Applications

This section of the document deals with five applications of the Environmental Literacy Scope and Sequence that you may find useful. First, application to state and national standards. Second, the relationships between natural and social systems from the social systems perspective. Third, the Environmental Literacy Benchmarks and their correlation with the Minnesota Graduation Standards. Fourth, examples of how to apply the Scope and Sequence in classroom learning, including a sample concept map. And fifth, sample lesson plans for familiarizing yourself and others with the Environmental Literacy Scope and Sequence.

Application to state and national standards

The developers of the Environmental Literacy Scope and Sequence, researched a wide array of resources in their work to create this document. From the beginning, it was recognized that with the resources in existence it would be a terrible error to disregard the work already accomplished. The Scope and Sequence incorporates standards from other states and national organizations which include:

- American Association for the Advancement of Science (AAAS): *Benchmarks for Science Literacy*
- North American Association for Environmental Education: *Guidelines for Learning*
- Hungerford’s Environmental Literacy Components
- National Research Council: National Science Education Standards
- Independent Commission on Environmental Education: *Are We Building Environmental Literacy?*
- Pew Charitable Trust: State Education and Environment Roundtable Literacy Models
- President’s Council on Sustainable Development: *Education for Sustainability: An Agenda for Action*
- Minnesota Graduation Standards
- Minnesota Science and Math Standards
- Minnesota Environmental Education Advisory Board: *A GreenPrint for Minnesota: State Plan for Environmental Education*
- Wisconsin Environmental Education Standards
- Florida Graduation Standards
- Izaac Walton League of America: *Community Sustainability*
- California Guide to Environmental Literacy
- Environmental Texas Essential Knowledge and Skills
- GreenPrint Council: Environmental Literacy Understandings
• Pennsylvania Proposed Academic Standards for Environment and Ecology
• Other works pertaining to ecology and social interaction with the environment

The foundation of the Environmental Literacy Scope and Sequence

A study completed by the Independent Commission on Environmental Education made two major points that reinforce the notion of needed reform in our environmental education methodology:5

• Environmental problems of the day will change over time, but the environmental literacy gained in schools will last a lifetime.
• Environmental education materials often do not provide a framework for progressive building of knowledge.

The President’s Council on Sustainable Development believes that understanding the principles of sustainability and the interdependence of the environment, the economy and social systems will help us learn to make changes necessary to become effective stewards of natural resources and the environment. This, in turn, would support development that meets the needs of the present without compromising the ability of future generations to meet their own needs.6

According to Edward T. Clark, Jr., author of Designing and Implementing an Integrated Curriculum, before we can design a new structure for education, it is necessary to identify those alternative assumptions that can guide and shape educational transformation. He suggests that this means adopting an assumption of “wholeness,” everything being connected to everything else, i.e. systems thinking. However, in order to build social and environmental systems thinking into environmental education, the process must be based on a solid understanding of the scope and sequence of concepts needed for a thorough understanding of systems and how to work with a systems perspective.7

Also, the California Guide for Environmental Literacy Project suggests that since problems of the world are based in relationships, systems thinking can be useful to redirect attention toward connections and the networks they form. This means that, to better promote environmental literacy, educators should increase their attention to:8

Wholeness by shifting from:

- Parts to the whole. The whole of a system better represents the system than the sum of its parts.
- Objects to relationships. Relationships are responsible for the sum being greater than the parts.
- Objective knowledge to contextual knowledge. Contextual knowledge includes the parts, relationships, and environment.
- Content to pattern. Patterns are configurations of relationships that appear repeatedly. They provide new insights into both the connections and the relationships.
- Quantity to quality. Mapping patterns is qualitative and can illuminate causes and distant effects.
- Hierarchies to networks. Complex systems, such as environmental systems, are always organized into networks. Social systems also reflect networking in decision making and other activities that are not reflected in the usually visible hierarchical structure of their organizations.

Process by shifting from:

- Structure to process. Understanding structures requires understanding the linkages and continuing events that underlie them.

AAAS and the benchmarks

Using the wealth of knowledge at hand, the Development Team chose the American Association for the Advancement of Science’s (AAAS) Systems Benchmarks listed in their publication, Benchmarks for Science Literacy as its foundation upon which to build the Environmental Literacy Scope and Sequence. AAAS has developed a carefully thought out conceptual scope and sequence for teaching the science of systems. It serves as a cornerstone for the development of a content scope and sequence for any approach to environmental education that is systems-based because it:

- Incorporates a “both/and” logic
- Assumes a living universe
- Values ecological thinking
- Is at the same time both local and global
- Honors the long-range view
- Promotes contextual thinking

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Furthermore, the team decided that these benchmarks were to be rewritten to meet two criteria: be expressed in a simplified manner in language easily understood by non-science educators and school children; and emphasize social systems and natural systems equally to emphasize their dual importance in environmental education activities.

The AAAS Benchmarks were reviewed and seven major systems concepts were identified that appeared to be key to understanding systems. It was later determined some of these concepts are taught by the Benchmarks themselves and that the seven could be reduced in number to five for the Environmental Literacy Scope and Sequence. The five major concepts could then be used as a guide to be used by students to formulate questions about social and natural systems they were examining. These Key Systems Concepts are parts and objects, interactions and relationships, subsystems, inputs and outputs, and change over time.

The following table highlights the original AAAS Benchmarks and the Environmental Literacy Benchmarks that evolved from them. The benchmarks are the indicators of the knowledge that should be achieved at each level. In understanding the benchmarks, consider the phrase, “By the end of the 2nd grade; 5th grade; 8th grade; and 12th grade, students should know that…”

The master concept to be understood from the AAAS benchmarks is vital to any and all environmental education. “Understanding how things work and designing solutions to problems of almost any kind can be facilitated by systems analysis.”

<table>
<thead>
<tr>
<th>Grades</th>
<th><strong>AAAS Benchmarks for Science Literacy</strong></th>
<th><strong>Environmental Literacy Scope and Sequence Benchmarks</strong></th>
</tr>
</thead>
</table>
| **K-2 (preK)** | • Most things are made of parts.  
• Something may not work if some of its parts are missing.  
• When parts are put together, they can do things that they couldn’t do by themselves.                                                                                                                          | • Social and natural systems are made of parts.  
• Social and natural systems may not continue to function if some of their parts are missing.  
• When the parts of social and natural systems are put together, they can do things they couldn’t do by themselves.                                                                 |
| **3-5**      | • In something that consists of many parts, the parts usually influence one another.  
• Something may not work as well (or at all) if a part is missing, broken, worn out, mismatched, or misconnected.                                                                 | • In social and natural systems that consist of many parts, the parts usually influence one another.  
• Social and natural systems may not function as well if parts are missing, damaged, mismatched or misconnected.                                                                                                                             |
| **6-8**      | • A system can include processes as well as things.  
• Thinking about things as systems means looking for how every part relates to others. The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.  
• Any system is usually connected to other systems, both internally and externally. Thus a system may be thought of as containing subsystems and as being a subsystem of a larger system. | • Social systems and natural systems may include processes as well as things.  
• The output from a social or natural system can become the input to other parts of social and natural systems.  
• Social and natural systems are connected to each other and to other larger and smaller systems.                                                                                                    |
| **9-12 (adult)** | • A system usually has some properties that are different from its parts, but appear because of the interaction of those parts.  
• Understanding how things work and designing solutions to problems of almost any kind can be facilitated by systems analysis. In defining a system, it is important to specify its boundaries and subsystems, indicate its relation to other systems, and identify what its input and its output are expected to be.  
• The successful operation of a designed system usually involves feedback. The feedback of output from some parts of a system to input for other parts can be used to encourage what is going on in a system, discourage it, or reduce its discrepancy from some desired value. The stability of a system can be greater when it includes appropriate feedback mechanisms.  
• Even in some very simple systems, it may not always be possible to predict accurately the result of changing some part or connection.                                                                 | • The interaction of social and natural systems can create properties that are different from either individual system.  
• Interaction between social and natural systems is defined by their boundaries, relation to other systems, and expected inputs and outputs.  
• Feedback of output from some parts of a managed social or natural system can be used to bring it closer to desired results.  
• It is not always possible to predict accurately the result of changing some part or connection between social and natural systems.                                                                 |
The social systems point of view

As we confront the task of creating an ecologically sustainable lifestyle, we need to have a clearer and deeper understanding of the social systems that constrain and guide almost all of our actions. We are so imbedded in our own social systems and the beliefs that underlie them that we are often unable to make them visible for analysis. In addition, we are often unaware of and unfamiliar with social systems in other cultures that might provide options for social organization that are more ecologically sustainable. Examining other ways of life can clarify which behavior is learned as opposed to what we may have assumed is inherent in the human creature.

What are social systems?

Homo sapiens is an animal species subject to the same biological realities and mechanisms as other animals. We humans differ in degree from other animals but not in absolutes. Despite popular misconceptions, humans are an integral part of the ecosystem (speaking globally), we are also integral parts of local ecosystems. We are subject to the same conditions as other species. For example, the earth has a carrying capacity for humans as well as other species; humans benefit from biodiversity; we are subject to natural population controls; we are subject to natural selection; etc.

The human brain is a specialized adaptive mechanism in the same sense as a double fur coat on a polar bear or gills on a fish. The advantage our human brain gives us is the ability to generate social systems that produce behavior patterns and tools that allow us to live in and adapt to our environment. Any kind of technology, from digging sticks to houses to highway systems to computers, is a product of those social systems.

Technology can only be understood in the context of the social system which produces it. Using a concept like the “built environment” as if it existed somehow in isolation from the hands and minds that built it and the natural systems that make it possible and within which it exists does not seem very useful; in fact, it can be counterproductive.

Culture (social life) is a series of interacting systems that helps the species survive in many types of environments. It may or may not be adaptive in the long term. Humans have only been around a few million years, and our own adaptations are already threatening our survival. The dinosaurs were around for 168 million. Humans have no reason to be arrogant about the survival value of human cultural systems.
These brain-generated systems help the species perform functions that other species may perform in other ways—getting and allocating food, finding shelter, keeping order, reproducing, and raising offspring. The systems are identified in various ways depending on the schools of thought, but they seem to include:

- **Economic organization** pertains to food getting or production and the allocation and distribution of resources. The economic system includes subsystems such as transportation.

- **Political organization** determines how order is kept and decisions are made. The political system includes subsystems such as the legal system.

- **Communications system** allows communication between individuals and groups. Products of this and other systems combined are technologies such as computers. This system includes subsystems such as language and arts.

- **Religious organization** explains and controls the otherwise unexplainable and uncontrollable.

- **Kinship systems** encompass all the rules surrounding reproduction and relationship.

- **Ideological systems** are the systems of belief that underlie the other systems.

Here are some examples of how the Environmental Literacy Benchmarks and the Key Systems Concepts and Supporting Concepts relate to the previously mentioned social systems:

- The **parts** of these systems are individuals, groups, ideas or beliefs, and products.

- These broad systems each encompass numerous **subsystems**, which vary widely, to the point that one society may not even recognize systems in another. The whole focus of anthropology for many years was identifying the systems in other cultures and how those systems functioned and were interconnected.

- Each of these systems in a society interacts intimately with the others to form a coherent interrelated whole for the society’s participants.

- The **structure** of a social system is composed of the parts of the systems and the ways these parts interact. The **function** of the system is what it does.

- Technology is not something apart, but is a product or **output** of these systems. To understand the total impact of a technology, it is necessary to understand the system **inputs** underlying it.

- Social systems **change over time** in response to many variables. This change is not always predictable.

- If there is **change** in one system, there will be change in others.
Some basic ideas in understanding the relationship of natural and social systems

One must be careful about tight analogies between natural and social systems. As Dr. Luther Gerlach, an anthropologist specializing in the relationship of culture and ecology, states, “Humans interact with nature most significantly through culture, in symbolic ways not comprehended by biological or physical ecosystem models. In other words, humans can generate wants and capabilities of meeting these wants that are far removed from feedback from the biophysical environment.”

In knowing the relationship of natural and social systems, students need to understand that:

1. Humans are subject to natural laws (see above).
   a. Humans are part of ecosystems.
   b. Human diversity strengthens biological and cultural systems.
   c. Humans use natural resources.
   d. Humans are subject to the same processes as other animals. For instance, concepts such as carrying capacity also apply to humans.

2. Social systems allow the human species to survive and adapt to environments.
   a. Beliefs and values form the basis for social systems.
   b. Examples of social systems include economic, political, communications, religious, kinship, and ideological systems.

3. Social systems affect and are affected by natural systems. Social systems affect natural systems, e.g. products and byproducts of our economic system pollute rivers and streams. This in turn affects our economic systems because taxpayers must pay to clean the river water before it can be used again. Social systems are affected by natural systems, e.g. shortages of water near large desert cities create the need for political and economic problem-solving and/or changes in values.
   a. Humans create complex systems to solve problems.
   b. Solutions to complex problems can have unforeseen consequences.
   c. Implementation of solutions can create additional problems.
   d. There are basically three kinds of action on environmental issues: technological, individual, and systemic.

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How to study social systems

If understanding social systems is so important, how does one go about making them visible and analyzing them? Children who grow up in any society learn its systems early on, because they must in order to function. For example, every child knows what it can expect from various members of its household in its first few years—who mother is, what she does, how she treats the child—the same with brother, sister, father, etc. We all learn to speak a language that is made up of a series of complex interrelationships of sounds and meanings. However, few of us are able to articulate very well the many systems that we learn. Therefore, we do not have a good understanding of how systems interrelate in our own culture.

Anthropologists use participant observation to make visible and analyze systems in societies they are not familiar with. They live in the society, learn what they can and can’t do, and what they are expected to do. Anthropologists watch people to see what they do, who they talk to, who they live with, how they make their living, and so on. They record daily life meticulously to see if they can establish the patterns that are the social systems. It is important to document and analyze the exchanges that take place between people—of words, things, services, actions. This helps to establish the nature of the patterns of relationships between people. These same techniques can be used in our own culture to determine, for instance, the decision-making system in a school district.

In societies with systems of recordkeeping, it is also possible to use documents, art, voice and video records, etc. to analyze patterns of interrelationship. Sociologists have specialized in studying complex industrialized societies. Because these societies were and are often large and complex, sociologists are more likely to gather data from existing documents and use techniques such as surveys.

Human geography is the analysis of spatial patterns that are evidence of and formed by both the natural systems in which they exist and the social systems by which people’s lives are organized. Analyzing these spatial patterns contributes greatly to our understanding of social systems and the surrounding natural systems. Demographic history and population dynamics contribute to an understanding of how these social and natural systems have evolved and changed.

It will become apparent, as one starts to do these social analyses, that there are two levels of understanding in most systems. There is the ideal—the way things are supposed to work, often formalized, documented, and articulated by members of the society, such as the rules for bringing something before an elected body. And there is the real system—the way things really happen. Most of us in our own cultures learn the ideal systems; indeed, we are overtly taught these. We are often left to learn the real systems on our own.

For instance, if someone asks us how to go about getting a matter put before our county commissioners, we will tell them to see the city clerk and try to be put on the agenda. That is the ideal system. However, people who spend time working with elected bodies will be more likely to go to the official they know or someone who knows the commissioner and talk to him/her about the issue, get an idea of where that person stands, and try to
persuade that person before the meeting. Then they ask to be put on the agenda when it is more likely that a) they will get on the agenda, and b) that the matter will be resolved favorably. That is the real system.

There is nothing subversive about this. In every culture there are the ideal systems and the real ones. The real systems are built on the understanding that ideal systems are necessary to define the ideals of a society, but that reality often must take into account the contingencies and vagaries of everyday life and the impinging of other systems. In order to understand why things happen as they do in social systems, it is necessary to acknowledge and understand both the ideal and the real.

To study social systems, one must usually use a combination of the techniques and methodology of all of the social sciences.
Environmental literacy and the Minnesota graduation standards

The following pages demonstrate: 1) the “environment” in the Graduation Standards and 2) the Environmental Literacy Benchmarks correlated with the Minnesota Graduation Standards. These are standards that can be achieved by examining the interaction between social and natural systems. The Scope and Sequence is correlated to the Minnesota Graduation Standards to provide an alternative means of using environmental education to achieve the standards.

Environment in the graduation standards

Listed below are the High Standards and Primary, Intermediate, and Middle level standards in which there is direct reference to connections to the environment or in which some of the concepts taught are identical to those in environmental literacy definitions.

<table>
<thead>
<tr>
<th>Standards</th>
<th>Inquiry (Learning Area 5)</th>
<th>Scientific Applications (Learning Area 6)</th>
<th>Social Studies (Learning Area 7)</th>
<th>Decision Making (Learning Area 8)</th>
<th>Resource Management (Learning Area 9)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Direct Science Experience</td>
<td>Family, School and Community</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate</td>
<td>Living and Nonliving Systems</td>
<td>Geography and Citizenship</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>Living Systems Earth and Space Systems</td>
<td>Geography and Culture</td>
<td>Personal Health</td>
<td></td>
<td>Informed Consumerism</td>
</tr>
</tbody>
</table>
Environmental Literacy Benchmarks correlated with the Minnesota Graduation Standards

The following tables provide information on the Minnesota Graduation Standards that apply to the Environmental Literacy Concepts being introduced. Each table represents the corresponding grade level divisions: primary (preK-2), intermediate (3-5), middle (6-8), and high (9-12). Note, the Graduation Standards divide the primary grades somewhat differently: primary (K-3) and intermediate (4-5).

Students should be introduced to examples of natural and social systems, and learn to identify the different parts and objects of social and natural systems. Discussion of how one part affects another encourages students to explore interactions and relationships between the parts of a natural or social system. Experiences should include a variety of systems, and involve questions on how well a system works or doesn’t work, when parts are missing or broken. The focus in the elementary grades should be on single systems and their parts and relationships.

At the secondary level, students should begin to look at interactions and relationships between multiple systems. In their study of natural and social systems, students should begin manipulating and observing systems to identify subsystems, the relationship of inputs and outputs to systems function, and learn to recognize how systems change over time. In the higher grades students should be able to apply systems thinking to many diverse interactions between natural and social systems.

<table>
<thead>
<tr>
<th>Environmental Literacy Benchmarks</th>
<th>Key Systems Concepts and Supporting Concepts</th>
<th>Correlation to Minnesota Graduation Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grades</strong></td>
<td><strong>PreK – 2</strong></td>
<td></td>
</tr>
<tr>
<td>Social systems and natural systems are made of parts.</td>
<td><strong>Parts and objects</strong></td>
<td><strong>Scientific Applications</strong></td>
</tr>
<tr>
<td>Social systems and natural systems may not continue to function if some of their parts are missing.</td>
<td>individuals, groups, ideas and concepts, biotic factors, abiotic factors, similarities and differences, properties</td>
<td><strong>Direct Science Experience</strong>: Understand basic science concepts through direct experience.</td>
</tr>
<tr>
<td>When the parts of social systems and natural systems are put together, they can do things they couldn’t do by themselves.</td>
<td><strong>Interactions and relationships</strong></td>
<td><strong>Social Studies</strong></td>
</tr>
<tr>
<td></td>
<td>structure, function</td>
<td><strong>Family, School and Community</strong>: Understand the interaction of location, family, school, and community.</td>
</tr>
<tr>
<td></td>
<td><strong>(See individual concept sheets.)</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Environmental Literacy Benchmarks

<table>
<thead>
<tr>
<th>Grades</th>
<th>Key Systems Concepts and Supporting Concepts</th>
<th>Correlation to Minnesota Graduation Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 – 5</td>
<td>In social and natural systems that consist of many parts, the parts usually influence one another. Social and natural systems may not function as well if parts are missing, damaged, mismatched, or mismatched.</td>
<td><strong>Scientific Applications</strong>&lt;br&gt;<strong>Living and Nonliving Systems:</strong> Understand interactions and interdependence of living systems. <strong>Social Studies</strong>&lt;br&gt;<strong>Geography and Citizenship:</strong> Understand the interaction of people, places, and locations.</td>
</tr>
<tr>
<td>Environmental Literacy Benchmarks</td>
<td>Key Systems Concepts and Supporting Concepts</td>
<td>Correlation to Minnesota Graduation Standards</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td><strong>Grades 6 – 8</strong></td>
<td>Interactions and relationships</td>
<td><strong>Applied Scientific Methods</strong></td>
</tr>
<tr>
<td>Social and natural systems can include processes as well as things.</td>
<td>population, structure, function, change and constancy, cycles, ideal and real, formal and nonformal, trophic level, feedback, reciprocity, predation, migration, communication</td>
<td><strong>Living Systems:</strong> Demonstrate knowledge of interactions and interdependence of living systems by understanding:</td>
</tr>
<tr>
<td>The output from a social or natural system can become the input to other parts of social and natural systems.</td>
<td><strong>Subsystems</strong></td>
<td>- The human body including heredity, reproduction, regulation, and behavior.</td>
</tr>
<tr>
<td>Social and natural systems are connected to each other and to other larger or smaller systems.</td>
<td>habitat, biome, boundary, scale, family and kinship, stratification, politics, economic, religion, language, niche, communities</td>
<td>- Plants, animals, and microorganisms including diversity, adaptation, populations, and ecosystems.</td>
</tr>
<tr>
<td><strong>Inputs and outputs</strong></td>
<td>artifact, waste, technology, instruction</td>
<td>- The dynamic effect of humans interacting with the environment.</td>
</tr>
<tr>
<td><strong>Change over time</strong></td>
<td>diversity, rate, ideas and concepts, geomorphism, accumulation, threshold, mutation, evolution, extinction, knowledge, innovation and invention, species (group)</td>
<td><strong>Earth Systems:</strong> Demonstrate understanding of:</td>
</tr>
<tr>
<td></td>
<td>(See individual concept sheets.)</td>
<td>- The structure of earth systems, including the geosphere, hydrosphere, and atmosphere.</td>
</tr>
<tr>
<td><strong>Physical Systems:</strong></td>
<td>Demonstrate understanding of the fundamental laws and concepts of the physical world including:</td>
<td>- Concepts of change and constancy in the earth’s history including theories of origin through evidence found in fossils, rocks, rock layers, landforms, and natural events.</td>
</tr>
<tr>
<td><strong>Physical Systems:</strong></td>
<td>Properties of matter.</td>
<td><strong>Social Studies</strong></td>
</tr>
<tr>
<td></td>
<td>Physical and chemical changes.</td>
<td><strong>Current Issue Analysis:</strong> Defend a position concerning a current event or issue by demonstrating understanding of:</td>
</tr>
<tr>
<td></td>
<td>Transfer of energy.</td>
<td>- Specific events or situations illustrating the impact of the issue.</td>
</tr>
<tr>
<td></td>
<td>Force and motion.</td>
<td>- Selection and defense of a position based on information.</td>
</tr>
<tr>
<td><strong>Social and natural systems can include processes as well as things.</strong></td>
<td><strong>Geography and Culture:</strong> Demonstrate knowledge of:</td>
<td>- Description of the responsibilities of citizens involved with the issue(s).</td>
</tr>
<tr>
<td></td>
<td>habitat, biome, boundary, scale, family and kinship, stratification, politics, economic, religion, language, niche, communities</td>
<td>- Summarizing findings in written, oral, or role-play presentation.</td>
</tr>
<tr>
<td><strong>Inputs and outputs</strong></td>
<td>artifact, waste, technology, instruction</td>
<td><strong>History and Citizenship:</strong> Demonstrate knowledge of:</td>
</tr>
<tr>
<td><strong>Change over time</strong></td>
<td>diversity, rate, ideas and concepts, geomorphism, accumulation, threshold, mutation, evolution, extinction, knowledge, innovation and invention, species (group)</td>
<td>- The facts and sequences of historical events.</td>
</tr>
<tr>
<td></td>
<td>(See individual concept sheets.)</td>
<td>- The origin and shaping influences of various points of view.</td>
</tr>
<tr>
<td><strong>Social and natural systems are connected to each other and to other larger or smaller systems.</strong></td>
<td><strong>Geography and Culture:</strong> Demonstrate knowledge of:</td>
<td>- Historical events in relationship to themes of change and migration.</td>
</tr>
</tbody>
</table>
### Environmental Literacy Scope and Sequence

<table>
<thead>
<tr>
<th>Environmental Literacy Benchmarks</th>
<th>Key Systems Concepts and Supporting Concepts</th>
<th>Correlation to Minnesota Graduation Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Grades</strong> 9 – 12 (adult)</td>
<td><strong>Parts and objects (all)</strong></td>
<td><strong>Scientific Applications</strong></td>
</tr>
<tr>
<td></td>
<td>individual, biotic factors, abiotic</td>
<td><em>Environmental Systems:</em> Demonstrate understanding of:</td>
</tr>
<tr>
<td></td>
<td>factors, similarities and differences,</td>
<td>• The use of decision-making models and scientific investigation and issues involving</td>
</tr>
<tr>
<td></td>
<td>properties, member, ideas and concepts,</td>
<td>relationships among the individual, society, economy, and the environment by</td>
</tr>
<tr>
<td></td>
<td>group</td>
<td>investigating and analyzing the scientific concepts, principles, laws, or theories that</td>
</tr>
<tr>
<td></td>
<td><strong>Interaction &amp; relationships (all)</strong></td>
<td>affect and are affected by environmental changes.</td>
</tr>
<tr>
<td></td>
<td>trophic level, structure, function,</td>
<td>• The components of social systems that affect and are affected by environmental</td>
</tr>
<tr>
<td></td>
<td>change and constancy, patterns, cycles,</td>
<td>changes.</td>
</tr>
<tr>
<td></td>
<td>feedback, migration, predation, population,</td>
<td>• The interactions between social and natural systems.</td>
</tr>
<tr>
<td></td>
<td>reciprocity, communication, synergy, cause</td>
<td>• Local, regional, or global implications of short- and long-term environmental changes.</td>
</tr>
<tr>
<td></td>
<td>and effect, probability, chaos, ecosystem,</td>
<td>• Methods for citizenship action.</td>
</tr>
<tr>
<td></td>
<td>ideal and real, formal and nonformal</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Subsystems (all)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>habitat, niche, biome, ecosystem, boundary,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>scale, communication, community, population,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>family and kinship, stratification, politics,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>economics, religion, language</td>
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<td></td>
<td><strong>Inputs and outputs (all)</strong></td>
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<td>energy and energy flow, resources,</td>
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<td>products, communication, waste,</td>
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<td>innovation/invention, artifact, instruction,</td>
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<td>technology</td>
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<td><strong>Change over time (all)</strong></td>
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<td>climate, geomorphism, probability,</td>
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<td>diversity, species, cycles, scale, rate,</td>
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<td>population, mutation, extinction, ideas and</td>
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<td>concepts, knowledge, innovation/invention</td>
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<td><em>(See individual concept sheets.)</em></td>
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**Feedback of output from some parts of a managed social or natural system can be used to bring it closer to desired results.**

It is not always possible to predict accurately the result of changing some part or connection between social and natural systems.

**Interaction between social and natural systems is defined by their boundaries, relation to other systems, and expected inputs and outputs.**

**Feedback of output from some parts of a managed social or natural system can be used to bring it closer to desired results.**

It is not always possible to predict accurately the result of changing some part or connection between social and natural systems.
Applications in the classroom

Concept mapping

Concept mapping allows you to see connections and understand relationships between ideas through the creation of a visual map. Below is one example of a concept map. For a more thorough understanding of the technique and its connection to learning, we recommend that you consult additional resources.
Sample unit of study

One of the benefits of the Environmental Literacy Scope and Sequence is that it can be used in traditional programs where the students engage in environmental lessons developed by other curriculum sources, or it can be used to develop curriculum. Both are presented here.

In traditional programs, using existing curriculum sources, teachers and environmental educators need to:

- Review the lessons and identify what the students are learning.
- Identify the Key Systems Concepts and Supporting Concepts that are involved in that learning.
- Describe how the Environmental Literacy Benchmarks apply to the lesson.
- Decide how to teach lessons so students understand how Benchmarks and Concepts relate to what they learned.
- Formulate a plan that uses the Benchmarks and Concepts to assess student learning.

An example of the non-traditional programs is the work of the State Education and Environment Roundtable and their education reform model called Using the Environment as an Integrating Context for Learning. This reform model uses community-based multidisciplinary units of study, developed at the local level, for improving student performance and achievement.

During a trial test of the Scope and Sequence, teams of teachers from two middle schools in Bemidji and East Grand Forks developed the following procedures for designing study units which met both the goal of interdisciplinary instruction and met the Minnesota Graduation Standards for at least two separate disciplines.

**Investigating Your Own Backyard: Plan Outline**

1. Select a topic that focuses on your community.
2. Establish the time context: past, present, or future.
3. Identify parts and objects, interactions and relationships, subsystems, inputs and outputs, and change over time applications to the social and natural systems you are examining.
4. Use the first six Environmental Literacy Benchmarks to determine how they apply (or might apply) to the system(s) you are studying.
5. Use the next six Benchmarks to help define the actual (or potential) relationship of these Benchmarks to the social and natural systems you are examining.
6. Use the Graduation Standards to clarify specific student tasks.
7. Assess student understanding of the environmental unit lessons using the Environmental Literacy Benchmarks, Concepts, and concept mapping at the appropriate grade level.
Setting the context

Mission: To create active lifelong learners by using the environment as an integrating context (EIC).

Description: This middle level project implements a community-based environmental curriculum that engages students in observing, investigating, and analyzing the interaction between natural and social systems.

Standards: Upon completion of all tasks, students will meet the criteria for:
- Scientific Applications: Living Systems
- Social Studies: Current Issue Analysis

Unit outcomes
- Gain knowledge and awareness of the role of resources in our area.
- Understand historical development of the land and its people.
- Understand the impact of our area on personal beliefs and values.
- Appreciate the diversity of the many ethnic groups that combine to give our community its identity.
- Provide opportunities for community and student interaction.
- Understand impact of our area in the world.

Standard tasks for assessment

1. Journaling
   - Compare and contrast the human body with other natural systems.
   - Demonstrate understanding of natural systems.
   - Record historical development.

2. Investigating
   - Participate in a field study.
   - Frame a researchable question.
   - Design and conduct an investigation.

3. Analyzing issue
   - Examine data and viewpoints.
   - Analyze the implications of the social and natural interactions.
   - Compare findings to other qualified sources.

4. Defending a position

Scientific Applications

Living Systems Task List
1. Maintain a journal to record observations which compare and contrast the human body with other natural systems.
2. Demonstrate a conceptual understanding of a natural system.
3. Investigate an ecosystem specific to your area through field study.
4. Frame a researchable question based on your field study which reflects human and/or natural interaction with that ecosystem.
5. Design and conduct an investigation and compare your results with other qualified sources.
6. Describe and defend a premise based on your investigation.

Social Studies

Current Issue Analysis Task List
1. Maintain a journal of the historic development of your area and its people.
2. Examine a range of historical and current viewpoints on a chosen issue impacting your area.
3. Analyze the roles of the players and their values, positions, responsibilities and rights relevant to the issue.
4. Select and defend a position.
**Unit planning process**

Unit study options can be determined by the teacher team, or in a more student-centered program, cooperatively by the teachers and students. This process is facilitated guided by asking open-ended questions. Once the natural and social systems are identified, the graduation standard tasks can be developed. Following this, the *Environmental Literacy Scope and Sequence* can then be used to guide student inquiry.

**Investigating Your Own Backyard: My Community and Its Environment**

*What do we want to know about its:*

- natural resources
- cultural heritage
- natural & social systems
- agriculture & prairie
- community & watershed
- commerce & transport
- wildlife & cultural pursuits
- aquatic ecosystems

*Can a community-based class project evolve from this unit?*
Sample activity lesson plans

Presented in this section are sample lesson plans for activities designed to familiarize participants with systems thinking and natural and social systems interactions. These lesson plans were developed for teacher in-service workshops that introduced educators to the *Environmental Literacy Scope and Sequence*. Use them for your own understanding of the Scope and Sequence or to help others understand it.

**Workshop lessons covered four separate systems awareness-building categories:**

1. **Personal:** Systems are an important part of my life.
   - I am a system comprised of smaller systems.
   - I am a part of larger natural systems.
   - I am a part of larger social systems.

2. **Contexts:** Systems are universal.
   - Social and natural system food webs are subsystems of the universe.
   - Solutions to environmental problems may not be the same in differing cultures.
   - Both formal and nonformal processes are factors in social system solutions to environmental problems.

3. **Curriculum:** Existing curricula have applications for the *Environmental Literacy Scope and Sequence*.
   - The *Environmental Literacy Scope and Sequence* can be used with national and state curricula currently in use.
   - The *Environmental Literacy Scope and Sequence* can be used with curricula that teachers are currently using.

4. **Environment as an Integrating Context:** Student-centered study units that focus on the community and its environs provide a rich opportunity to examine the interaction of social and natural systems that use the *Environmental Literacy Scope and Sequence*.

**Lesson plans, arranged in the order of introduction for systems development thinking, include:**

1. I am comprised of smaller systems and am a part of larger systems.
2. How are cows and cars alike?
3. How is a hamburger hooked to the stars?
4. I can find interactions between natural and social systems.
5. I can find applications for the Scope and Sequence in EE lessons.
Environmental Literacy Benchmark Cards

Throughout the following activities, there are references to the Environmental Literacy Benchmark Cards. These are the individual Benchmarks placed on note cards for use in the activities.

| PreK-2 |
|------------------------|------------------------|------------------------|------------------------|
| Social systems and natural systems are made of parts. | Social systems and natural systems that consist of many parts, the parts usually influence one another. | Social and natural systems can include processes as well as things. | The interaction of social and natural systems can create properties that are different from either individual system. |
| **Single systems** | **Single systems** | **Single systems** | **Multiple systems** |
| Social systems and natural systems may not continue to function if some of their parts are missing. | Social and natural systems may not function as well if parts are missing, damaged, mismatched, or misconnected. | The output from a social or natural system can become the input to other parts of social and natural systems. | Interaction between social and natural systems is defined by their boundaries, relation to other systems, and expected inputs and outputs. |
| **Single systems** | **Single systems** | **Multiple systems** | **Multiple systems** |
| When the parts of social systems and natural systems are put together, they can do things they couldn’t do by themselves. | Social and natural systems are connected to each other and to other larger or smaller systems. | Feedback of output from some parts of a managed social or natural system can be used to bring it closer to desired results. | It is not always possible to predict accurately the result of changing some part or connection between social and natural systems. |
| **Single systems** | **Multiple systems** | **Multiple systems** | **Multiple systems** |
I am comprised of smaller systems and am a part of larger systems.

**Time required:** 45 minutes

**Outcome:** Learners will understand that they are comprised of smaller natural systems, that they are members of larger natural and social systems, and that all these systems interact.

**Assessment:**
1. Learners can draw a concept map of the relationship of themselves to smaller or larger natural and social systems.
2. Learners can verbally convey to the rest of the class how a specific Environmental Literacy Benchmark relates to their concept map and give examples.

**Materials:**
- 1 nontoxic marker per team
- 2 poster tablet sheets per team
- 1 roll of masking tape
- Environmental Literacy Benchmark Cards
- 1 tablet post-it notes per group

**Note:** Exercises 1 and 2 are best run concurrently using three small groups after the “most important organ system in my body” discussion.

**Exercise 1. I am a system comprised of many smaller interacting systems.**

*The Environmental Literacy Scope and Sequence Project is based on building understandings about social and natural systems—how they work and how they interact. You live in a universe of interacting systems. In fact, you are comprised of interacting systems. Let’s explore some of those systems.*

- Ask participants to think about: “What is the most important organ system of my body.”
- Participants write their decision on a post-it and paste on wall. Post different organ systems side by side. Post same organ systems under one another.
- Read the decisions—ask why they selected a particular system as “most important.”
- Introduce idea that if one system is missing, you are not the same organism (system) and perhaps not able to continue to function.
• Divide workshop participants into work groups. (Preferably 2 to 4 groups, depending on the number of workshop participants in the session.)
• Start lesson by asking workshop participants to identify some of their organ systems. List on board or tablet.
• Make exercise assignment: On one of the poster sheets on your table, draw a circle in the middle of the sheet and write “me” in it.
• Draw circles around “me” and list the organ systems your group can identify. Connect these organ systems to “me” with lines.
• Mix the Benchmark cards and give one card to each of the groups in the session. Do not refer to the cards as “Benchmarks.” Inform them that they are receiving a “statement” about systems.
• Groups write their statement at the top of the poster paper. They should discuss what it means. After discussion, the group should discuss one relationship between “me” and one of the organ systems. How does the statement relate to the system they chose? What does this mean to “me”? What might this mean to “we” as a species? (Give examples.)
• Groups post their worksheets on the wall. Each group elects a spokesperson who reports to the whole group.
• Ask if anyone in the whole group has questions that they want to ask of the work group or make additions to what they have mapped.
• Groups keep their Benchmark card for the rest of the introductory exercises.

Exercise 2: I am a part of larger natural and social interacting systems.

Each of us is a part of larger systems. These systems can be either natural or social systems. We affect them and they affect us. Let’s see if we can identify some of them.

• Assign each of the work groups one of two topics: natural systems or social systems.
• Ask groups to list examples of the kinds of larger natural and social systems to which they belong. Give an example, such as “family” for social and “habitat” for natural, to help the workshop participants get a general idea of what they should map during this exercise.
• Each group maps systems and chooses one of the natural or social systems of which they are a part. Give a new Benchmark card to each of the groups. Describe how the “statement” might relate to the system they chose. Give an example.
• Groups post their work and each spokesperson reports to rest of participants in terms of their selected Benchmark.
• Discuss with the group and suggest additions where appropriate.
• Groups keep their new Benchmark card for the rest of the introductory exercises.
How are cows and cars alike?

This lesson is designed to help people analyze the social and natural systems in which they live and function. This is often difficult, because even though we have learned these systems and can act on them, we do not normally bring them to a level at which we can consciously see all the parts and interrelationships. Often, we try out solutions that are only based on part of the system, and we often find that these solutions do not work very well. When these systems are analyzed, the analysis can lead us to solutions that may have a much better chance of success.

Time required: 45 minutes

Outcome: Learners will understand that social and natural systems are interrelated in many ways.

Assessment:
1. Learners can draw a concept map of the relationship of cars to both social and natural systems.
2. Learners can verbally convey to the rest of the class how a specific Environmental Literacy Benchmark relates to their concept map and give examples.

Materials:
- 1 poster tablet sheet per team
- 1 nontoxic marker per team
- 1 roll masking tape

Note: This lesson is generally done as a concurrent task with two other exercises to avoid repetition of the points being made about the Environmental Literacy Benchmarks.

Tell the participants:
Let’s look at an example of interacting social and natural systems on another continent and see what we can learn from it about ourselves.

The Duruma are a cattle-raising people in east central Africa. When the British colonized their country, the British noticed that the Duruma cattle seemed to have a major problem with an insect-borne disease. To be helpful, the British introduced the Duruma to veterinary medicine. The medical help worked so well that the cattle multiplied to the point that they stripped the land and destroyed their pasturage. The British suggested—to them, a simple
solution—sell or slaughter some of the cattle. What the British had not learned were that the cattle were much more than an economic commodity to the Duruma.

**List these on an easel pad:**

**Time:** 5 minutes

To the Duruma, the cattle were important because:

- Cattle were part of a girl’s dowry when she was married and therefore a symbol of family solidarity, linking lineages in the kinship system.
- Cattle were used as gifts between political entities to symbolize friendship and agreements. They were therefore symbols of political strength in the political system.
- Cattle were important markers of social status—the more cattle, the higher the status in the social stratification system.
- Cattle were important parts of religious rituals and therefore important to the religious system.
- Cattle were closely connected in a complicated system of real estate privileges.
- Cattle produced milk, which was sold in the marketplace, and thus the living cattle were important to the economic system.
- Because of all these intertwined systems, the Duruma could not voluntarily give up numbers of cattle, even though they were obviously destroying the land. The Duruma and the westerners could not come to a mutually agreeable solution.
- The Duruma’s solution to the problem was to ask the government to open up the national park nearby for cattle grazing.
- The cattle, the Duruma culture, and their central African environment had come to exist as a viable set of interacting systems, of which the insect-borne disease was one factor and the cow, another.

**Exercise 1. How is a car like a cow?**

**Time:** 15 minutes

So what have the Duruma got to do with us? We could also ask, “How is a cow like a car?”

We have an issue in this country that many people, including many land use planners, think is a major problem—urban sprawl. Many people blame the rapid growth of sprawl on the car as a convenient method of individual transportation. The apparently simple solution is to convince people to give up driving their cars and build mass transportation systems instead, or convince people to live in central urban areas and walk to work,
play, and the grocery store. However, in 20 years of promoting these solutions, they really have not worked very well. Urban sprawl is worse rather than better.

Why is this so? What are we missing? Let’s see if we can analyze the systems in our culture in which the car plays a major role.

**Lead a group discussion on the systems in which the car is involved.**

**Time:** 10 minutes

Write the group’s answers on the easel pad as they talk.

**What natural systems does the car impact?** Soil, water, air, land use, etc.

**In which social systems does it play a role?** Answers can be wide-ranging. People will tend to start out with small surface systems, then move to larger ones as the implications begin to dawn on them. They should begin to see the massive intertwining of the car with ideological, political, legal, economic, social stratification systems, and even systems of courtship, rites of passage, and definitions of gender.

When people begin to notice that the car is both a symbol of, and provides access to, freedom and independence, help them look back at the ideologies on which this country was founded to see why the simple solution to urban sprawl is very far from simple.

**Exercise 2. Creating a concept map.**

Divide the group into smaller groups of 3 to 5 people.

**Time:** 15 minutes

Ask them to create a concept map of the interacting social and natural systems in which the car is involved. These can be collected and evaluated or the small groups can summarize their maps for the class.

**What they should all conclude is that all of these systems are related, not just to the car, but to each other.**
How is a hamburger hooked to the stars?

**Time required:** 45 minutes

**Outcome:** Learners will understand that their food items are related to larger interacting natural and social systems.

**Assessment:**
1. Learners can draw a concept map of the relationship of one part of a hamburger to larger natural and social systems.
2. Learners can verbally convey to the rest of the class how a specific Environmental Literacy Benchmark relates to their concept map and give examples.

**Materials:**
- 1 nontoxic marker per team
- 1 poster tablet sheet per team
- 1 roll of masking tape
- Environmental Literacy Benchmark Cards. (Keep your Benchmark Cards for the next exercise.)

**Tell the participants** that the purpose of this exercise is to show how a hamburger is hooked to the stars.
- Divide the class into the same work groups formed for previous exercises. (Preferably two to four groups of four to six persons per group.)
- Start lesson by asking groups to write hamburger in center of poster paper and draw a circle around it.
- Ask students to list the parts of a hamburger in a circle around the center circle containing the word hamburger.
- Review their work. Assign a different part of the hamburger to each of the groups.
- Ask the groups to map the natural and social systems related to the part of the hamburger that they were assigned. Be sure to show how their part is “hooked to the stars.” They should make the connection that each of the parts is directly or indirectly dependent upon the sun.
- Give each group a third Benchmark card. Instruct them to write the statement on their concept map. Ask them to be prepared to report to the class how this statement relates to their concept map and give examples.
- Each group elects a spokesperson to report to the class. Groups report. Solicit comments and observations from the class.

**Briefly summarize:** You have been working with 12 Environmental Literacy Benchmarks evolved from NAAEE and AAAS national standards. These Benchmarks represent an age-appropriate method of creating a systems perspective in learners by teaching them to use the Benchmarks to examine/ask questions about environmental and social systems.
I can find interactions between natural and social systems.

**Time required:** 90 minutes

**Outcome:** Learners understand that natural and social systems are comprised of interacting parts and that social systems can exert a significant influence on natural systems.

**Assessment:**
1. Learners can draw a concept map of a natural and a social system and the relationship between these systems.
2. Learners can verbally convey to the rest of the class how a specific Environmental Literacy Benchmark relates to their concept map and give examples.

**Materials:**
- 1 nontoxic marker per team
- 2 poster tablet sheets per team
- 1 roll of masking tape
- Environmental Literacy Benchmark Cards

The operative definition of environmental education that we use in the *Environmental Literacy Scope and Sequence* is “studies focused on the interaction between natural and social systems.” *A GreenPrint for Minnesota: State Plan for Environmental Education* promotes using the school, community, and regional resources to identify opportunities for environmental studies. This is also true in using the Environment as an Integrating Context for Learning (EIC). Community-based means more than just the town that the students live in. Ideally, workshop participants would be sent into the community to look for evidence of these interactions. However, this won’t work for most workshops and there isn’t time. This lesson serves as an alternative to allow participants to examine natural and social system interactions.

**Exercise 1. I can describe a system and its interacting parts.**

**Time:** 45 minutes

We are going to examine some natural and social systems to see if we can describe their parts and how they interact. Later in the exercise we are going to examine how social and natural systems interact.

- Divide the class into six groups.
Ask the groups to make a concept map of the parts of their system and discuss how some of the parts interact. Interactions such as those between:
- prairie – family farm
- forest – paper industry
- river – city

Distribute one of the single systems Environmental Literacy Benchmarks cards to each of the six groups. Ask the group to write the “statement” at the top of the poster paper.

Ask the groups to select an interaction between two parts they discussed. How does the “statement” relate to this interaction?

Have each group select a spokesperson (or persons) to read their “statement.” Then groups describe their work to the class and tell how the “statement” applies to their work. Give the class a chance to comment or question the presenter.

Briefly review the six single systems Benchmarks.

**Exercise 2: I can describe how a natural and social system interacts.**

**Time:** 45 minutes

Create three groups by combining the groups in Exercise 1 according to the list of interactions above.

Instruct the groups to briefly review the systems they mapped in Exercise 1 with each other. Then, in the center of the poster paper, make two overlapping circles. Write the names of the systems in the circles.

Next, ask groups to map some of the interactions that might occur between the two systems around the circles. Connect the interactions with a line to the overlapped portion of the circles.

Distribute two multiple systems Benchmark cards to each of the groups.

Ask the groups to select one interaction they discussed. How do the “statements” relate to this interaction?

Have each group select a spokesperson (or persons) to read their “statements.” Then groups describe their work to the class and tell how the “statements” applies to their work. Give the class a chance to comment or question the presenter.

Briefly review the six multiple systems Benchmarks.

**Discussion**

**Time:** 5 minutes

Could the participants identify alternative interactions that might change the outcomes? How could the Benchmarks be used to help identify alternative interactions?
I can find applications for the Scope and Sequence in EE lessons.

**Time required:** 45 minutes

**Outcome:** Learners understand how to use the Environmental Literacy Benchmarks to illustrate their applications to existing environmental education lessons.

**Assessment:**
1. Learners can draw a concept map of the relationship of an environmental education lesson to the Environmental Literacy Benchmarks.
2. Learners can verbally convey to the rest of the class how a specific Environmental Literacy Benchmark relates to their concept map of an environmental education lesson and give examples.

**Materials:**
- 1 nontoxic marker/team
- 1 poster tablet sheets/team
- 1 roll of masking tape
- Environmental Literacy Benchmark cards
- WILD Aquatic manual, *Migration Headache*, p. 87
- WILD manual, *Deadly Links*, p. 197
- PLT manual, *Keep on Truckin’,* p. 148
- WOW manual, *Get Involved*, p. 310
- WET manual, *Choices and Preferences*, p. 367
- MinnAqu manual, *The Lake Game*, pp. 3-10

In this exercise, we are going to explore how the systems statements we have been working with relate to environmental education materials that you may already have been using.

- Divide the class into three to six groups. Give each group one of the listed manuals with the selected lesson marked with a bookmark or paper clip.
- Ask that a spokesperson from each of the groups reads the lesson to its members.
- Each group writes the name of their lesson in the center of the poster paper. Draw a circle around the lesson name.
- Groups map what the students are “doing.” Circle them and connect with a line to the lesson name.
- Groups then select one of the students’ “doing” tasks and map what students are learning from doing that task. Circle them and connect to the “doing” item with lines.
- Each group then selects one of the student “learning” items and maps the concepts that are involved in what the students are learning. Circle them and connect to the “learning” item they selected.
• Distribute one new Benchmark to each group. They discuss how it relates to the lesson they examined and report to the other groups.
• Groups examine the Concept sheets that pertain to their “learning” item that they selected from above.
• Groups discuss teaching and assessment strategies they would use to be sure the Concepts and Benchmarks are taught during the lesson.
• Groups use the workshop handout materials to select the Graduation Standard Learning Areas to which their lesson relates.
• Groups’ spokespersons report their work to the class. Invite questions and comments.

**Summary:** The *Environmental Literacy Scope and Sequence* does not require curriculum writing efforts. What it does is provide an opportunity to reexamine what we are teaching and how we could modify our lesson plans/units to include the Environmental Literacy Benchmarks, too. This has the potential of adding an assessment opportunity that was missing before as well as relating what we are teaching to the Graduation Standards.

**Extension 1: I can find applications for the Scope and Sequence in lessons I am teaching.**

**Time:** 45 minutes
Use the same process in this lesson, but participants use one of their own lessons or units.

**Extension 2: I can change lessons to teach the Environmental Literacy Benchmarks.**

**Time:** 45 minutes
This is an extension of the two lessons above. Use the work they have already completed in either of the two lessons.
Ask participants to do the following:

• Look at the Benchmarks and Concepts that you identified in the last exercise. What teaching strategies would you use to make sure that the students learn and understand the Concepts? How would you help the students learn the Benchmarks and understand how they applied to the lesson? List on poster paper.
• Discuss how you would assess the students to see if they understand the Concepts, Benchmarks, and the objectives of the lesson. Record your assessment plan on poster paper.
• Groups report their findings.
• Discuss the value of using concept mapping as a means of assessment.