading is to review the available data on the genetic variation found within a species, including available data on the results of controlled-environment and field tests (provenance, progeny, etc.) that inform the amount and type of quantitative genetic differentiation among populations that has occurred as adaptive processes in response to selective pressures, in many cases environmental. Potential measures include genetic partitioning and the heritability of traits. Not every species will have data available. Include information from population genetics studies where relevant. Identifying gaps in knowledge is useful as well. Please address where relevant:*

1. ***Ploidy level***
2. ***Provenance variation***
3. ***Adaptive capacity*** *(neutral and adaptive genetic variation, plasticity)*
4. ***Hybrid zones, including regions of known introgression***
5. ***Baseline level of genetic diversity based on molecular markers*** *(e.g., heterozygosity, allelic diversity, effective population size, average inbreeding)*

SEED TRANSFER GUIDANCE

Author Guidance: *The goal of this subheading is to describe the data and methods used in seed transfer guideline development and to provide links to websites or tools available for this species. Authors can refer to descriptions in the previous section if seed transfer guidelines are based on the previously described data. Not every species will have data available. Identifying gaps in knowledge is useful as well.*

TREE BREEDING

Author Guidance: *Please address where relevant:*

1. ***Breeding initiatives*** *– Include updated status of domestication and breeding programs (where and by whom), current generation of improvement, and worldwide exchange of North American genetic material*
2. ***Species of interest*** *– include natural or commercial hybrids, or both*
3. ***Selection goals*** *– include favorable traits*
4. ***Inheritance of complex and adaptive traits***
5. ***Genetic improvement for pests and pathogens***

Genomic Resources for Forest Tree Species

AVAILABLE SNP ARRAYS

7. DISTURBANCE REGIME: INSECTS AND DISEASES

Dominant Insects and Diseases

Author Guidance: *This section needs to highlight the main biotic agents affecting the tree species and indicate agents' relative importance to individual trees or populations (e.g., wood borers vs. defoliators). Include a short description of biology, life cycle, and overlap in distribution range with host. Please categorize or group insects or diseases (or both) affecting the tree species based on their presence on one of the following 4 tree compartments:* ***1)*** *Roots,* ***2)*** *Bole (Bark, Phloem, and Xylem),* ***3)*** *Foliage, Shoot, Twig, and* ***4)*** *Flowers, Fruits, Seeds. Please address where relevant:*

1. ***Spatiotemporal patterns and historical trends***
2. ***Current conditions***
3. ***Potential future changes from climate change***

The first time that an insect or disease is mentioned, please use the common name with the scientific name followed directly after in parentheses. Whenever the insect or disease is mentioned again, please use only the common name.

Table 7.1: *Table displaying ranking and brief summary of significance of insects and diseases across tree compartment/category. Supplied by Author.*

Response to Insects and Diseases

Author Guidance: *Provide a synthesis of documented effects on species. Utilize the categorical labeling of the 4 compartments in the above section. Please address where relevant:*

1. ***Resistance and sensitivity –*** *Include how tree resistance may change with size/age due to crown, stem, and root traits and how in total these traits affect probability of tree mortality from insects or diseases.*
2. ***Physiology impacts –*** *Describe what to look for as a symptom or sign of occurrence, and timeline of manifestation. List agents that may cause similar symptoms. Discuss the tree developmental stage mostly affected (e.g., seedlings, saplings, trees).*
3. ***Trait adaptations***

Figure 7.1: *Provide photos of symptoms and signs of occurrence with timing of optimal detection or monitoring (or both). Supplied by Author.*

2nd-Order Interactions

Author Guidance: *Please address where relevant:*

1. ***Wildland fire*** *(cross-reference as pertinent to Wildland Fire section)*
2. ***Drought*** *(cross-reference as pertinent to Drought section)*
3. ***Climate*** *(cross-reference as pertinent to Distribution and Environmental Associations section)*

Management Considerations

Author Guidance: *Address options for minimizing impact and facilitating recovery. Synthesize and describe strategies to reduce aesthetic or value loss to tree species individuals, stands, and landscapes. Consider monitoring, evaluation, and outbreak control – both timing and resources. Distinguish among direct control and preventive measures.*

8. DISTURBANCE REGIME: WILDLAND FIRE

Dominant Fire Regime

Author Guidance: *Please address where relevant:*

1. ***Historical dominant fire regime description.*** *Include frequency, seasonality, intensity, severity, size.*
2. ***Degree of departures from historical regime and description of contemporary fire regime***
3. ***Potential future changes in fire regime***

Response to Fire

Author Guidance: *For instances where the species has a positive/dependent association with fire, and it is considered necessary for regeneration or growth, please discuss these items in Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of fire below:*

1. ***Regeneration strategy*** *(after catastrophic fire, otherwise discuss in Section 3)*
2. ***Fire resistance and sensitivity*** *(How tree resistance may change with fire severity and size/age due to crown, stem, and root traits and how, in total, these traits affect probability of tree mortality from fire). Include:*
    a. *Roots (depth and location of fine roots)*
    b. *Stem (bark thickness, accumulation rates and taper, rugosity and other traits that influence heat transfer)*
    c. *Crown*
        i. *Architecture (branching and pruning habits)*
        ii. *Branch morphology (branch and bud size, leaf arrangement and length, bud protection, epicormic/basal resprouting ability)*
    d. *Litter flammability*
3. ***Physiology Impacts***
    a. *Bole defects (describe how tree responds to fire-caused injury to the stem such as development of catfaces/fire scars, decay spread)*
    b. *Are there known fire-induced physiological responses to the tree (e.g., resin flow or duct induction)?*
4. ***Trait adaptations***

2nd-Order Interactions

Author Guidance: *For instances where the species has a positive/dependent association with fire, and it is considered necessary for regeneration or growth, please discuss these items in Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of fire below:*

1. ***Insects, pathogens*** *(cross-reference as pertinent to Insects and Diseases section)*

2. ***Drought*** *(cross-reference as pertinent to Drought section)*
3. ***Climate*** *(cross-reference as pertinent to Distribution and Environmental Associations section)*

Management Considerations

Author Guidance: *Address options for minimizing impact and facilitating recovery. Synthesize and describe strategies to reduce aesthetic or value loss to tree species individuals, stands, and landscapes. Consider monitoring, preventative measures, and response measures. For instances where the species has a positive/ dependent association with fire, and management practices are responding to this relationship, please discuss these items in Section 5 and include a note that readers should refer back to Section 5. Otherwise, please address all information related to the negative impact of fire below.*

9. DISTURBANCE REGIME: DROUGHT

Dominant Drought Regime

Author Guidance: *Please address where relevant:*

1. ***Current/historically observed conditions in range (some examples)***
   a. *Snowmelt-dominated soil water supply*
   b. *Dry in warm season (Mediterranean climate) vs. consistent seasonal moisture*
   c. *Arid, semiarid, or mesic climate*
   d. *El Niño–Southern Oscillation-driven precipitation variability*
   e. *Low-frequency precipitation variability drivers*
2. ***Historical or paleoclimatic "megadroughts" known in range***
3. ***Potential future changes in drought regime***
   a. *Loss of snowpack*
   b. *Increased dry spell length*
   c. *Hotter droughts*

Response to Drought

Author Guidance: *For instances where the species has a positive/dependent association with drought, and it is considered necessary for regeneration or growth, please discuss these items in Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of drought below:*

1. ***Regeneration strategy*** *(after catastrophic drought; otherwise, discuss in Section 3)*
2. ***Drought resistance and sensitivity*** *(include how tree resistance may change with size/age due to crown, stem, and root traits and how in total these traits affect probability of tree mortality from severe or extended drought)*
3. ***Physiology impacts*** *(impacts and timeline of stress manifestation)*
4. ***Trait adaptations***
   a. *Leaves (e.g., stomatal response, leaf waxiness)*
   b. *Xylem anatomy and relevance to cavitation risks*
   c. *Roots (deep? adaptive?)*
   d. *Grows in areas with persistently high water tables (wetlands, riparian areas with more reliable supply)*
5. ***Stand to population level responses***
   a. *Changes in representation or role in stands*
   b. *Changes in range (cross-reference as pertinent to Distribution and Environmental Associations section)*

2nd-Order Interactions

Author Guidance: *For instances where the species has a positive/dependent association with drought, and it is considered necessary for regeneration or growth, please discuss these items in Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of drought below:*

1. ***Insects, pathogens*** *(cross-reference as pertinent to Insects and Diseases section)*
2. ***Wildland fire*** *(cross-reference as pertinent to Wildland Fire section)*
3. ***Climate*** *(cross-reference as pertinent to Distribution and Environmental Associations section)*

Management Considerations

Author Guidance: *Address options for minimizing impact and facilitating recovery. Synthesize and describe strategies to reduce aesthetic or value loss to tree species individuals, stands, and landscapes. Consider monitoring, preventive measures, and response measures. For instances where the species has a positive/ dependent association with drought, and management practices are responding to this relationship, please discuss these items in Section 5 and include a note that readers should refer back to Section 5. Otherwise, please address all information related to the negative impact of drought below.*

10. ADDITIONAL DISTURBANCES

Author Guidance: *For other disturbances that have a strong significance to the species (e.g., hurricanes, ice damage, herbivory), please use the guide below. Each disturbance with significance should be given its own Section based on this format. For Section titles, please use the naming convention that has been used for Sections 7, 8, and 9.*

Dominant Disturbances

Author Guidance: *Please address where relevant:*

1. ***Spatiotemporal patterns and historical trends***
2. ***Current conditions***
3. ***Potential future changes from climate change***

Response to Disturbances

Author Guidance: *For instances where the species has a positive/dependent association with the disturbance, and it is considered necessary for regeneration or growth, please discuss these items in Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of the disturbance below:*

1. ***Regeneration strategy*** *(after catastrophic disturbance; otherwise, discuss in Section 3)*
2. ***Disturbance resistance and sensitivity***
3. ***Physiology impacts***
4. ***Trait adaptations***

2nd-Order Interactions

Author Guidance: *For instances where the species has a positive/dependent association with the disturbance, and it is considered necessary for regeneration or growth, please discuss these items in*

Section 3 or 4 (Life History Traits, Reproduction, and Early Growth/Tree Growth and Stand Dynamics) as appropriate. If this is the case, please include a note in this heading that readers should refer back to Section 3 or 4. Otherwise, please address all information related to the negative impact of the disturbance below:

1. ***Insects, pathogens*** *(cross-reference as pertinent to Insects and Diseases section)*
2. ***Wildland fire*** *(cross-reference as pertinent to Wildland Fire section)*
3. ***Drought*** *(cross-reference as pertinent to Drought section)*
4. ***Climate*** *(cross-reference as pertinent to Distribution and Environmental Associations section)*

Management Considerations

Author Guidance: *Address options for minimizing impact and facilitating recovery. Synthesize and describe strategies to reduce aesthetic or value loss to tree species individuals, stands, and landscapes. Consider monitoring, preventative measures, and response measures. For instances where the species has a positive/dependent association with the disturbance, and management practices are responding to this relationship, please discuss these items in Section 5 and include a note that readers should refer back to Section 5. Otherwise, please address all information related to the negative impact of the disturbance below.*

11. GOODS AND SERVICES

Goods

WOOD PRODUCTS

Author Guidance: *List the wood products provided by the species. Products may be more common for commercial species, and could include durable harvested wood products (e.g., lumber, wood panels), energy products (e.g., firewood and charcoal), and pulp and paper products. Include information on wood characteristics such as strength, hardness, dimensional stability, ease of drying, resistance to splitting, density, workability (machinability), and response to pressure treatments and finishing. In addition to physical properties, discuss the importance of the wood species to relevant economies. Discuss whether the species has opportunities to mitigate climate change by being used in lieu of fossil fuel-extensive products, including bioenergy opportunities.*

NONWOOD PRODUCTS

Author Guidance: *List the nonwood products provided by the species. Nonwood products may apply to both commercial and noncommercial species. Examples include finished products like baskets, syrup, medicine, and food.*

Ecosystem Services

Author Guidance*: For all subheadings focus on ecosystem services that are specific to the tree species, rather than ecosystem services that are general to many tree species. The following subheadings are not comprehensive, and any service not specifically identified in a subheading can be placed in the "Other" subheading.*

BIODIVERSITY

Author Guidance: *List the types of animal and plant life (both domestic and wild) found within the tree species domain. Please note that many of the forest plants that contribute to biodiversity are harvested for wood, food, and medicine, as well as other products. Address the various wildlife*

habitats that the tree species supports (e.g., growing sites for plants, nesting, feeding, and mating sites for animals, resting and overwintering areas for migratory mammals, birds and butterflies, nurseries for juvenile stages of fish, habitat creation at different soil depths by invertebrates).

FOREST CARBON AND NUTRIENT DYNAMICS

Author Guidance: *Address the measure of carbon storage and emission based on tree size, growth, and longevity. Include information on how effective the tree species is at maximizing carbon sequestration and storage in the forest and harvested wood products. Also address the species ability to sequester soil carbon.*

If possible, detail the potential for the tree species to monetize its carbon sequestration and storage capacity. If included specify associated variables such as site conditions, harvest practices, and intended products.

Separately, discuss if the tree species can be used for pollution abatement activities (e.g., absorbing mine-land pollutants). Additionally, discuss how the tree species responds to nutrients including synthetic fertilizers (i.e., is it well-suited for short-rotation forestry/energy crops like poplar?).

RECREATION

Author Guidance: *List the common recreational activities found within the tree species domain. Where possible, detail specific activities such as hunting and fishing (e.g., do recreationists visit this site because of a particular tree species (e.g., redwoods))?*

OTHER (ADDITIONAL CONSIDERATIONS)

Author Guidance: *List any additional ecosystem services not covered by the categories listed above that can be associated specifically with the tree species domain.*

12. URBAN FORESTRY

Author Guidance: *The Urban Forestry section emphasizes species specific responses to urban ecosystem conditions across different site contexts (e.g., natural areas, street trees). This section will only address instances where the silvics of the species in an urban context diverges from what has previously been addressed in the chapter. Note that research may be limited or not exist for some of these headings and subheadings.*

Urban Range and Abundance

Author Guidance: *Note whether the occurrence, abundance, or importance value of the focus species differs from that of the modeled range.*

Forests in Cities

Author Guidance: *Focus on forests in cities, which may also be referred to as "urban forested natural areas," "woodlands," or "forest patches." These sites are biophysically akin to traditional definitions of forests.*

REPRODUCTION AND EARLY GROWTH

Author Guidance: *Please address where relevant:*

1. ***Seed production, banking, and dissemination***
2. ***Seedling development***
3. ***Vegetation reproduction and propagation***

SAPLING STAGES TO MATURITY

Author Guidance: *Please address where relevant:*

1. ***Growth and survival*** *(note form, single-stem, or multi-stem, and branch attachment)*
2. ***Rooting habit*** *(for example, response to urban soils or site conditions, such as soil compaction)*
3. ***Reaction to competition*** *(note issues of planting density that leads to altered dynamics, including competition, but also facilitation (e.g., shading, belowground interactions, etc.)*
4. ***Damaging agents*** *(damaging agents considered must be exacerbated or unique to cities, for example, road salt or salinity tolerance)*

Trees in Planted Urban Landscapes

Author Guidance: *Focus on the silvics of trees located in sites characterized by intensive management (e.g., street trees, landscaped park trees, stormwater infrastructure). These trees are often planted and fall under the purview of arborists.*

SAPLING STAGES TO MATURITY

Author Guidance: *Please address where relevant:*

1. ***Growth and mortality*** *(note form, single-stem, or multi-stem, and branch attachment)*
2. ***Rooting habit*** *(for example, response to urban soils or site conditions, such as soil compaction)*
3. ***Reaction to competition*** *(note issues of planting density that leads to altered dynamics, including competition, but also facilitation (e.g., shading, belowground interactions, etc.)*
4. ***Damaging agents*** *(damaging agents considered must be exacerbated or unique to cities, for example, road salt or salinity tolerance)*

Urban Goods, Services, and Social Value

Author Guidance: *Consider the benefits and disservices of trees that are specific to urban areas (e.g., heat island or stormwater mitigation, impact on air temperature, foraging, etc.) Include any practices of harvesting goods from the species that are unique to urban areas.*

13. KNOWLEDGE GAPS

Author Guidance: *For any section with significant knowledge gaps, please indicate relevant research opportunities here.*

CONTRIBUTORS

Authorship Team

Author Guidance: *Use this space to indicate the Lead Author and all Co-authors. This should be the same as what you indicated at the beginning of your chapter.*

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Acknowledgments

Author Guidance: *Use this space to recognize other collaborators besides your authorship team who assisted in the production of your chapter. It is appropriate to acknowledge technicians, cooperators, sources of special materials, visual information specialists, and other individuals or groups who have gone above and beyond to help with the research, writing, or publication of the chapter. Acknowledgements should be simply worded. Avoid language that implies endorsement.*

APPENDIXES

Author Guidance: *For any section where you feel supplemental information should be supplied to readers, please include these resources and this information below.*

A.1 Distribution and Environmental Associations

Author Guidance: *You may choose to include the alternative map here that was not included in the chapter body, either the actual forest inventory data (*_Actual_sp*.png) or the current modeled habitat (*_CurrentPredicted_Consensus_sp*.png). You may also choose to provide additional information related to other sources of modeled habitat or known locations of the species not provided from the Figures and Tables resource folder.*

You may choose to include the box plots for elevation, mean annual precipitation, and mean annual temperature. You may also choose to provide additional or supplemental information related to environmental conditions that are not provided in the Figures and Tables resource folder.

A.2 Life History Traits, Reproduction, and Early Growth

A.3 Tree Growth and Stand Dynamics

A.4 Management

A.5 Genetics

A.6 Disturbance Regime: Insects and Diseases

A.7 Disturbance Regime: Wildland Fire

A.8 Disturbance Regime: Drought

A.9 Additional Disturbances

A.10 Goods and Services

A.11 Urban Forestry

LITERATURE CITED

Author Guidance: *List all resources that were cited in your paper here. See Author Guidance Package for citation formatting.*