



Learning, Experiences, & Activities in Forestry

What?

is a forest...

Why?

are they important...

How?

do we sustain...

What?

is the future...

“The health and productivity of our forests depend upon the attitudes and understanding of their use by forest owners, users, and consumers of forest products. Forestry education is key to the long-term stewardship of our forests by helping people be informed forest products consumers, users, and owners of our valuable forests.”

- Gene Francisco

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Wisconsin Center for Environmental Education and
Wisconsin Department of Natural Resources - Division of Forestry

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Field Experience* at the Central Wisconsin Environmental Station



The Wisconsin K-12 Forestry Education Program

Learning, Experiences, & Activities in Forestry

**A Partnership Between the Wisconsin Department of Natural Resources - Division
of Forestry and the Wisconsin Center for Environmental Education**

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A Conceptual Guide to K-12 Forestry Education in Wisconsin

Table of Contents

Program Overview.....	6
Mission	
Goals	
LEAF Services	
Rationale for Forestry Education in Wisconsin.....	7
Purpose of This Publication	
Conceptual Framework Overview.....	11
Conceptual Framework.....	12
What is a forest.....	12
Why are they important.....	15
How do we sustain.....	17
What is the future.....	20
Scope and Sequence Overview.....	24
Example Diagram.....	25
Scope and Sequence.....	26
References.....	37
Appendix.....	39
Wisconsin's Model Academic Standards	



What Is LEAF?

LEAF (Learning, Experiences, & Activities in Forestry) is Wisconsin's K-12 forestry education program. It was created to provide comprehensive forestry education for Wisconsin's kindergarten through 12th grade students. In 2001, Wisconsin K-12 forestry education stakeholders met to discuss the current status of and the needs for Wisconsin-based K-12 forestry education. Although a variety of programs existed, voids were identified in delivery and dissemination of educational materials and services. To present a more unified effort, stakeholders supported the development of a comprehensive program that would cooperate with 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 at the 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.

Mission

The mission of LEAF is to initiate and facilitate the development, dissemination, implementation, and evaluation of forestry education programs within Wisconsin schools.

Goals

- ✿ To document forestry concepts Wisconsin K-12 students should learn.
- ✿ To develop "Wisconsinized" K-12 forestry education materials for use in the classroom and field.
- ✿ To build partnerships with other Wisconsin K-12 forestry education stakeholders and support their efforts.
- ✿ To provide teachers professional development opportunities in forestry education including college credit courses and workshops.
- ✿ To assist schools with the infusion of standards-based* forestry education concepts into their classroom curriculum. (*See page 24 for an explanation of the Wisconsin Model Academic Standards.)
- ✿ To assist schools forests with site management and education plan development, networking, and training programs.

LEAF Services

Professional Development – Graduate level courses (face-to-face, on-line) and workshops for educators, resource professionals, and forest landowners.

School Forest Program – Education and management plan development assistance and resources.

Resources – K-12 forestry education lesson guide with supplements, web-based materials including on-line tree ID key, additional publications.

Community Connections – Presentations and workshops at events state-wide.

Consulting – Assistance with forestry education adoption for school districts, outdoor education facilities, and various organizations.

A Rationale for Forestry Education in Wisconsin

Step into any Wisconsin school building and chances are you'll find students learning about rainforests. If you ask the students what they have learned, they might say something about the value of rainforests in sustaining biodiversity and the sequestering of greenhouse gases. They might say something about the displacement of indigenous cultures, extinction, or the need to stop deforestation.

Ask the same students about Wisconsin's forests, and they might not have an answer. Although the understanding of global issues is indeed important, students first need to understand their own "backyard." This includes studying local ecosystems, local human systems (both economic and social), and how they are all interrelated.

Historically, Wisconsin's forests provided jobs for a growing immigrant work force, building materials for a developing nation, and dollars for a fledgling state economy. Forests continue today as an important part of Wisconsin. Our forests cover 46% of the state. They provide habitat for wildlife, recreational opportunities for residents and visitors, and a basis for a major part of Wisconsin's economy. Our forests benefit each of us through the protection of Wisconsin's air and water quality, their aesthetic beauty, and the products they provide. You might say that our forests are a basic human life support system, affecting the quality of life that we all enjoy.

Today, our forests face the greatest potential for change since 19th century logging. On the near horizon are changes in forest ecosystems, forest demands, and forest values. As our population continues to grow and demands on our forests increase, Wisconsin's citizens will need to play an active role in sustaining our forests as ecosystems and human systems. To do this our citizens need the knowledge and skills to make decisions and to understand the impact of their choices.

Why do students know more about rainforests? Organizations have done a good job of developing and marketing education materials and resources. Similar efforts related to Wisconsin forests have been incomplete until now.

LEAF is a long-term program designed to bring together existing efforts and provide the resources necessary to help schools infuse forestry education into their current curriculum. This document is designed to guide K-12 educators as they provide Wisconsin students an opportunity to receive logically sequenced, comprehensive education about Wisconsin's forests.

Purpose of This Publication

- A) Identify and present concepts educators can convey to students to help them understand the importance of Wisconsin's forests and the role that we all play in sustaining them.
- B) Guide educators as they incorporate forestry education into their curricula and help them meet the Wisconsin Model Academic Standards.
- C) Direct the development of LEAF educational materials.
- D) Serve as a framework for other forestry education efforts in Wisconsin.

Conceptual Framework



Conceptual Framework

Forest-related topics cover a wide array of information, which could be overwhelming to understand and to teach. This framework divides forestry education into teachable concepts, organized in a manner that makes them easy to communicate. **The framework is not a curriculum itself**, but the structure around which activities and lessons in the K-12 Lesson Guide have been built. The framework is designed to evolve as forestry education evolves. We encourage educators to modify and add to this framework as curriculum is developed to best meet their needs.

Detailed forestry principles are not listed in this document because they are beyond the scope of this framework and K-12 education. Specific details related to the concepts in this framework are used in activities to enhance understanding and provide examples. Teachers indicated that the topic of careers was extremely important. For that reason, careers are not listed specifically in this framework but are woven throughout the entire lesson guide and appear repeatedly.

Many individuals and organizations provided input in developing this conceptual framework. Initially, forestry education concepts and ideas were gathered from Wisconsin citizens with an interest in forests and from existing state and national forestry education lesson guides. Educators and representatives from over 20 different organizations then highlighted areas of importance within the information that had been gathered. Existing conceptual frameworks such as the *K-12 Energy Education Program—A Conceptual Guide in Wisconsin* and *A Biodiversity Education Framework—Key Concepts and Skills* were used as references for the structure of this document.

This framework is organized under four themes posed as questions: What is a forest? Why are forests important? How do we sustain forests? What is the future of forests? Each theme is followed by concepts that address the question, and the concepts are further divided into numbered subconcepts. The themes are arranged so that they build upon each other. Students progress from a basic understanding of forests to the understanding of forests in a social context. Definitions of some terms relative to use in this document are provided for clarity.

What?

is a forest...

- Definition of a Forest
- Classification of Forests
- Trees as Part of the Forest
- Forests as Ecosystems
- Biodiversity and Forests

Why?

are they important...

- Historical Importance
- Current Importance
- Future Importance

How?

do we sustain...

- Forest Owners
- Definition of Forest Management
- Reasons to Manage Forests
- Forest Managers
- Forest Management Decisions
- Forest Management Issues

What?

is the future...

- Studying Forests
- Your Connection to Forests
- The Future of Forests

What?

is a forest...



*The concepts in this theme provide students with a fundamental knowledge of Wisconsin's forests and help students appreciate forests as **ecosystems**. Comprehending these concepts will lead to an understanding of the interrelationship between forests and humans.*

Definition of a Forest

Identifying what constitutes a forest provides students the basis for examining forests in a broader context.

1. Forests are ecosystems characterized by a dominance of tree cover and they contain a variety of other organisms (e.g., other plants, animals).
2. Forests differ in **composition** and **structure**. These are both affected by biotic (e.g., animals, plants, humans) and abiotic (e.g., soil, moisture, sunlight, climate) factors.
3. Forests are renewable resources. They can be used and regenerated at regular intervals.

Classification of Forests

Classifying and differentiating forests into biomes and types help students make connections among the forests in their community, the forests in Wisconsin, and other forests in the world.

4. Different forest **biomes** exist around the world. Examples of forests that grow in some of the biomes include **tropical forests**, **temperate forests**, and **boreal forests**. Wisconsin is in the temperate forest biome.
5. Different types of forests exist within a biome. Some of the types of forests in Wisconsin include **coniferous**, **deciduous**, and deciduous and coniferous mixes.

Trees as Part of the Forest

One of the defining characteristics of forests is the trees in them. The following information helps students appreciate the uniqueness of trees and comprehend how individual trees function and fit into a forest ecosystem.

6. A tree is a perennial plant (lives more than one growing season) with a well-defined woody stem, crown, and roots.
7. Trees compete for nutrients, sunlight, space, and water.
8. Trees have life stages that include germination, growth, maturity, reproduction, decline, and death.
9. As part of the forest community, trees have various roles (e.g., providing habitat, holding soil). The presence of trees alters the surrounding environment.

Forests as Ecosystems

*Understanding basic **ecological principles** and how they apply to forest **communities** helps students appreciate the characteristics of living systems and how they relate to humans.*

10. An ecosystem is characterized by its composition, structure, and function.
11. Ecosystem structure consists of different types of organisms (e.g., producers, consumers) interacting with one another and their environment. Humans are part of ecosystems.

Glossary

biome

A regional ecosystem characterized by distinct types of vegetation, animals, and microbes that have developed under specific soil and climatic conditions.

boreal forest

A forest that grows in regions in the northern hemisphere with cold temperatures. Dominant tree species usually include spruces, fir, aspen, and birch.

community

A group of plants and animals living and interacting with one another in a given area.

composition

The species in a community.

coniferous forest

Type of forest containing cone-bearing trees.

deciduous forest

Type of forest containing trees that shed their leaves for part of each year.

ecological principle

Governing principles about natural systems and how they operate (e.g., food chains, predation, water cycle).

ecosystem

An area that contains organisms (e.g., plants, animals, bacteria) interacting with one another and their nonliving environment. Ecosystems can be of any size (e.g., forest, meadow, log).

structure

The horizontal and vertical distribution of layers in a forest.

temperate forest

A forest that grows in regions with moderate temperatures, found north and south of tropical forests.

tropical forest

A forest that grows in "winterless" tropical climates with high temperatures and generally high annual rainfall.

12. Ecosystem functions include the fixation of energy through the process of photosynthesis, the flow of energy through **food chains** and **food webs**, and the cycling of matter.
13. Ecosystems are continuously undergoing natural change. This natural change occurs through such processes as long-term evolution or through relatively short-term processes such as succession, in which one plant community gradually supplants another.
14. Ecosystems are dynamic and altered by natural or human disturbance. Disturbance plays an ongoing role in ecosystem structure and function.
15. Forest ecosystems are interconnected with other terrestrial (e.g., prairies) and aquatic (e.g., wetlands) ecosystems.

Biodiversity and Forests

*Understanding the following information helps students make connections between forests, **biodiversity**, and **sustainability**.*

16. Biodiversity (or biological diversity) encompasses the variety and variability of all life on earth. It includes three levels: **ecosystem diversity**, **species diversity**, and **genetic diversity**.
17. There is biodiversity within a forest. Different forests have different levels of biodiversity.
18. Regions in Wisconsin differ in climate (e.g., precipitation, temperature) and the results of glaciation (e.g., soil, topography). These variations lead to different forest communities with differing species, thereby contributing to biodiversity.

Glossary

biodiversity

The variety and complexity of all life on earth.

ecosystem diversity

The variety of communities or ecosystems in a given area over time.

food chain

A series of organisms in which one eats or decomposes another and the transfer of food energy occurs.

food web

A group of interconnected food chains.

genetic diversity

Genetic variation within a population or species.

species diversity

Variety of species present in a given area.

sustainability

The ability of natural resources to provide ecological, economic, and social benefits for present and future generations.



Why? are they important...

Concepts in this section help students investigate the connection between Wisconsin's forests and their own lives. Recognizing these connections increases students' awareness and understanding of the importance of sustainable forests to humans.

Historical Importance

Historical perspectives on forests provide students an understanding of how forests have been important to humans throughout time.

19. Wisconsin's forests provided basic resources (e.g., food, clothing, shelter) for early Native Americans and European settlers.
20. As Europeans settled Wisconsin, forests provided jobs for a growing immigrant workforce, resources for building the nation, and dollars for a new state economy.
21. Early logging, the resultant **cutover**, attempts to change land use, and the **reforestation** of pre-existing forest lands were activities that contributed to the need for **forestry**.
22. The **lumber era** shaped Wisconsin's economic, cultural, social, and environmental landscapes. Influences of this time period are still visible in Wisconsin today.

Glossary

cutover

Land that has been logged. This term is often used as "the cutover," which refers to northern Wisconsin after it was heavily logged during the period from the 1850s to the 1920s.

forestry

The practice of creating, managing, using, and conserving forests for human benefit.

lumber era

The time in Wisconsin's history from the 1850s to the 1920s when timber was harvested at a rapid pace.

reforestation

The reestablishment of forest cover.

Current Importance

Understanding the following information provides students the opportunity to see the wide range of ways forests impact their lives.

- 23. Humans **value** forests for their aesthetic, cultural, ecological, economic, educational, and recreational benefits.
- 24. The degree of emphasis individuals place on forest values may vary. Reasons can include wealth, health, religion, culture, ecological knowledge, and personal experience.
- 25. Forests impact air and water quality, prevent soil erosion, and provide habitat for wildlife.
- 26. Wisconsin’s forests have multiple economic values including forest products, recreation, tourism, and jobs. Forests provide a variety of raw materials for many industries.
- 27. Forests can shape the economic, social, and cultural composition of local communities.
- 28. Humans depend on forests for products and services they use every day.

Future Importance

The following information helps students identify the continuing need for forests in the future.

- 29. Our worldwide economic system is based on resources—both natural and human. Wisconsin forests are part of this system. Changes in the use of Wisconsin forests may affect forests worldwide.

- 30. As the human population continues to grow, demands on forest resources will increase. Maintaining forest ecosystems through sustainable forestry can help perpetuate ecological systems and ensure the delivery of goods and services to society over time.

Glossary

value

To assign worth to something.



How?

do we sustain...

These concepts help students understand the role humans play in sustaining Wisconsin's forests.

For students to become participating members of a society that works toward sustainable forests, they must be able to comprehend the role forest management plays in meeting society's needs.

Forest Owners

Understanding who owns Wisconsin's forests helps students identify the basis for different forest management decisions.

31. Wisconsin's forests are under private (e.g., **industrial, non-industrial private forests**), public (e.g., county, state, national forests), and tribal ownership; each may have different objectives.
32. Forests are ecosystems that can cross over property lines.
33. The scale of forest ownership can vary from hundreds of thousands of acres in a national forest to an individual tree in an **urban forest**.

Definition of Forest Management

Understanding what forest management is helps students explore further topics on management.

34. Forest management is the use of techniques (e.g., planting, harvesting) to **promote, conserve, or alter** forests to meet desired outcomes.

35. Management can lead to changes in composition, structure, and growth of forests.

Glossary

alter

To change the composition or structure of a forest.

conserve

To use or manage a certain type of tree or type of forest in a sustainable manner.

industrial forest

A forest which is owned by a company or corporation that operates a primary wood-using plant (e.g., sawmill, paper mill).

non-industrial private forest

A forest which is owned by an individual or group of individuals who do not own a primary wood using plant.

promote

To encourage the growth of a particular tree or type of forest.

urban forest

The trees and associated living organisms in an urban area.

Reasons to Manage Forests

Understanding the reasons forests are managed helps students develop informed attitudes about forest management.

36. Forests can be managed for ecological (e.g., water resources, wilderness, wildlife), economic (e.g., forest products, recreation), and social (e.g., aesthetic appreciation, recreation) outcomes. Many of these outcomes are interrelated and can be managed for simultaneously.
37. As global demand for forest resources increases, more pressure is placed on existing forests. Forest management and advances in research and technological systems can help to ensure forest resources remain sustainable.

Forest Managers

By understanding that many individuals and groups are involved in forest management, students will recognize that the responsibility of forest management is shared.

38. The **public trust** empowers governments to have a role in conserving, maintaining, and sustaining forest resources by enacting laws, creating policies, establishing agencies, creating public lands, and providing management incentives for forest landowners.
39. A variety of agencies, companies, and individuals manage forests. Forest resource professionals in each of these areas have training and responsibilities to meet individual, societal, and environmental needs through forest management and/or education.

40. Organizations, communities, and individuals play a part in forest management efforts by volunteering, raising and allocating funds, voting, participating in the planning process, and making consumer choices.

Forest Management Decisions

Understanding how forests are managed helps students participate in forest management decisions.

41. Forests can be managed for single or multiple uses. These uses may require different management methods.
42. There are environmental (e.g., forest composition, **topography**, endangered species), social (e.g., laws, knowledge, recreation, aesthetics), and economic (e.g., cost, return) factors that can influence management decisions.
43. The type and intensity of forest management is dependent on desired outcomes, **forest type**, ownership, parcel size, and location.
44. Management starts with planning. Wisconsin foresters prepare forest management plans based on land owner goals and objectives, capabilities of the forest site, and tools available (e.g., planting, harvesting, using **prescribed fire**).
45. Forests can be managed sustainably, while not limiting future options. **Sustainable management** of forests includes maintaining forest **health**, productivity, diversity, and **integrity** for both current human needs and the needs of future generations.

Forest Management Issues

The following information helps students understand the complexity of forest management decisions by examining management issues and the factors that contribute to them.

46. Management may have positive or negative social, economic, or ecological effects, which may affect resource sustainability.
47. People's perceptions of forest management decisions may differ when their beliefs, values, and knowledge differ. Issues can arise from these differences. Management decisions can be affected by many factors (e.g., politics, science, emotion, economics).
48. The use of some management techniques (e.g., fire, **clearcutting**) can be controversial because they may have safety issues, aesthetic impact, and their current and past use is sometimes misunderstood.
49. Managing forests for **multiple use** can meet the needs of many users. Some forest uses are not compatible, so conflict may arise.

Glossary

clearcutting

Harvesting all trees in a given area at the same time. This is sometimes used as a management technique to encourage species that do not tolerate shade during regeneration.

forest type

A category of forest usually defined by its dominant vegetation (e.g., oak-pine barrens, maple-oak-white pine).

health

The general condition of the forest in reference to soundness and vigor (growth).

integrity

The condition of a forest as a whole including composition, structure, and function.

multiple use

A type of forest management that promotes at least two types of forest use (e.g., for recreation and wildlife habitat).

prescribed fire

A fire planned and conducted to achieve management goals.

public trust

Responsibility the public places on government to care for their interests.

sustainable management

Maintenance of forests to meet current and future ecological, economic, and social needs.

topography

The relative elevation and configuration of features in a landscape.

What?

is the future...

Concepts in this theme help students identify ways to ensure Wisconsin's forests are sustained for future generations. For students to willingly and effectively take action regarding forest resource management, they must have a clear understanding of what forests are, why they are important, what is involved in their management, and how citizens affect each of these.

Studying Forests

The following information helps students better understand how forests are studied and that there is more to be learned about forests and their management.

50. Science and technology contribute to the understanding of forests, the impacts of human actions on these systems, and how forests can be sustained. As knowledge is gained, forest management is adapted.
51. Increased population and demand on forest resources lead to the need for increases and improvements in management (e.g., harvest techniques, genetics), technological systems (e.g., **GIS**, tools), and **wood utilization**. Without advances in these areas, sustainability of forests is more difficult.
52. Forest research and management involves professionals with backgrounds in many fields, including forestry, biology, wildlife, soils, water, land management, urban planning, engineering, sociology, geography, technology, environmental education, and chemistry.

Your Connection to Forests

Students will recognize their role as citizens in making decisions regarding resource use and the ways those decisions influence forests.

53. All citizens have a responsibility to **stewards** of the environment that sustains human life. This includes making informed decisions about forest resources.
54. A citizen, acting individually or as part of a group, can make lifestyle decisions and take a variety of actions to ensure the sustainable use of our forests.
55. Forest-related decisions can be affected by politics, science, emotion, and economics. The current and future relationship between the quality of human life and the quality of forests will be determined by these decisions.

The Future of Forests

Understanding current and future trends in forestry helps students predict how scientific, technological, and societal changes will influence forests. Students will also be able to evaluate how personal and societal actions affect forests.

56. Management for sustainable forests will continue to require creativity, innovation, and collaborative thinking by individuals, organizations, governments, and industry.
57. Challenges related to forestry will change over time. As new challenges arise, forestry professionals will need to respond. Examples of current challenges include **fragmentation** of forest lands, **non-native species**, **threatened species**, and **endangered species**.
58. Individuals, organizations, and governments base decisions and actions on underlying beliefs, values, and knowledge. As the human population continues to grow, values and needs will change and affect the decisions made about forest resource use.
59. The role that public and private forest lands play in meeting human needs will change over time.
60. Choices humans make today directly affect our ability to sustain forest ecosystems essential to meeting future needs.

Glossary

endangered species

A species that is in danger of becoming extinct.

fragmentation

The process of dividing a forest into smaller patches of forest and non-forest land.

GIS (Geographic Information System)

A computerized system that gives resource managers the ability to organize and access information (e.g., soil type, water shed, population density) about a specific area.

non-native species

A plant or animal species found outside its natural range.

steward

A person who takes responsibility to make decisions and take actions today that will allow resources to be maintained in a healthy manner.

threatened species

A species that is likely to become endangered.

wood utilization

The manufacture of raw materials into saleable goods with as little waste of the resource as possible.

Suggested Scope and Sequence



Suggested Scope and Sequence

Introduction

This section provides guidelines showing when and to what extent to integrate forestry education concepts into school curricula. LEAF developed this suggested scope and sequence with the help of K-12 teachers who attended the *Wisconsin K-12 Forestry Education Program—Developing a Forestry Education Framework Workshop* in April 2002. The structure of the following section was developed based on *Wisconsin's Model Academic Standards* and the *Atlas of Science Literacy*. This section can be used as a guide for when (grade level) and where (subject area) forestry education concepts can be incorporated into a curriculum.

Note that this scope and sequence is not a one-size-fits-all solution to forestry education; educators and curriculum designers in each school system will need to determine the best ways to introduce concepts into their curricula. For example, after surveying existing curricula, educators may find that they are already addressing some of these concepts. If educators are not covering a particular concept, then they may revise curriculum to include it. The K-12 Forestry Education Lesson Guide contains interdisciplinary forestry-related activities that can be used by educators to bring forestry education concepts into their lessons.

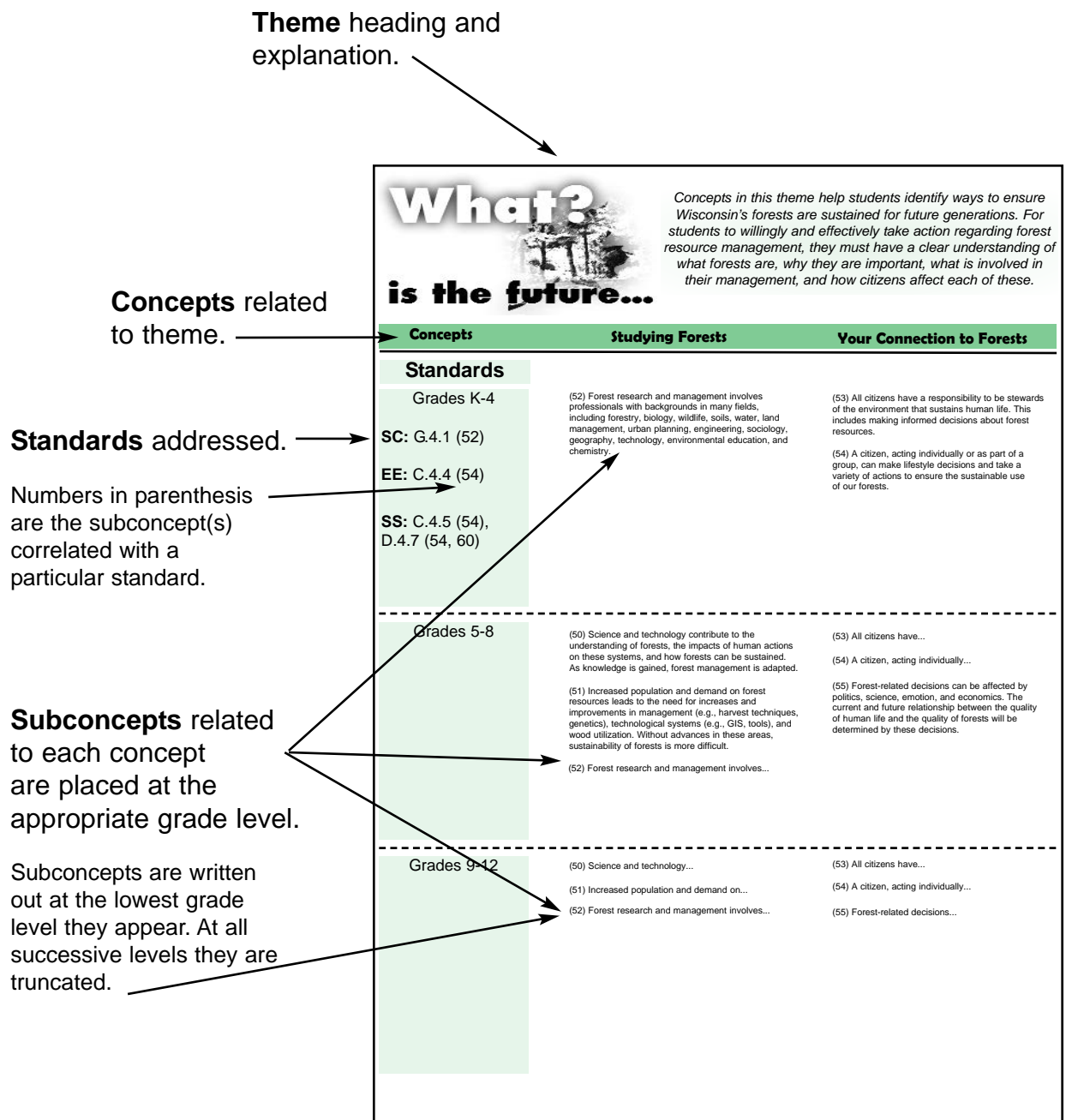
Wisconsin Model Academic Standards

The Wisconsin Model Academic Standards were developed by the Wisconsin Department of Public Instruction. 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 subconcepts in this framework have been correlated with the standards to enhance ease of use for educators. The four subject areas cited (science, environmental education, social studies, and agriculture education) have the most direct correlation to the subconcepts. Certainly, other subject areas will be covered and listed in the K-12 Forestry Education Lesson Guide. Full text of the standards cited in the scope and sequence can be found in the appendix of this document.

How to use the following diagrams

All of the concepts and subconcepts have been placed on diagrams under the four theme headings. The purpose of this structure is to visually represent at which level (K-4, 5-8, 9-12) each of the subconcepts is introduced and how they spiral to higher grade levels. Some subconcepts are core ideas in forestry education that spiral through all levels. Other subconcepts enhance core ideas and may only appear at one or two levels. The levels chosen were based on *Bloom's Taxonomy of Cognitive Development* and correlated with the levels within Wisconsin's Model Academic Standards. The appropriate standards are listed at each level for reference.

Example Diagram



Key to standards* abbreviations:

SC: science
 EE: environmental education
 SS: social studies
 AG: agriculture education

*Standards in other subject areas, such as English language arts, mathematics, and visual arts, will be addressed in the lesson guide.

What? is a forest...



The concepts in this theme provide students with a fundamental knowledge of Wisconsin's forests and help students appreciate forests as ecosystems. Comprehending these concepts will lead to an understanding of the interrelationship between forests and humans.

Concepts	Definition of a Forest	Classification of Forests
Standards		
Grades K-4		
SC: F.4.1 (7), F.4.2 (2), F.4.3 (8), F.4.4 (2, 11) EE: B.4.1 (12), B.4.4 (11), B.4.8 (3), B.4.9 (3) AG: E.4.3 (2), E.4.6 (3)	<p>(1) Forests are ecosystems characterized by a dominance of tree cover and they contain a variety of other organisms (e.g., other plants, animals).</p> <p>(2) Forests differ in composition and structure. These are both affected by biotic (e.g., animals, plants, humans) and abiotic (e.g., soil, moisture, sunlight, climate) factors.</p> <p>(3) Forests are renewable resources. They can be used and regenerated at regular intervals.</p>	
Grades 5-8		
SC: F.8.1 (6), F.8.2 (6), F.8.8 (9) EE: B.8.2 (13), B.8.3 (16, 17), B.8.6 (5), B.8.7 (12), B.8.8 (7, 11, 15) SS: A.8.6 (14)	<p>(1) Forests are ecosystems...</p> <p>(2) Forests differ in composition...</p> <p>(3) Forests are renewable resources...</p>	<p>(4) Different forest biomes exist around the world. Examples of forests that grow in some of the biomes include tropical forests, temperate forests, and boreal forests. Wisconsin is in the temperate forest biome.</p> <p>(5) Different types of forests exist within a biome. Some of the types of forests in Wisconsin include coniferous, deciduous, and deciduous and coniferous mixes.</p>
Grades 9-12		
SC: F.12.8 (13, 14), F.12.9 (12) EE: B.12.3 (14), B.12.7 (16, 17), B.12.8 (13, 14)	<p>(2) Forests differ in composition...</p> <p>(3) Forests are renewable resources...</p>	<p>(4) Different forest biomes exist...</p> <p>(5) Different types of forest exist...</p>

Trees as Part of the Forest

Forests as Ecosystems

Biodiversity and Forests

(6) A tree is a perennial plant (lives more than one growing season) with a well-defined woody stem, crown, and roots.

(7) Trees compete for nutrients, sunlight, space, and water.

(8) Trees have life stages that include germination, growth, maturity, reproduction, decline, and death.

(11) Ecosystem structure consists of different types of organisms (i.e., producers, consumers) interacting with one another and their environment. Humans are part of ecosystems.

(12) Ecosystem functions include the fixation of energy through the process of photosynthesis, the flow of energy through food chains and food webs, and the cycling of matter.

(6) A tree is a perennial plant...

(7) Trees compete for...

(8) Trees have life stages...

(9) As part of the forest community, trees play various roles (e.g., providing habitat, holding soil). The presence of trees alters the surrounding environment.

(11) Ecosystem structure consists...

(12) Ecosystem functions include...

(13) Ecosystems are continuously undergoing natural change. This natural change occurs through such processes as long-term evolution or through relatively short-term processes such as succession, in which one plant community gradually supplants another.

(14) Ecosystems are dynamic and altered by natural or human disturbance. Disturbance plays an ongoing role in ecosystem structure and function.

(15) Forest ecosystems are interconnected with other terrestrial (e.g., prairies) and aquatic (e.g., wetlands) ecosystems.

(16) Biodiversity (or biological diversity) encompasses the variety and variability of all life on earth. It includes three levels: ecosystem diversity, species diversity, and genetic diversity.

(17) There is biodiversity within a forest. Different forests have different levels of biodiversity.

(18) Regions in Wisconsin differ in climate (e.g., precipitation, temperature) and the results of glaciation (e.g., soil, topography). These variations lead to different forest communities with differing species, thereby contributing to biodiversity.

(10) An ecosystem is characterized by its composition, structure, and function.

(12) Ecosystem functions include...

(13) Ecosystems are continuously...

(14) Ecosystems are dynamic...

(15) Forest ecosystems...

(16) Biodiversity...

(17) There is biodiversity...

(18) Regions in Wisconsin differ...

Why? are they important...

Concepts in this section help students investigate the connection between Wisconsin's forests and their own lives.

Recognizing these connections increases students' awareness and understanding of the importance of sustainable forests to humans.

Concepts	Historical Importance	Current Importance
Standards		
Grades K-4		
SC: E.4.7 (28)	(19) Wisconsin's forests provided basic resources (e.g., food, clothing, shelter) for early Native Americans and European settlers.	(23) Humans value forests for their aesthetic, cultural, ecological, economic, educational, and recreational benefits.
EE: B.4.10 (28)	(20) As Europeans settled Wisconsin, forests provided jobs for a growing immigrant work force, resources for building the nation, and dollars for a new state economy.	(25) Forests impact air and water quality, prevent soil erosion, and provide habitat for wildlife.
SS: A.4.4 (19, 20, 22), B.4.2 (21), D.4.3 (29)	(21) Early logging, the resultant cutover, attempts to change land use, and the reforestation of pre-existing forest lands were events that contributed to the need for forestry. (22) The lumber era shaped Wisconsin's economic, cultural, social, and environmental landscapes. Influences of this time period are still visible in Wisconsin today.	(28) Humans depend on forests for products and services that they use everyday.
<hr/>		
Grades 5-8		
SC: E.8.6 (21)	(21) Early logging, the resultant cutover...	(23) Humans value forests...
EE: B.8.5 (21), B.8.10 (21, 22), B.8.15 (21, 22), B.8.16 (29), B.8.24 (21)	(22) The lumber era...	(24) The degree of emphasis individuals place on forest values may vary. Reasons can include wealth, health, religion, culture, ecological knowledge, and personal experience.
SS: A.8.4 (21, 22), D.8.3 (29)		(25) Forests impact air and water...
AG: F.8.1 (28, 29), F.8.2 (26)		(26) Wisconsin's forests have multiple economic values, including forest products, recreation, tourism, and jobs. Forests provide a variety of raw materials for many industries.
		(27) Forests can shape the economic, social, and cultural composition of local communities.
		(28) Humans depend on forests...
<hr/>		
Grades 9-12		
EE: B.12.2 (25, 26), B.12.10 (26), C.12.2 (24, 26)		(23) Humans value forests...
SS: D.12.3 (29)		(24) The degree of emphasis...
		(25) Forests impact air and water...
		(26) Wisconsin's forests have...
		(27) Forests can shape...

Future Importance

(29) Our worldwide economic system is based on resources—both natural and human. Wisconsin forests are part of this system. Changes in the use of Wisconsin forests may affect forests worldwide.

(29) Our worldwide...

(30) As population continues to grow, demands on forest resources will increase. Maintaining forest ecosystems through sustainable forestry can help perpetuate ecological systems and ensure the delivery of goods and services to society over time.

(29) Our worldwide...

(30) As population continues to grow...



How?

do we sustain...

These concepts help students understand the role humans play in sustaining Wisconsin's forests. For students to become participating members of a society that works toward sustainable forests, they must be able to comprehend the role forest management plays in meeting society's needs.

Concepts	Forest Owners	Definition of Forest Management	Reasons to Manage Forests
Standards			
Grades K-4		(34) Forest management is the use of techniques (e.g., planting, harvesting) to promote, conserve, or alter forests to meet desired outcomes.	
SS: A.4.9 (34), C.4.5 (40)			

Grades 5-8		(31) Wisconsin's forests are under private (e.g., industrial, non-industrial private forests), public (e.g., county, state, national forests), and tribal ownership; each may have different objectives.	(34) Forest management...
SC: F.8.10 (37, 45), G.8.3 (46, 48)		(35) Management can lead to changes in composition, structure, and growth of forests.	(36) Forests can be managed for ecological (e.g., water resources, wilderness, wildlife), economic (e.g., forest products, recreation), and social (e.g., aesthetic appreciation, recreation) outcomes. Many of these outcomes are interrelated and can be managed for simultaneously.
EE: B.8.5 (35), B.8.10 (34,35), B.8.23 (38, 39), C.8.1 (47)		(32) Forests are ecosystems that can cross over property lines.	(37) As global demand for forest resources increases, more pressure is placed on existing forests. Forest management and advances in research and technological systems can help to ensure forest resources remain sustainable.
SS: A.8.10 (37), D.8.4 (37)		(33) The scale of forest ownership can vary from hundreds of thousands of acres in a national forest to an individual tree in an urban forest.	
AG: E.6-8.3 (40)			

Grades 9-12		(31) Wisconsin's forests...	(34) Forest management...
SC: B.12.4 (37)		(32) Forests are ecosystems...	(35) Management...
EE: B.12.2 (36), B.12.9 (34), B.12.12 (45), B.12.13 (38)			(36) Forests can be managed...
SS: A.12.12 (42), C.12.11 (48)			(37) As global demand for forest...
AG: E.12.1 (45), E.12.2 (44)			

Forest Managers

Forest Management Decisions

Forest Management Issues

(40) Organizations, communities, and individuals play a part in forest management efforts by volunteering, raising and allocating funds, voting, participating in the planning process, and making consumer choices.

(38) The public trust empowers governments to have a role in conserving, maintaining, and sustaining forest resources by enacting laws, creating policies, establishing agencies, creating public lands, and providing management incentives for forest landowners.

(39) A variety of agencies, companies, and individuals manage forests. Forest resource professionals in each of these areas have training and responsibilities to meet individual, societal, and environmental needs through forest management and/or education.

(40) Organizations...

(41) Forests can be managed for single or multiple uses. These uses may require different management methods.

(42) There are environmental (e.g., forest composition, topography, endangered species), social (e.g., laws, knowledge, recreation, aesthetics), and economic (e.g., cost, return) factors that can influence management decisions.

(44) Management starts with planning. Wisconsin foresters prepare forest management plans based on landowner goals and objectives, capabilities of the forest site, and tools available (e.g., planting, harvesting, conducting prescribed burns).

(45) Forests can be managed sustainably, while not limiting future options. Sustainable management of forests includes maintaining forest health, productivity, diversity, and integrity for both current human needs and the needs of future generations.

(46) Management may have positive or negative social, economic, or ecological effects, which may affect resource sustainability.

(47) People's perceptions of forest management decisions may differ when their beliefs, values, and knowledge differ. Issues can arise from these differences. Management decisions can be affected by many factors (e.g., politics, science, emotion, economics).

(48) The use of some management techniques (e.g., fire, clearcutting) can be controversial because they have safety issues, aesthetic impact, and their current and past use is sometimes misunderstood.

(49) Managing forests for multiple use can meet the needs of many users. Some forest uses are not compatible, so conflict may arise.

(38) The public trust...

(39) A variety...

(40) Organizations...

(41) Forests can be managed...

(42) There are environmental...

(43) The type and intensity of forest management is dependent on desired outcomes, forest type, ownership, parcel size, and location.

(44) Management starts...

(45) Forests can be managed...

(46) Management may have...

(47) People's perceptions of...

(48) The use of some management...

(49) Managing forests for...

What?

is the future...

Concepts in this theme help students identify ways to ensure Wisconsin's forests are sustained for future generations. For students to willingly and effectively take action regarding forest resource management, they must have a clear understanding of what forests are, why they are important, what is involved in their management, and how citizens affect each of these.

Concepts	Studying Forests	Your Connection to Forests
Standards		
Grades K-4 SC: G.4.1 (52) EE: C.4.4 (54) SS: C.4.5 (54), D.4.7 (54, 60)	(52) Forest research and management involves professionals with backgrounds in many fields, including forestry, biology, wildlife, soils, water, land management, urban planning, engineering, sociology, geography, technology, environmental education, and chemistry.	(53) All citizens have a responsibility to be stewards of the environment that sustains human life. This includes making informed decisions about forest resources. (54) A citizen, acting individually or as part of a group, can make lifestyle decisions and take a variety of actions to ensure the sustainable use of our forests.
Grades 5-8 SC: G.8.1 (52) EE: B.8.22 (52) SS: A.8.11 (57) AG: E.6-8.3 (53)	(50) Science and technology contribute to the understanding of forests, the impacts of human actions on these systems, and how forests can be sustained. As knowledge is gained, forest management is adapted. (51) Increased population and demand on forest resources leads to the need for increases and improvements in management (e.g., harvest techniques, genetics), technological systems (e.g., GIS, tools), and wood utilization. Without advances in these areas, sustainability of forests is more difficult. (52) Forest research and management involves...	(53) All citizens have... (54) A citizen, acting individually... (55) Forest-related decisions can be affected by politics, science, emotion, and economics. The current and future relationship between the quality of human life and the quality of forests will be determined by these decisions.
Grades 9-12 EE: B.12.9 (50, 51), B.12.14 (50), B.12.21 (52) SS: C.12.9 (54) AG: D.12.4 (52)	(50) Science and technology... (51) Increased population and demand... (52) Forest research and management involves...	(53) All citizens have... (54) A citizen, acting individually... (55) Forest-related decisions...

The Future of Forests

(60) Choices humans make today directly affect our ability to sustain forest ecosystems essential to meeting future needs.

(56) Management for sustainable forests will continue to take creativity, innovation, and collaborative thinking by individuals, organizations, governments, and industry.

(57) Challenges related to forestry will change over time. As new challenges arise, forestry professionals will need to respond. Examples of current challenges include fragmentation of forestlands, non-native species, threatened species, and endangered species.

(60) Choices humans make...

(56) Management for sustainable...

(57) Challenges related...

(58) Individuals, organizations, and governments base decisions and actions on underlying beliefs, values, and knowledge. As the human population continues to grow, values and needs will change and affect the decisions made about forest resource use.

(59) The role that public and private lands play in meeting human needs will change over time.

(60) Choices humans make...

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Appendix

Wisconsin's Model Academic Standards

Agriculture (AG)

- D.12.4 Explore traditional and nontraditional food, fiber, and ornamental horticultural jobs/careers and identify the necessary skills, aptitudes, and abilities
- E.4.6 Identify ways in which agricultural use of land impacts the environment
- give examples of how agricultural practices impact water supply and water quality for both groundwater and surface water
 - understand what natural resources are and be able to classify them as renewable or nonrenewable
 - identify materials used in packaging food and fiber products
 - list common types of air pollutants
- E.6-8.3 Recognize the importance of community service
- E.12.1 Understand the application of agricultural technologies that can sustain production while reducing environmental impact
- E.12.2 Analyze benefits, costs, and consequences of land use
- determine the potential land use for the following using soil maps: food and fiber production; residential, commercial, and industrial development; and transportation rights-of-way
 - compare and contrast economic and recreational benefits of land use
 - explain, design, and demonstrate projects that can improve wildlife habitat
- F.8.1 Explain how food, fiber, and natural resources are part of a global economy
- identify food, fiber, and natural resource items used in their daily lives
 - identify local, regional, national, and international entities that process and distribute food and fiber, and categorize them under the headings of processor, wholesaler, or retailer
 - identify the businesses that are involved in getting food and natural resource items from where they are produced or processed to where they are consumed
 - explain the distribution of money within the marketing of a product from production to consumer
- F.8.2 Recognize that agricultural businesses produce, process, transport, and sell food, fiber, and natural resources to make a profit
- compare the wants and needs of consumers to the cost and production levels of food, fiber, and natural resource items
 - calculate the value of agricultural commodities found on a typical farm

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.4.8 Describe and give examples of natural resources; e.g., water, minerals, soils, air
- B.4.9 Distinguish between renewable and nonrenewable resources
- B.4.10 Describe how they use natural resources in their daily lives
- B.8.2 Explain how change is a natural process, citing examples of succession, evolution, and extinction
- B.8.3 Explain the importance of biodiversity
- B.8.5 Give examples of human impact on various ecosystems
- B.8.6 Describe major ecosystems of Wisconsin
- B.8.7 Illustrate the conservation of matter using biogeochemical cycles; e.g., carbon, nitrogen, phosphorous
- B.8.8 Explain interactions among organisms or populations of organisms
- B.8.10 Explain and cite examples of how humans shape the environment
- B.8.15 Analyze how people impact their environment through resource use
- B.8.16 Recognize the economic, environmental, and other factors that impact resource availability and explain why certain resources are becoming depleted
- 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.8.24 Create a timeline of Wisconsin history in resource management
- B.12.2 Describe the value of ecosystems from a natural and human perspective; e.g., food, shelter, flood control, water purification
- B.12.3 Evaluate the stability and sustainability of ecosystems in response to changes in environmental conditions
- B.12.5 Analyze past and current trends in ecosystem degradation and species extinction

- B.12.7 Evaluate the importance of biodiversity
- B.12.8 Relate the impact of human activities in ecosystems to the natural process of change, citing examples of succession, evolution, and extinction
- B.12.9 Evaluate ways in which technology has expanded our ability to alter the environment and its capacity to support humans and other living organisms
- B.12.10 Identify and evaluate multiple uses of natural resources and how society is influenced by the availability of these resources
- 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
- B.12.13 Analyze how different political and governmental systems manage resource development, distribution, consumption, and waste disposal
- B.12.14 Investigate how technological development has influenced human relationships and understanding of the environment
- B.12.21 Research the roles of various careers related to natural resource management and other environmental fields
- C.4.4 Identify some of the decisions and actions related to the issue
- C.8.1 Define and provide examples of environmental issues, explaining the role of beliefs, attitudes, and values
- C.12.1 Compare the effects of natural and human-caused activities that either contribute to or challenge an ecologically and economically sustainable environment
- C.12.2 Explain the factors that contribute to the development of individual and societal values
- C.12.3 Maintain a historical perspective when researching environmental issues; include past, present, and future considerations

Science (SC)

- B.12.4 Show how basic research and applied research contribute to new discoveries, inventions, and applications
- E.4.7 Using the science themes, describe resources used in the home, community, and nation as a whole
- E.8.6 Describe through investigations the use of the earth's resources by humans in both past and current cultures, particularly how changes in the resources used for the past 100 years are the basis for efforts to conserve and recycle renewable and nonrenewable resources

Science (SC) continued

- F.4.1 Discover how each organism meets its basic needs for water, nutrients, protection, and energy in order to survive
- F.4.2 Investigate how organisms, especially plants, respond to both internal cues and external cues
- F.4.3 Illustrate the different ways that organisms grow through life stages and survive to produce new members of their type
- F.4.4 Using the science themes, develop explanations for the connections among living and nonliving things in various environments
- F.8.1 Understand the structure and function of cells, organs, tissues, organ systems, and whole organisms
- F.8.2 Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments
- F.8.8 Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet
- F.8.10 Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends
- 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
- G.4.1 Identify the technology used by someone employed in a job or position in Wisconsin and explain how the technology helps
- 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.8.3 Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life

Social Studies (\$\$)

- A.4.4 Describe and give examples of ways in which people interact with the physical environment, including use of land, location of communities, methods of construction, and design of shelters
- A.4.9 Give examples to show how scientific and technological knowledge has led to environmental changes, such as pollution prevention measures, air-conditioning, and solar heating
- A.8.4 Conduct a historical study to analyze the use of the local environment in a Wisconsin community and to explain the effect of this use on the environment
- A.8.6 Describe and distinguish between the environmental effects on the earth of short-term physical changes, such as those caused by floods, droughts, and snowstorms, and long-term physical changes, such as those caused by plate tectonics, erosion, and glaciation
- A.8.10 Identify major discoveries in science and technology and describe their social and economic effects on the physical and human environment
- A.8.11 Give examples of the causes and consequences of current global issues, such as the expansion of global markets, the urbanization of the developing world, the consumption of natural resources, and the extinction of species, and suggest possible responses by various individuals, groups, and nations
- A.12.12 Assess the advantages and disadvantages of selected land use policies in the local community, Wisconsin, the United States, and the world
- B.4.2 Use a timeline to select, organize, and sequence information describing eras in history
- C.4.5 Explain how various forms of civic action such as running for political office, voting, signing an initiative, and speaking at hearings, can contribute to the well-being of the community
- C.12.9 Identify and evaluate the means through which advocates influence public policy
- C.12.11 Evaluate the ways in which public opinion can be used to influence and shape public policy
- D.4.3 Identify local goods and services that are part of the global economy and explain their use in Wisconsin
- 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

Social Studies (\$\$) continued

- D.8.3 Describe Wisconsin's role in national and global economies and give examples of local economic activity in national and global markets
- D.8.4 Describe how investments in human and physical capital, including new technology, affect standard of living and quality of life
- D.12.3 Analyze and evaluate the role of Wisconsin and the United States in the world economy

