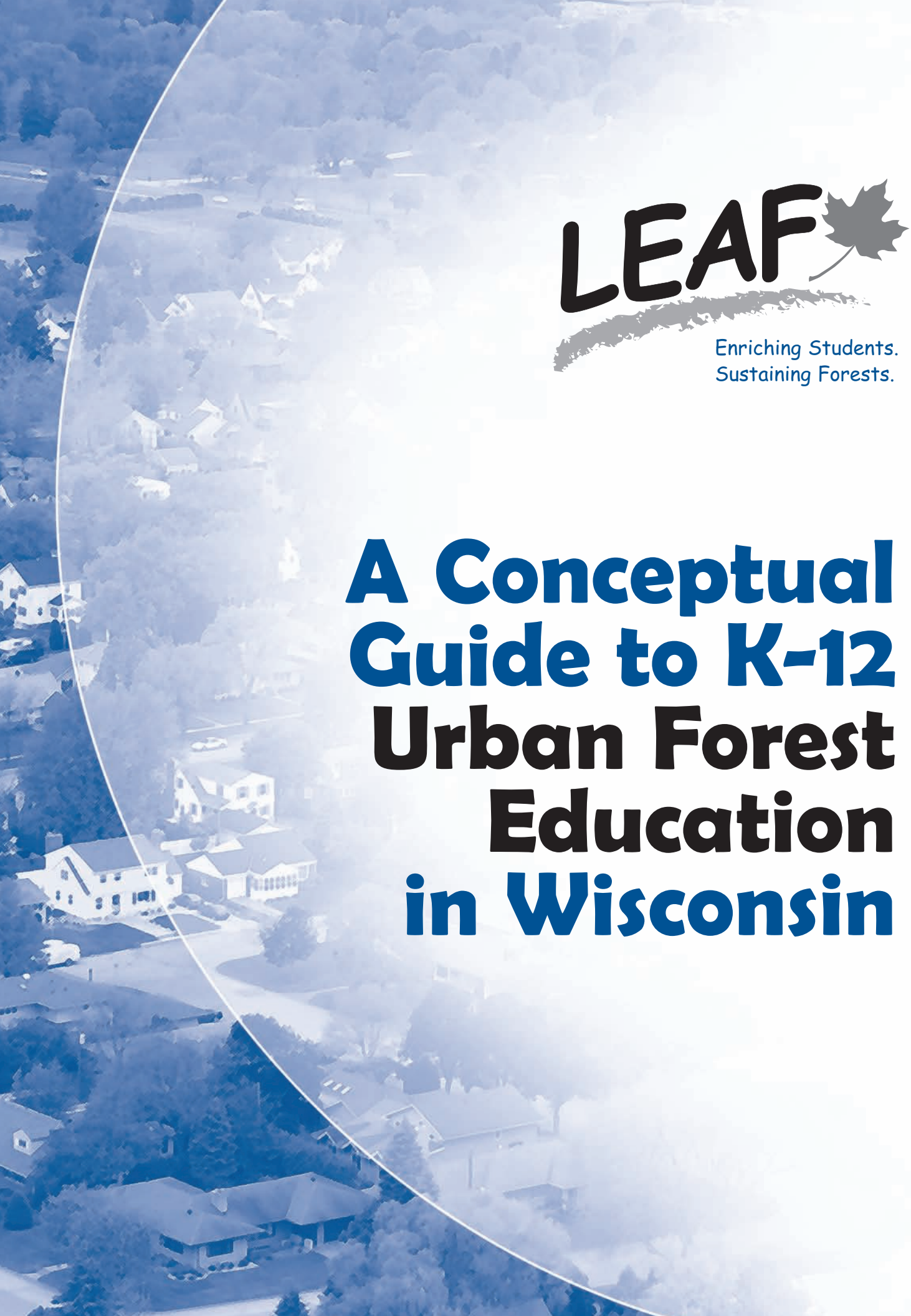


LEAF

Enriching Students.
Sustaining Forests.

A Conceptual Guide to K-12 Urban Forest Education in Wisconsin

LEAF - **L**earning, **E**xperiences, & **A**ctivities in **F**orestry

The Wisconsin K-12 Forestry Education Program

LEAF STAFF

STERLING STRATHE
Director

SARAH GILBERT
Forestry Education Specialist

KELLY MORTENSON
Digital Media Specialist

JEREMY SOLIN
School Forest Education Specialist

JESSICA TOMASZEWSKI
Program Assistant

TABLE OF CONTENTS

LEAF was created to help promote forestry education in Wisconsin schools. In 2001, Wisconsin K-12 forestry education stakeholders evaluated the current status of and the needs for Wisconsin-based K-12 forestry education. A variety of programs existed, but voids were identified in delivery and dissemination of educational materials and services. To offer a more unified effort, stakeholders supported the development of a comprehensive program that would enhance existing efforts.

During the spring of 2001, legislation was written to establish the LEAF Program as a partnership between the Wisconsin Department of Natural Resources - Division of Forestry and the Wisconsin Center for Environmental Education at the College of Natural Resources, University of Wisconsin-Stevens Point. Funding for the program is provided through a surcharge on the sale of seedlings from Wisconsin Department of Natural Resources - Division of Forestry nurseries.

LEAF PROGRAM
Wisconsin Center for Environmental Education
College of Natural Resources
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
PHONE: (715) 346-4956
EMAIL: leaf@uwsp.edu
WEBSITE: www.uwsp.edu/leaf

ACKNOWLEDGEMENTS

CONCEPTUAL FRAMEWORK DEVELOPMENT (2005)

CATHY BRODBECK
Madison Gas and Electric

BOB BRUSH
University of Wisconsin-Stevens Point (Retired)

SAM CARMAN
Indiana Department of Natural Resources

CINDY CASEY-WIDSTRAND
Wisconsin Department of Natural Resources - Urban Forestry

SALLY ELLINGBOE
Retired Educator

TODD ERNSTER
City of Stevens Point Forestry Department

RICHARD HAUER
University of Wisconsin-Stevens Point

LEIF HUBBARD
Wisconsin Department of Transportation

JILL JOHNSON
USDA Forest Service

DON KISSINGER
Wisconsin Department of Natural Resources - Urban Forestry

DAVE LISKA
City of Waukesha

RICHARD RIDEOUT
Wisconsin Department of Natural Resources - Urban Forestry

JOAN STEVENS
Greenfield City Tree Commission

BRIAN WAHL
University of Wisconsin-Stevens Point
Graduate Student

LES WERNER
University of Wisconsin-Stevens Point

DENNIS YOCKERS
Wisconsin Center for Environmental Education

RON ZILLMER
Midstate Technical College

SCOPE AND SEQUENCE DEVELOPMENT (2005)

DELORES BREWSTER
Hawthorne Glen Environmental Center, Milwaukee

PEGGY DILLMAN
Lincoln Avenue School, Milwaukee

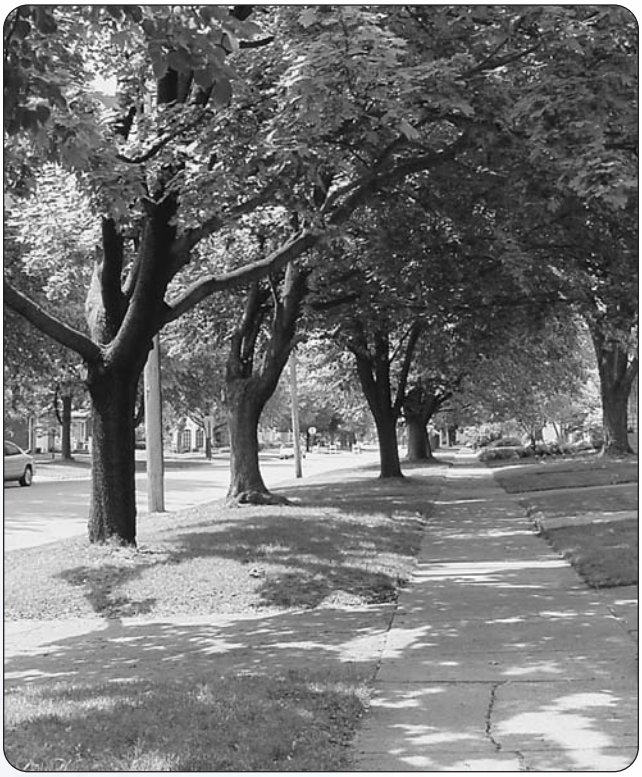
ROGER FESTERLING
Wisconsin Lutheran High School, Milwaukee

SUZANNE KLEIN
School on the Lake, Menasha

JUDY KLIPPEL
Havenwoods Environmental Center, Milwaukee

BARB LUKASZEWSKI
Victory School, Milwaukee

BRENT NERAT
School on the Lake, Menasha



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CONCEPTUAL GUIDE REVIEW

PAT ARNDT
Berlin Area School District

CATHY BRODBECK
Madison Gas and Electric

SUNSHINE BUCHHOLZ
Wisconsin Center for Environmental Education

ROBERTA BURZYNSKI
USDA Forest Service

CINDY CASEY-WIDSTRAND
Wisconsin Department of Natural Resources - Urban Forestry

RANDY CHAMPEAU
Wisconsin Center for Environmental Education

PEGGY DILLMAN
Lincoln Avenue School, Milwaukee

SALLY ELLINGBOE
Retired Educator

TODD ERNSTER
City of Stevens Point Forestry Department

ROGER FESTERLING
Wisconsin Lutheran High School, Milwaukee

RICHARD HAUER
UW-Stevens Point

LEIF HUBBARD
Wisconsin Department of Transportation

JILL JOHNSON
USDA Forest Service

DON KISSINGER
Wisconsin Department of Natural Resources - Urban Forestry

SUZANNE KLEIN
School on the Lake, Menasha

JUDY KLIPPEL
Havenwoods Environmental Center, Milwaukee

DAVE LISKA
City of Waukesha

BARB LUKASZEWSKI
Victory School, Milwaukee

BRENT NERAT
School on the Lake, Menasha

RICHARD RIDEOUT
Wisconsin Department of Natural Resources - Urban Forestry

PHILLIP RODBELL
USDA Forest Service

DAVID SCHARFENBERGER
Wachtel Tree Service

JEFFERY TREU
WE Energies

BRIAN WAHL
University of Wisconsin-Stevens Point Graduate Student

LES WERNER
University of Wisconsin-Stevens Point

JOE WILSON
Greening Milwaukee

DENNIS YOCKERS
Wisconsin Center for Environmental Education

RON ZILLMER
Midstate Technical College

INTRODUCTION

The LEAF Program is Wisconsin's K-12 forestry education program. LEAF works to encourage K-12 teachers in Wisconsin to teach about Wisconsin's forests and forestry. To accomplish this, LEAF offers professional development, classroom and field materials, consultation, and other services.

Urban forests are an important resource in Wisconsin. They provide benefits such as stormwater retention, energy use reductions, carbon sequestration, as well as aesthetic values. During the development of the *LEAF Conceptual Guide to K-12 Forestry Education in Wisconsin,* urban forestry was identified as an area that should be addressed separately so that its unique characteristics could be explored more fully.

It was decided that an urban forest supplement would be created and used in conjunction with the existing LEAF educational materials. An urban forest conceptual guide was needed to guide the development of the K-12 urban forest supplement educational materials.

CONCEPTUAL GUIDE AND SCOPE AND SEQUENCE

This conceptual guide includes two parts – a conceptual framework and a scope and sequence. The conceptual framework identifies the important ideas, or concepts, that students in Wisconsin should learn by the time they graduate from high school. The scope and sequence identifies at what grade level those concepts should be taught.

This guide is arranged under four themes posed as questions: “What is an urban forest?” “Why are they important?” “How do we sustain them?” and “What is the future?” Each theme contains concepts that address the question, and the concepts are further divided into numbered subconcepts. Definitions of some terms relative to use in this document are provided for clarity.

The concepts identified here are not detailed urban forestry principles – those principles are beyond the scope of this document and K-12 education. These concepts are, instead, basic ideas that informed citizens of Wisconsin should understand. By understanding these ideas, citizens will be able to make educated, knowledgeable decisions regarding their urban forests.

ADDITIONAL SUBCONCEPTS

In addition to the important ideas identified in this document, certain basic ideas from the original *LEAF K-12 Forestry Education Conceptual Guide* should also serve as a guide when creating urban forestry-based materials. The subconcepts listed below from that document have been identified to help promote a more complete understanding.

- **Subconcept 6.** A tree is a perennial plant (lives more than one growing season) with a well-defined woody stem, crown, and roots.
- **Subconcept 7.** Trees compete for nutrients, sunlight, space, and water.
- **Subconcept 8.** Trees have life stages that include germination, growth, maturity, reproduction, decline, and death.

WISCONSIN MODEL ACADEMIC STANDARDS

The subconcepts in this guide have been correlated with the Wisconsin Model Academic Standards so teachers can address the academic standards while infusing urban forestry education into the curriculum. These standards are listed in the scope and sequence section. The standards specify what students should know and be able to do by certain points in their K-12 education. School districts may use the academic standards as guides for developing local grade-by-grade curricula. The four subject areas cited (science, environmental education, social studies, and agriculture education) have the most direct correlation to the subconcepts.

The concepts in this theme help students understand what urban forests are and how urban forests are connected to other ecosystems.

DEFINING THE URBAN FOREST

1. An urban forest is all the trees and other vegetation in and around a town, village, or city. Plants, people, and animals are part of the urban forest.
2. An urban forest is an ecosystem. An ecosystem is an area that contains living (e.g., trees, people, animals) and nonliving (e.g., soil, buildings, utilities, roads) things existing together and interacting. Humans play a dominant role in the urban ecosystem.
3. Different components make up urban forests. They may include street trees, park trees, woodlands, **riparian** areas, manicured lawns, the urban-rural interface, and others.

URBAN FOREST CONNECTIONS

4. Urban forest ecosystems are part of matter cycling and **energy webs**.
5. Trees from all over the world with the ability to tolerate climate, soils, and maintenance **regimes** are being planted in Wisconsin's urban forests.

GLOSSARY

Energy Webs: A system where energy is transferred through a series of interconnected food chains.

Regime: A system of administration.

Riparian: Relating to the land around a river or another body of water.

The concepts in this theme help students investigate the connection between urban forests and their own lives.

ENVIRONMENTAL BENEFITS

6. The tree canopy retains stormwater, reduces **heat island** effects, absorbs pollutants, and provides wildlife habitat. These benefits are important and quantifiable.

SOCIAL BENEFITS

7. Urban forests affect the physical and psychological health of human residents.

GLOSSARY

Heat Island: The phenomenon that, because concrete and asphalt absorb and radiate heat, cities are five to nine degrees warmer than rural areas.

ECONOMIC BENEFITS

8. A healthy urban forest can provide economic benefits including reduced energy use costs, reduced stormwater runoff, and increased property values.

9. The benefits of healthy, well-maintained urban forests outweigh the costs to maintain them.

The concepts in this theme help students understand the role humans play in sustaining urban forests.

DEFINING URBAN FOREST MANAGEMENT

10. Urban forest management is the use of planning and science-based techniques (e.g., planting, mulching, pruning, removal, monitoring, evaluation) to meet desired outcomes.

11. Jobs related to urban forestry include: arborists, planners, city foresters, nursery workers, landscapers, consultants, landscape architects, educators, researchers, public works or utility employees, and park and recreation staff.

12. Urban forests are managed for both individual trees and as groups of trees for the impact they have on the community.

GLOSSARY

Biodiversity: The variety and complexity of all life on Earth.

Invasive Species: A species that enters an area and causes harm by outcompeting species that are already there.

CHALLENGES

13. Land development practices and poor construction techniques used to build homes, businesses, utilities, roads, etc., can kill or damage existing trees and make growing new trees difficult.

14. Urban forest ownership is divided among many property owners with different and sometimes conflicting goals; this complicates management.

15. Trees in the urban environment may be under more stress than trees in rural areas due to difficult growing conditions (e.g., soil compaction, limited space, pollution); urban trees are managed more intensively to counteract these conditions.

16. **Invasive** plant and animal species, pests, diseases, and damaging weather events can create problems in urban forests; management attempts to control these.

SOLUTIONS

17. Urban forest management is most effective when there is adequate input from resource professionals, governmental bodies, and citizens.

18. Inclusion of private lands and participation of private landowners in urban forest management is essential to successfully manage an urban forest as an ecosystem.

19. A community must have strong local interest, policies and goals that accommodate trees, and technical expertise available to implement them, in order to successfully manage its urban forest.

20. **Biodiversity**, in terms of canopy cover, diameter and species distribution, richness, evenness, and genetic diversity, can help decrease the impact of invasive species, pests, diseases, construction activities, and damaging weather events.

The concepts in this theme help students identify the challenges and possibilities that urban forests may face in the future.

ISSUES

21. Issues such as **urban sprawl**, tree neglect, and insects and diseases are changing the characteristics of urban forests.

22. Declining health and abundance of urban trees, especially in metropolitan regions of the country (and world), can result in increased stormwater runoff, reduced air quality, and overall climate change on a global scale.

YOUR CONNECTION

23. Individuals, neighborhood groups, volunteer groups, and elected officials can have a positive influence on others by increasing recognition of the proper care, value, and importance of an urban forest.

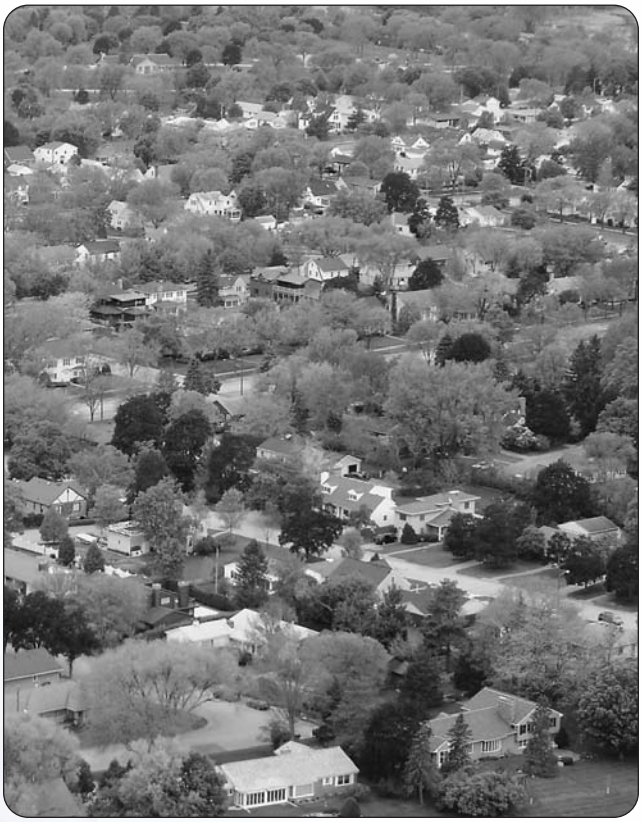
24. All citizens have a responsibility to be stewards of the environment. Decisions they make affect urban forests as well as other forests.

RESEARCH

25. Research can show potential benefits of proper management, identify new uses for trees, find ways to protect urban forests from insects and disease, and suggest improvements for tree care techniques.

GLOSSARY

Urban Sprawl: Widespread, low-density development spreading out from urban areas into previously undeveloped farmland and forestland.



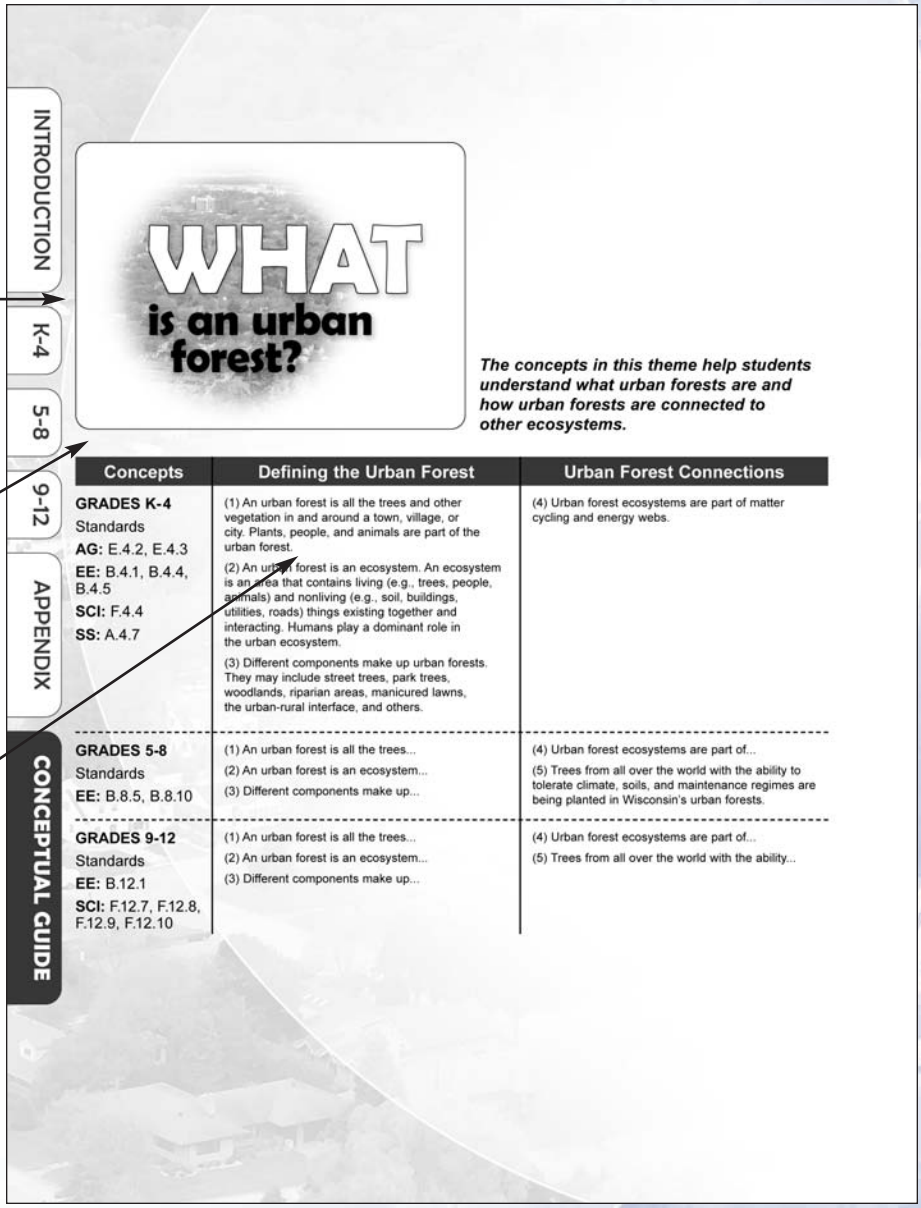
SCOPE AND SEQUENCE EXAMPLE DIAGRAM

CONCEPTS related to the theme.

STANDARDS addressed.

SUBCONCEPTS related to each concept are placed at the appropriate grade level.

Subconcepts are written out at the lowest grade level in which they appear. At all successive levels, they are truncated.



KEY TO STANDARDS* ABBREVIATIONS

AG.....Agriculture Education
EE .....Environmental Education
SCI .....Science
SS .....Social Studies

* Standards in other subject areas such as Language Arts, Mathematics, and Visual Arts will be addressed in the lesson guide.

The concepts in this theme help students understand what urban forests are and how urban forests are connected to other ecosystems.

Concepts	Defining the Urban Forest	Urban Forest Connections
GRADES K-4 Standards **AG:** E.4.2, E.4.3 **EE:** B.4.1, B.4.4, B.4.5 **SCI:** F.4.4 **SS:** A.4.7	(1) An urban forest is all the trees and other vegetation in and around a town, village, or city. Plants, people, and animals are part of the urban forest. (2) An urban forest is an ecosystem. An ecosystem is an area that contains living (e.g., trees, people, animals) and nonliving (e.g., soil, buildings, utilities, roads) things existing together and interacting. Humans play a dominant role in the urban ecosystem. (3) Different components make up urban forests. They may include street trees, park trees, woodlands, riparian areas, manicured lawns, the urban-rural interface, and others.	(4) Urban forest ecosystems are part of matter cycling and energy webs.
GRADES 5-8 Standards **EE:** B.8.5, B.8.10	(1) An urban forest is all the trees... (2) An urban forest is an ecosystem... (3) Different components make up...	(4) Urban forest ecosystems are part of... (5) Trees from all over the world with the ability to tolerate climate, soils, and maintenance regimes are being planted in Wisconsin's urban forests.
GRADES 9-12 Standards **EE:** B.12.1 **SCI:** F.12.7, F.12.8, F.12.9, F.12.10	(1) An urban forest is all the trees... (2) An urban forest is an ecosystem... (3) Different components make up...	(4) Urban forest ecosystems are part of... (5) Trees from all over the world with the ability...

The concepts in this theme help students investigate the connection between urban forests and their own lives.

Concepts	Environmental Benefits	Social Benefits	Economic Benefits
GRADES K-4 Standards **EE:** B.4.10	(6) The tree canopy retains stormwater, mitigates noise and views, reduces heat island effects, absorbs pollutants, and provides wildlife habitat. These benefits are important and quantifiable.	(7) Urban forests affect the physical and psychological health of human residents.	
GRADES 5-8	(6) The tree canopy retains...	(7) Urban forests affect the...	(8) A healthy urban forest can provide economic benefits including reduced energy use costs, reduced stormwater runoff, and increased property values.
GRADES 9-12 Standards **EE:** B.12.2, B.12.12, D.12.8 **SCI:** G.12.3, H.12.1	(6) The tree canopy retains...	(7) Urban forests affect the...	(8) A healthy urban forest... (9) The benefits of healthy, well-maintained urban forests outweigh the costs to maintain them.

The concepts in this theme help students understand the role humans play in sustaining urban forests.

Concepts	Defining Urban Forest Management	Challenges
GRADES K-4 Standards **AG:** D.4.5 **EE:** B.4.11, C.4.1, C.4.5	(10) Urban forest management is the use of planning and science-based techniques (e.g., planting, mulching, pruning, removal, monitoring, evaluation) to meet desired outcomes. (11) Jobs related to urban forestry include: arborists, planners, city foresters, nursery workers, landscapers, consultants, landscape architects, educators, researchers, public works or utility employees, and park and recreation staff.	(13) Land development practices and poor construction techniques used to build homes, businesses, utilities, roads, etc., can kill or damage existing trees and make growing new trees difficult. (15) Trees in the urban environment may be under more stress than trees in rural areas due to difficult growing conditions (e.g., soil compaction, limited space, pollution); urban trees are managed more intensively to counteract these conditions. (16) Invasive plant and animal species, pests, diseases, and damaging weather events can create problems in urban forests; management attempts to control these.
GRADES 5-8 Standards **EE:** B.8.3, B.8.22, B.8.23 **SCI:** G.8.1	(10) Urban forest management is... (11) Jobs related to urban forestry include... (12) Urban forests are managed for both individual trees and as stands of trees for the impact they have on the community.	(13) Land development practices and poor... (15) Trees in the urban environment may... (16) Invasive plant and animal species, pests...
GRADES 9-12 Standards **EE:** B.12.21, C.12.1	(10) Urban forest management is... (11) Jobs related to urban forestry include... (12) Urban forests are managed for both...	(13) Land development practices and poor... (14) Urban forest ownership is divided among many property owners with different and sometimes conflicting goals; this complicates management. (15) Trees in the urban environment may... (16) Invasive plant and animal species, pests...

Solutions

(20) Biodiversity, in terms of canopy cover, diameter and species distribution, richness, evenness, and genetic diversity, can help decrease the impact of invasive species, pests, diseases, construction activities, and damaging weather events.

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(20) Biodiversity, in terms of canopy cover, diameter and species distribution, richness, evenness, and genetic diversity...

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(17) Urban forest management is most effective when there is adequate input from resource professionals, governmental bodies, and citizens.

(18) Inclusion of private lands and participation of private landowners in urban forest management is essential to successfully manage an urban forest as an ecosystem.

(19) In order to successfully manage its urban forest, a community must have strong local interest, policies and goals that accommodate trees, and technical expertise available to implement them.

(20) Biodiversity, in terms of canopy cover, diameter and species distribution, richness, evenness, and genetic diversity...

The concepts in this theme help students identify the challenges and possibilities that urban forest may face in the future.

Concepts	Issues	Your Connection	Research
GRADES K-4 Standards **EE:** C.4.3, D.4.5, E.4.1 **SS:** D.4.7	(21) Issues such as urban sprawl, tree neglect, and insects and diseases are changing the characteristics of urban forests.	(23) Individuals, neighborhood groups, volunteer groups, and elected officials can have a positive influence on others by increasing recognition of the proper care, value, and importance of an urban forest. (24) All citizens have a responsibility to be stewards of the environment. Decisions they make affect their urban forest as well as other forests.	
GRADES 5-8 Standards **EE:** D.8.3, D.8.5, E.8.1 **SS:** D.8.11	(21) Issues such as urban... (22) Declining health and abundance of urban trees, especially in metropolitan regions of the country (and world), can result in increased stormwater runoff, reduced air quality, and overall climate change on a global scale.	(23) Individuals, neighborhood... (24) All citizens have a...	(25) Research can show the benefits of proper tree planting and preventative maintenance so that funding and effort can be put into preventative maintenance instead of crisis management.
GRADES 9-12 Standards **EE:** B.12.13, B.12.22, D.12.4, D.12.5, D.12.7, E.12.3	(21) Issues such as urban... (22) Declining health and...	(23) Individuals, neighborhood... (24) All citizens have a...	(25) Research can show the...

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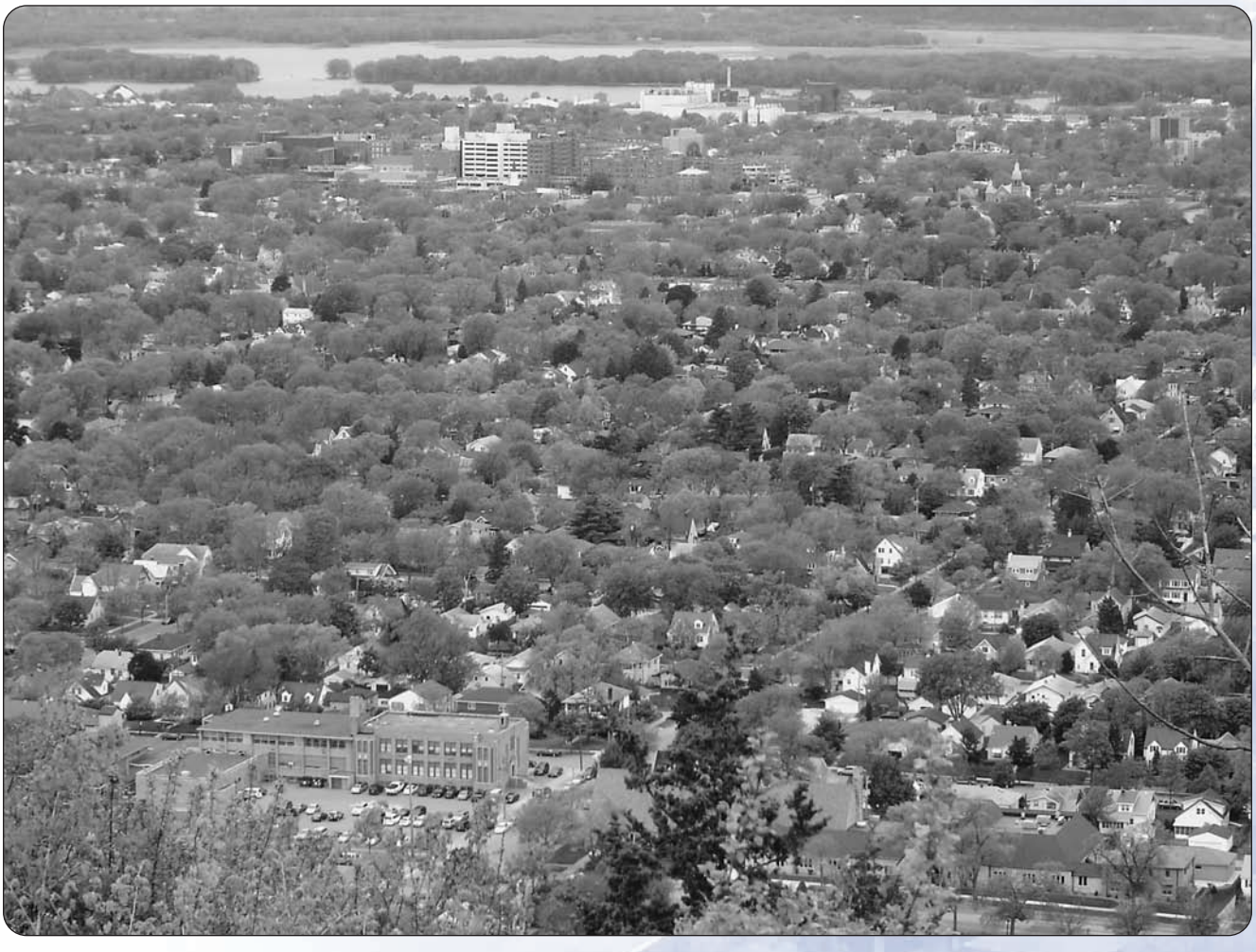

APPENDIX: WISCONSIN'S MODEL ACADEMIC STANDARDS

AGRICULTURE (AG)

D.4.5 Identify careers in the areas of food, fiber, and ornamental plant production and processing.

E.4.2 Identify the different ways land is used.
- Recognize how land use affects plants, domestic animals, and wildlife
- Identify the different uses of land in one's community.

E.4.3 Understand how different climatic conditions determine the plants that are grown in an area.

ENVIRONMENTAL EDUCATION (EE)

B.4.1 Describe the flow of energy in natural systems, citing the sun as the source of energy on the Earth: e.g., a food chain.

B.4.4 List the components of an ecosystem, including the qualities of a healthy habitat.

B.4.5 Describe natural and human-built ecosystems.

B.4.10 Describe how they use natural resources in their daily lives.

B.4.11 List jobs in the community that result from or are influenced by processing and using natural resources.

B.8.3 Explain the importance of biodiversity.

B.8.5 Give examples of human impact on various ecosystems.

B.8.10 Explain and cite examples of how humans shape the environment.

B.8.22 Identify careers related to natural resources and environmental concerns.

B.8.23 Identify governmental and private agencies responsible for environmental protection and natural resource management.

B.12.1 Evaluate the relationship of matter and energy and the flow of energy in natural, managed, and built systems.

B.12.2 Describe the value of ecosystems from a natural and human perspective; e.g., food, shelter, flood control, water purification.

B.12.12 Evaluate the environmental and societal costs and benefits of allocating resources in various ways and identify management strategies to maintain economic and environmental sustainability.

APPENDIX:
WISCONSIN'S MODEL ACADEMIC STANDARDS

ENVIRONMENTAL EDUCATION (EE) (CONTINUED)

B.12.13 Analyze how different political and governmental systems manage resource development, distribution, consumption, and waste disposal.

B.12.21 Research the roles of various careers related to natural resource management and other environmental fields.

B.12.22 Research individuals who have made important contributions to the field of resource management.

C.4.1 Identify environmental problems and issues.

C.4.3 Identify people and groups of people that are involved in the issue.

C.4.5 Identify proposed solutions to the issue and discuss arguments for and against the issue.

C.12.1 Compare the effects of natural and human-caused activities that either contribute to or challenge an ecologically and economically sustainable environment.

D.8.3 List reasons why an individual or group chooses to participate or not participate in an environmental activity in the home, school, or community.

D.8.5 Explain how personal actions can impact an environmental issue: e.g., doing volunteer work in conservation.

D.12.4 Describe the rights and responsibilities of citizenship in regard to environmental problems and issues.

D.12.5 Develop a plan to maintain or improve some part of the local or regional environment, and enlist support for the implementation of that plan.

D.12.7 Analyze political, educational, economic, and governmental influences on environmental issues, and identify the role of citizens in policy formation.

D.12.8 Use cost-benefit analysis to evaluate proposals to improve environmental quality.

E.4.1 Identify and describe examples of their environmental civil responsibilities and the actions they take to meet them.

E.8.1 Formulate a personal plan for environmental stewardship.

E.12.3 Take action in regard to environmental issues in the home, school, or communities.

APPENDIX: WISCONSIN'S MODEL ACADEMIC STANDARDS

SCIENCE (SCI)

F.4.4 Using science themes, develop explanations for the connections among living and nonliving things in various environments.

F.12.7 Investigate how organisms both cooperate and compete in ecosystems.

F.12.8 Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution.

F.12.9 Using the science themes, investigate energy systems (related to food chains) to show how energy is stored in food (plants and animals) and how energy is released by digestion and metabolism.

F.12.10 Understand the impact of energy on organisms in living systems.

G.8.1 Identify and investigate the skills people need for a career in science or technology and identify the academic courses that a person pursuing such a career would need.

G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation, including implications for the individual and the community.

H.12.1 Using science themes and knowledge of the earth and space, life and environmental, and physical sciences, analyze the costs, risks, benefits, and consequences of a proposal concerning resource management in the community and determine the potential impact of the proposal on life in the community and the region.

SOCIAL STUDIES (SS)

A.4.7 Identify connections between the local community and other places in Wisconsin, the United States, and the world.

D.4.7 Describe how personal economic decisions, such as deciding what to buy, what to recycle, or how much to contribute to people in need, can affect the lives of people in Wisconsin, the United States, and the world.

D.8.11 Describe how personal decisions can have a global impact on issues such as trade agreements, recycling, and conserving the environment.