

**A QUESTIONING FRAMEWORK FOR SHAPING
ENVIRONMENTAL LITERACY**



DEVELOPED BY

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and

**THE CENTER FOR ENVIRONMENTAL EDUCATION
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A QUESTION-BASED FRAMEWORK FOR SHAPING ENVIRONMENTAL LITERACY

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Section 1:
ACKNOWLEDGEMENTS

This body of work reflects input from a wide range of people who have been developing environmental education from its earliest beginnings. There are too many to list individually but their impact on those of us who actually developed this framework and its questions is profound.

This material began its development over a decade ago and grew out of an ERIC document. And a taskforce from ASTM on Environmental Literacy. The primary developer of this framework worked with a group from SAGEE (The Secretary's Advisory Group on Environmental Education) in Massachusetts. That group developed and published Benchmarks on the Way to Environmental Literacy. The logical next step was this Framework.

Of concern to a number of us was the movement within the EE community to focus much of the curriculum materials on environmental issues rather than the basics of environmental literacy. This further motivated this Question-based Framework.

I owe a great debt of gratitude to my associates on the project:

Dr. John Disinger, is an emeritus professor in the School of Natural Resources of The Ohio State University, where he was a regular faculty member from 1971-1995. For a number of years he taught courses in Conservation/Environmental History and Evaluation of Environmental Impact, and continues to teach on a part-time basis. He also served year-long terms as SNR's Acting Director (1988-89) and Acting Assistant Director (1993-94). From 1971-1991, he was associated with the ERIC Clearinghouse for Science, Mathematics and Environmental Education, serving as its associate director for environmental education from 1974-1991.

Dr. Bora Simmons, Teacher Education Department, Northern Illinois University, Professor of Curriculum and Instruction and past president of the North American Association for Environmental Education,

They both have read and commented on several drafts and made many cogent recommendations to improve the document.

I am indebted to various SAGEE members who commented on various sections of the work and have provided continued support throughout the effort. Particular support has come from Jim Lafley, Barbara Waters, Ellie Horwitz, and Sandy Ryack-Bell.

The staff at Antioch New England Institute, particularly Michael Duffin and Sherman Morrison have given of their time and expertise to help pull all this together with the help of various graduate student from the Antioch New England Graduate School and the Center for Environmental Education.

My deepest thanks to all these people.

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Section 2:
INTRODUCTION TO
A QUESTION-BASED FRAMEWORK
FOR SHAPING ENVIRONMENTAL LITERACY

This Framework is built on the premise that although environmental issues and concepts change with time and changing technologies, the questions that underlie them remain the same. **The Questioning Framework for Shaping Environmental Literacy is a curriculum building device based on the premise that questions lead to, and provide the CONTEXT for, basic concepts about the environment and our relationships with it.** Such concepts underlie the environmental issues that many programs use as the starting point of their efforts in environmental education. It is our view that environmental issues are *inappropriate starting points*. Rather environmental education that leads to true environmental literacy, should begin with the context setting questions. We further believe that although the answers to the questions may change with increased knowledge and technologies, the questions remain essentially the same over long periods of time and should be revisited a number of times during one's lifetime. *Our task as educators, be we teachers, parents, youth leaders, or adult instructors, is to help learners formulate and frame good questions to explore.*

The challenge for becoming environmentally literate is to know and explore the basic questions and to revisit them periodically to discover, based on continuing advances in knowledge and technology, what the optimal solutions currently are. Many of the environmental literacy questions that must be dealt with remain the same, regardless of the time period in which they are asked and investigated. But the answers to those questions will vary with the times at which they are asked. Our knowledge about the environment changes rapidly; our ignorance grows equally fast, often more rapidly. This is because for every question answered or problem resolved, several new ones are generated.

This Framework is basically **INTEGRATIVE**. One might refer to it as interdisciplinary, or even a-disciplinary. The questions explored often require information from more than one traditional discipline to determine viable answers. In the day-to-day world that makes up our environment, we seldom work only within a single academic discipline. Rather, we blend information from several

disciplines to create new information and identify or new alternatives. But blending disciplines is increasingly difficult in a world dominated by disciplinary approaches.

This Framework is based on the understanding **that environment is our total surroundings**. Environment can be considered to have at least three interconnected, interacting components:

- the bio-geo-physical (non-human) environment;
- the social environment; and
- the mind/body (psycho-physiological) inner environment.

The essence of environmental literacy is our response to the questions we learn to ask about our world and our relationships with it, the ways we seek and find answers to those questions, and the ways we use the answers we have found. Thus, environmental literacy demands understandings, skills, attitudes, and habits of mind that empower individuals to relate to their environments in a positive fashion, and to take day-to-day and long-term actions to maintain or restore sustainable relationships with other people and the environment.

Environmental literacy is the goal of environmental education. Environmental education is the processes by which people gain environmental literacy.

Environmental literacy should be perceived as a developmental process rather than an end state; it is a continuum of understandings, skills, attitudes and habits of mind. Although there is not a simple, straightforward linear progression of *degrees of literacy*, there is an educationally functional sequence.

DEGREES OF ENVIRONMENTAL LITERACY

Its three stages are **Nominal Environmental Literacy, Functional Environmental Literacy, and Operational Environmental Literacy**:

- **Nominal** implies basic cognitive awareness and some beginning understanding;
- **Functional** implies focused application of useful knowledge and skills to specific issues; and
- **Operational** implies broad application of broader environmental literacy knowledge and skills to daily life.

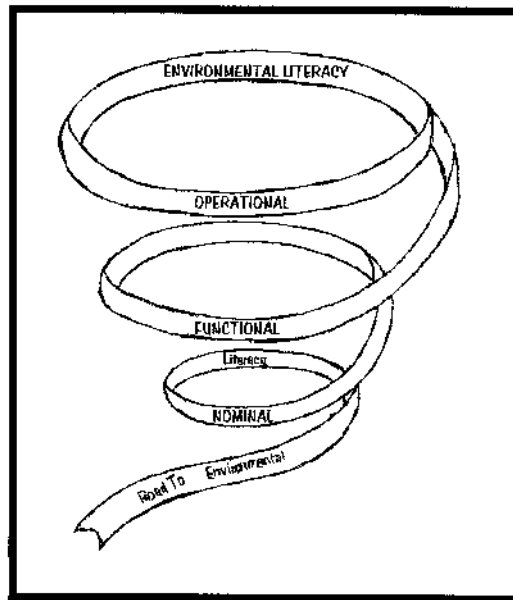


Figure 1.

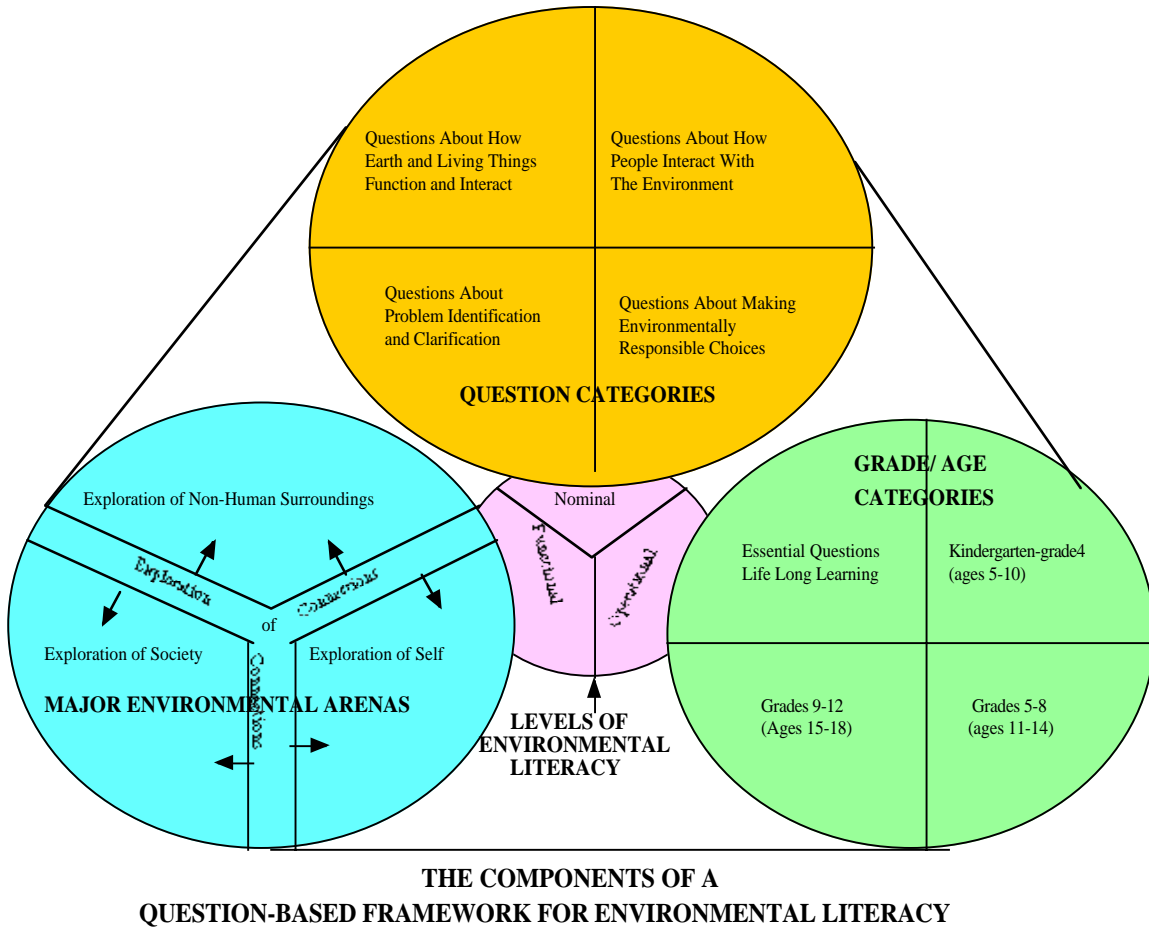
A working goal is that by the completion of 12 years of formal and informal schooling, the average graduate should have attained *at least* a **functional** level of environmental literacy.

THE MAJOR ENVIRONMENTAL ARENAS

In this framework, the basic questions are arranged within four arenas. They are:

- Exploration of Non-human Surroundings;
- Exploration of Society;
- Exploration of Self; and
- Exploration of Connections.

These arenas identify a structure that contributes to assuring that students will develop the knowledge and skills needed to think, feel, and act in ways that preserve the integrity of the environment. A structure to meet not only their immediate personal and societal physical, social, and emotional needs, but the needs of generations yet to come. Learners need to be empowered not only to deal with current human/environment interactions and issues, but also to perceive and head off potential negative environmental issues in the future.



QUESTION CATEGORIES

Four categories of questions related to the environmental arenas are part of the Framework. These include:

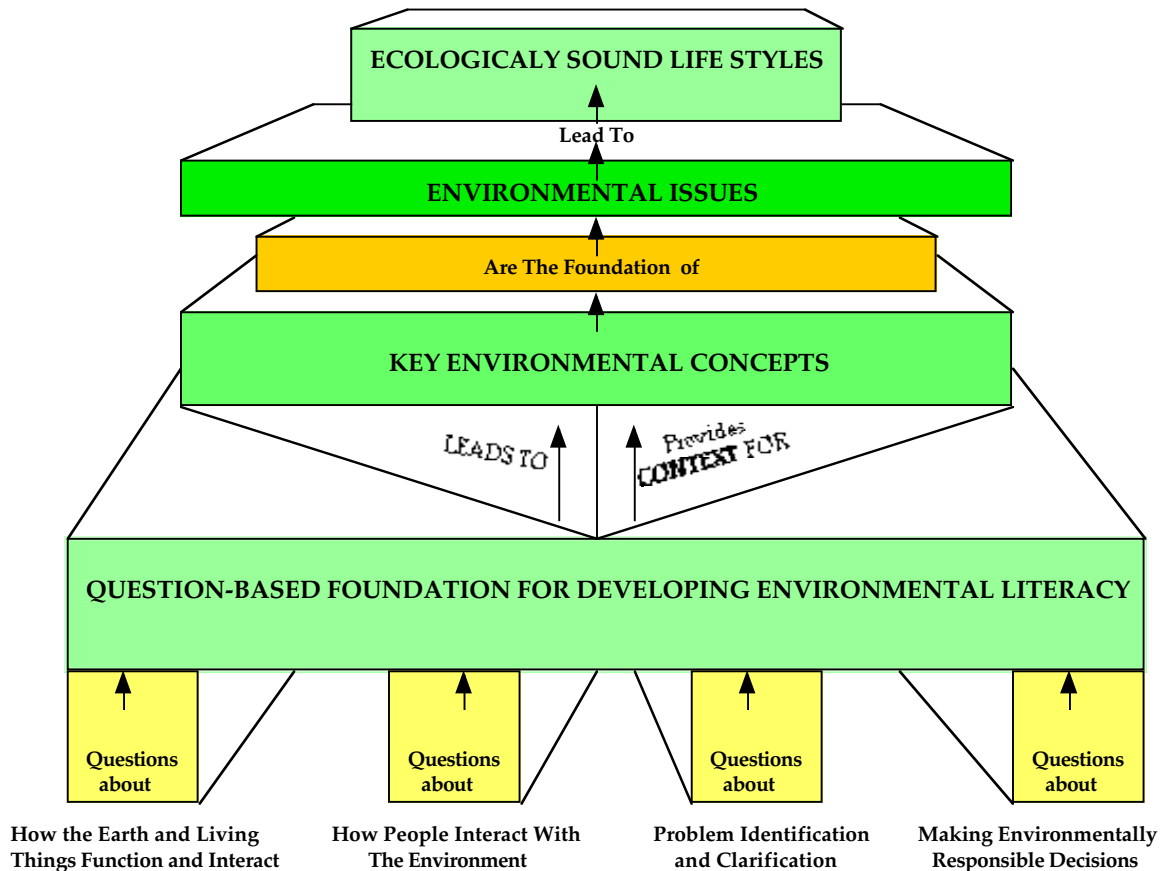
1. Questions About How the Earth and Living Things Function and Interact;
1. Questions About How People Interact With The Environment;
3. Questions About Problem Identification and Clarification;
4. Questions About Making Environmentally Responsible Choices

GRADE/AGE CATEGORIES

For convenience, the sets of questions in this framework are further broken out into roughly three year groups of K-12 grade levels plus Essential Questions that need to be explored throughout life-long learning. The presumption is that after several years of learning, K-4, 5-8, and 9-12, students should be able to deal with the questions set forth in each designated grouping. Grade levels are used because most people are

more familiar with them than with arbitrary designations of developmental levels. Although grades K-4 are generally equivalent to ages 5-10, Grades 5-8 to ages 11-14, and Grades 9-12 to ages 15-18, developmental skills and understandings will vary widely among students in those age and grade levels. In any case, chronological age is not synonymous with developmental level.

This **organizing framework** is equally applicable to formal and non-formal program development. It will also be applicable in home schooling situations. It is built on the concept, illustrated in the next diagram, that illustrates the structure of the educational development beginning from a set of questions that provide the **CONTEXT** for environmental education. That education leads to key concepts that help inform environmental issues and which lead learners to begin mastering the knowledge and skills for ecologically sound lifestyles.



QUESTION-BASED MODEL FOR SHAPING ENVIRONMENTAL LITERACY THAT LEADS TO ECOLOGICALLY SOUND LIFE STYLES

USING THIS MODEL

The questions in this framework contribute to a broad spectrum of general education that leads to an enlightened citizenry with a ecological perspective. Developing effective answers to the many questions here and those additional ones the learners themselves will pose requires using information from a variety of disciplines. Thus the framework is truly integrative in nature. If the questions are broadly interpreted and creatively designed, they can be applied in many contexts. The task of the environmental educator is to skillfully frame the scope, context, and timing of questions so as to bring the relevant environmental concepts into better focus for the learner. The challenge is to teach them how to think, not what to think.

QUESTION FORMAT EXPLANATION

In this Framework, for each grade level grouping, **The main questions are set bold in 16 pt. type**, and the sub-questions in standard 12 pt. type. Following each question with its sub-questions is a red code (in parentheses) that indicates its place in the framework and includes possible academic subject areas that may provide useable information to develop answers to the questions.

The general coding is based upon the major components of the overall Environmental Literacy Framework as indicated below:

Roman numerals indicate the appropriate Environmental Arenas
Capital letters indicate the appropriate Environmental Literacy Levels
Standard numbers indicate the appropriate Question Category
Lower case letters indicate the appropriate Grade/Age Category

Example: IIB3b-s, e, g

The content areas that are involved are:

Art = **ar**
Civics = **c**
Communications = **co**
Economics = **e**
Ethics = **et**
Geography = **g**
Health = **he**
History = **h**
Mathematics = **m**
Psychology = **p**
Science = **s**
Social Science = **ss**

Section 3:

Using the Questioning Framework For Shaping Environmental Literacy: Questions Asked and Answered

The Questioning Framework for Shaping Environmental Literacy is a curriculum building device based on the premise that **questions lead to, and provide the CONTEXT for, basic concepts about the environment and our relationships with it.** Such concepts underlie the environmental issues that many programs use as the starting point of their efforts in environmental education. It is our view that environmental issues are *inappropriate starting points*. Rather environmental education that leads to true environmental literacy, should begin with the context setting questions. We further believe that although the answers to the questions may change with increased knowledge and technologies, the questions remain essentially the same over long periods of time and should be revisited a number of times during one's lifetime. *Our task as educators, be we teachers, parents, youth leaders, or adult instructors, is to help learners formulate and frame good questions to explore.*

Navigating This Document

This segment of the document is based on questions asked and answered about the framework and its use. It is divided into six categories. You can proceed to whichever of the categories that will give you the most useful information.

- A. SOME FUNDAMENTAL BACKGROUND ON ENVIRONMENTAL LITERACY**
- B. THE NATURE OF THE QUESTION-BASED FRAMEWORK FOR SHAPING ENVIRONMENTAL LITERACY**
- C. USING QUESTIONS AS TEACHING TOOLS**
- D. DEVELOPING CURRICULUM FROM THE QUESTION-BASED FRAMEWORK**
- E. HELPING LEARNERS SEEK AND FIND ANSWERS—SHAPING INSTRUCTION**
- F. RESOURCES**

A. SOME FUNDAMENTAL BACKGROUND ON ENVIRONMENTAL LITERACY

What Is Environment?

The environment is simply our surroundings. Each one of us is a functioning organism with both an external and internal environment. As whole organisms we constantly interact with our environment and are acted upon by the environment. Environment is considered to have three major components—the bio-geo-physical environment, the social environment, and the mind-body (psycho-physiological) environment. These three components have ongoing interactions, interconnections, and feedback mechanisms that determine the overall health and sustainability of each component.

In a sense, all education is environmental education. In practical reality, environmental education focuses on the day to day interactions between whole organisms, their internal environments and the biophysical environments that surround them. Environmental education involves a great many of the traditional academic disciplines as they relate to the interactions among organisms and their environments. Environmental education has many guises but the goal of all of them is to establish environmental literacy among our citizenry.

What is environmental literacy?

Environmental literacy is a set of understandings, skills, attitudes, and habits of mind that empowers individuals :

- to relate to their environment in a positive fashion; and
- to take day to day and long term actions to maintain or restore sustainable relationships with other people and the biosphere.

The essence of environmental literacy is the way we respond to the questions we learn to ask about our world and our relationships with it; the ways we seek and find answers to those questions; and the ways we use the answers we have found.

Environmentally literate people know and understand:

- the physical processes that shape the patterns of the Earth's surface;
- the characteristics and spatial distribution of ecosystems on Earth's surface;
- the characteristics, distribution, and migration of human populations on Earth;
- the patterns and networks of economic, social, and political interdependence on Earth;
- the processes, patterns, and functions of human settlement;
- how human actions modify the physical environment;
- how physical systems affect human systems;
- the changes that occur in the perception, use, distribution, and importance of resources.

Environmentally literate people also share a variety of skills. These include:

- accessing objective, reliable information relevant to specific issues;
- communicating information to others effectively;
- making thoughtful choices from among a range of alternatives;
- working effectively with others to bring about needed changes;
- and a range of basic process and decision making skills such as:

Process skills

- | | |
|-----------------------|---------------------------|
| • observing | • classifying |
| • inferring | • predicting |
| • measuring | • comparing & contrasting |
| • critical thinking | • creative thinking |
| • communicating | • interpreting data |
| • estimating | • categorizing |
| • analyzing | • synthesizing |
| • drawing conclusions | • cooperative skills |

Decision-making skills

- problem and issue identification
- formulating operational definitions
- cooperative problem solving
- generating relevant questions
- gathering verifiable information
- suggesting potential alternative solutions
- projecting consequences of each alternative
- choosing among alternatives
- acting on the choice

Environmentally literate people also tend to share certain habits of mind.

Such habits of mind include questions that help us in:

- determining the systems involved in the issues that concern us;
- determining the historical development and background of issues as well as their current status;
- determining the potential consequences of actions we may take;
- determining the connections and interconnections among objects and events;
- determining who is managing and for what;
- determining the environmental costs and benefits of our actions—who gains and who loses?
- maintaining an open mind about assumed causes and effects and discrepant events that challenge orthodox thinking.
- seeking and treating root causes rather than superficial symptoms of dysfunctional systems.

Using habits of mind questions to perceive and understand environmental issues one finally arrives at questions of what to do about resolving the issue. This involves asking routine questions, and finding answers to them.

- What can I do about this issue?
- What should I do about this issue?
- What must I do about this issue?
- What am I doing, or going to do, about this issue?

What are the three major levels of environmental literacy?

Environmental literacy is a continuum of understandings, skill, attitudes and habits of mind. Although there is not a strict linear progression of *degree of literacy* there is a usable sequence of degrees of environmental literacy for developmental purposes. Three degrees have been designated as *nominal*, *functional*, and *operational*. **Nominal** implies basic cognitive awareness and understanding; **functional** implies narrowly focused issue application; **operational** implies broad application in daily life. By the completion of 12 years of schooling, along with non-formal learning settings, the average graduate should have attained *at least* a **functional** level of environmental literacy.

How does environmental education differ from environmental literacy?

Environmental education is a process aimed at developing a citizenry that is aware of, and concerned about, the total environment and its associated problems. A citizenry which has the knowledge, attitudes, motivations, commitments and skills to work individually and collectively towards the solution of current problems, as well as the prevention of new ones. *The goal of environmental education is to develop an environmentally literate citizenry, thus environmental education focuses on empowering individual to deal effectively with positive and negative relationships between people and their environments.* Environmental education is designed to foster and nurture growth of ENVIRONMENTAL LITERACY throughout the human life span. The essence of environmental literacy lies in the questions we learn to ask about our world and our relationships with it; in the ways we respond to such questions, the ways we seek and find answers to those questions; and the ways we use the answers we have found. We have to learn how to ask good questions.

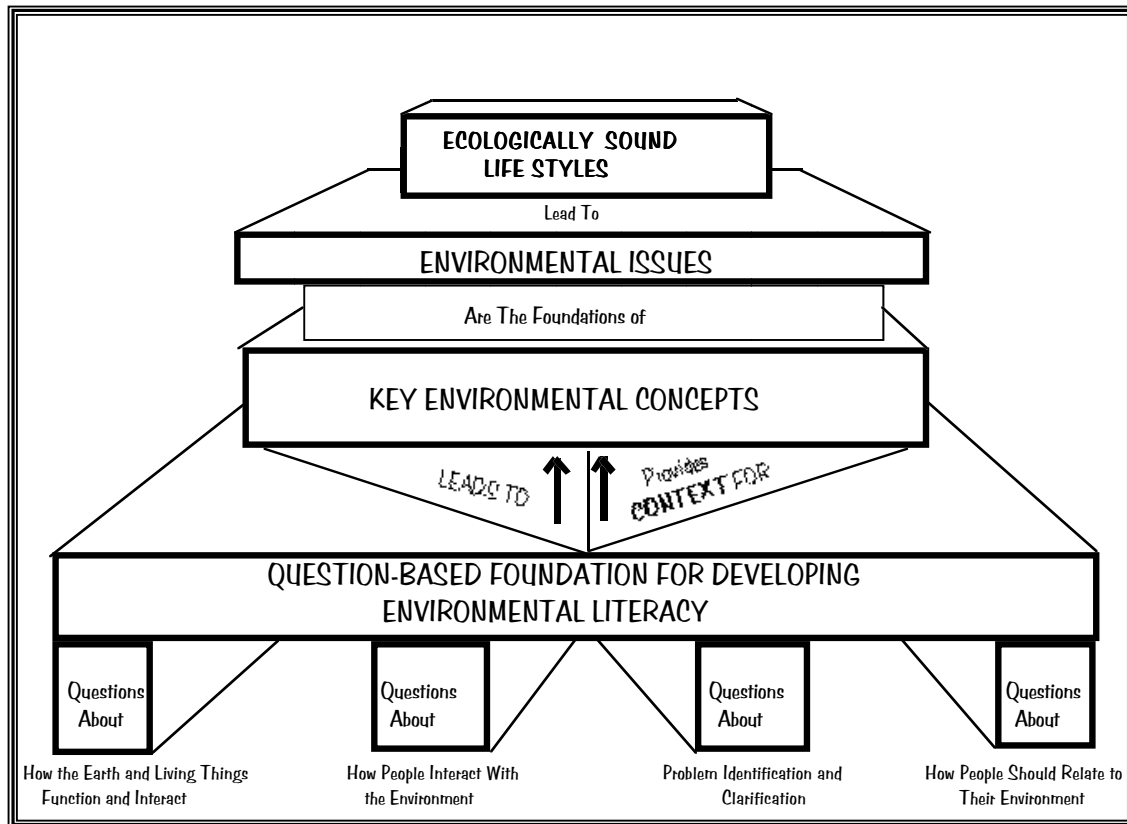
How does environmental education differ from environmental advocacy?

Environmental education *differs* from environmental advocacy *in empowering people with the knowledge, skills, and attitudes needed to make informed choices RATHER THAN simply advocating specific choices.* However, effective and appropriate environmental advocacy in a democracy depends upon the presence of an environmentally literate citizenry.

B. THE NATURE OF THE QUESTION-BASED FRAMEWORK FOR SHAPING ENVIRONMENTAL LITERACY

What is the purpose of the Framework?

The purpose of the Framework is to provide an organized set of effective questions that together form a comprehensive curriculum base for the development of environmental literacy. The questions provide a **CONTEXT** for the teaching of environmental **CONCEPTS and ISSUES** that can lead **ECOLOGICALLY SOUND LIFESTYLES.**



Can I use environmental issues to develop environmental literacy?

Much of the instructional materials available today for environmental education are focused on particular environmental problems or issues. Some of these problems and issues are appropriate to the age group you are working with, many are not. However, environmental issues, particularly ones the learners perceive as relevant to them, are important motivators as the learners develop through the levels of environmental literacy.

It needs to be remembered that to effectively deal with any environmental issue there are underlying concepts and understandings that need to be possessed by the learner. Without those concepts and understandings the suggested resolutions to the problems and issues will tend to be quite faulty. Research tends to show that people need to proceed roughly from awareness, to understanding, to action on environmental issues. Although in detail the process is somewhat more complicated than that. *Too often we want to rush from awareness to action with little, or poor, understanding of the nature and history of the issue.*

What is an INTEGRATIVE framework?

We refer to this framework as INTEGRATIVE because the questions require information and skills from several traditional disciplines for responsible answers. The questions become vehicles for integrating these individual disciplines without making a big issue about whether the study is interdisciplinary, multidisciplinary, adisciplinary or whatever.

C. USING QUESTIONS

Who should use the Question-based Framework?

The questions in this framework should be useful to teachers, youth leaders, curriculum developers. Indeed it should be useful to anyone interested in the challenge of developing and nurturing environmental literacy in our citizenry in a way different from the typical instructional pattern of lecture and recite..

The questions in the framework could be used to teach in almost any subject if they are broadly interpreted and applied in other contexts. The task of the environmental educator is to skillfully frame the scope, context, and timing of the questions so as to bring the relevant environmental concepts into better focus for the learners.

How can I elicit the Framework Questions from my kids?

The various questions will be most meaningful to the kids if they come up with them. You can of course, present the questions to them and let them decide if they want to pursue them or not. It is better if you start a dialogue with the kids that engages their interest and leads them to ask the questions themselves. If the questions emerge from their dialog the learners are more likely to pursue their own answers and do the work necessary to get appropriate answers in either formal or non-formal settings

In order to get kids to ask questions and explore for answers, the teacher or youth leader has to create a learning environment that is physically, psychologically, and

emotionally safe for the learner. The questions have to become couched in words that are comfortable and understandable for the age group and the questions need to be revised with the learners to a level and scope that any resultant actions are potentially doable by the learners.

It helps if you, the teacher or leader, prepare the dialogue beforehand by asking some questions yourself about the topic and using the data base of questions to help sharpen your own approach. Then you can engage the learners in a similar dialogue but be careful not to be too leading in the questions you ask them.

What is the role of Questioning in shaping change?

Robert Graef offers the following couplets to indicate the value of questioning strategies:

*“Answers tend to terminate curiosity.
Questions stimulate and direct curiosity*

*“Facts” are valid only until disproved.
Good Questions usually have much longer lives.”*

He further suggests that: *“One isn’t asked to “believe” questions, only to ponder them... good questions go on seeking after truth.”*

Also consider the following:

“Questioning is a basic tool for rebellion. It breaks open the stagnant hardened shells of the present, and opens up the options that might be explored.

Questioning reveals the profound uncertainty that is imbedded deep in all reality beyond the facades of confidence and sureness. It takes this uncertainty towards growth and new possibilities.

Questioning can change your entire life. It can uncover hidden powers and stifled dreams inside of you...things you may have denied for many years.

Questioning can change institutions and entire cultures. It can empower people to create strategies for change.

Asking A Question that leads to a strategy for action is a powerful contribution to resolving any problem.

Asking Questions that open up more options can lead to many unexpected solutions.

Asking questions that help adversaries shift from their stuck positions on an issue can lead to acts of healing and reconciliation.

Asking questions that are unaskable in our culture at the moment can lead to the transformation of our culture and its institutions.

Asking Questions and listening for the strategies and ideas embedded in people's own answers can be the greatest service a social change worker can give to a particular issue."

(Based on the work of Fran Peavey)

<http://www.jobsletter.org.nz/vivian/stratq97.htm>

What are some of the key questioning strategies to be used in implementing the framework?

Guidelines for Generating Questions. These include:

- Questions should be ANSWERABLE within a reasonable amount of time. That time frame is shorter with younger learners and can be increased as the learner matures.
- Questions should be COMPARATIVE, and the comparison must have some basis or general context involving a) common sense or logic, or b) prior knowledge that is pertinent.
- Questions should be somewhat TANTALIZING, being neither obvious nor tedious.
- Questions should AVOID SCIENTIFIC JARGON and AVOID HIGH TECH TOOLS.

There are actually many categories of Questions to be used in guiding learners. Each category is focused on particular aspects of learning. In guiding a learners development of ideas about particular issues a mix of questions from each of the categories is most helpful. Categorizing the questions is a learned skill, helping learners frame and explore questions is still the basic task.. One categorization of questions is as follows:

Process questions
Context setting questions
Focusing questions
Investigative questions
Connection questions
"What if "questions
"How do we know" questions
"What does it mean-to-me "questions
Implication questions
Values questions
Ethics questions

Additional Types of Questions *

Comparison

- How are these things alike? What particular characteristics are similar?
- How are they different? What particular characteristics are different?

Classification

- Into what groups could you organize these things?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

Induction

- Based on the following facts (or observations) what can you conclude?
- How likely is it that _____ will occur?

Deduction

- Based on the following generalization (or rule or principle) what predictions can you make or what conclusions can you draw that must be true?

- If _____, then what can you conclude must happen?
- What are the condition that make this conclusion inevitable?

Error Analysis

- What are the errors in reasoning in this information?
- How is this information misleading?
- How could it be corrected or improved?

Constructing Support

- What is an argument that would support the following claim?
- What are the limitations of or assumptions underlying this argument?

Abstracting

- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?

Analyzing Perspectives

- Why would someone consider this to be good (or bad or neutral)?
- What is the reasoning behind their perspective?
- What is an alternative perspective and what is the reasoning behind it? *

D. DEVELOPING CURRICULUM FROM THE QUESTION-BASED FRAMEWORK

What is the teacher's role in developing curriculum from the questioning framework?

- Choose questions you think are appropriate to the developmental level of your group.
- Determine any discipline-oriented skills and content the students will need to have mastered in order to be able to investigate the questions.
- See that most of those skills and content have been learned or can be soon taught to the learners.
- Create some experiential projects that will help students have direct involvement with the environment relative to the various potential questions.
- Dialogue with the students to help them "own the questions" for themselves.

- Guide the students in cooperative groups to answer the questions and determine the reliability and validity of their answers.
- Work with the students to develop appropriate assessment of their work.

How can you use the framework to develop non-formal youth programs?

A key aspect of designing programs based on this Framework is to consider the places learners should see and visit while seeking answers to selected questions. Help students to consider these questions, even restate them in their own words. Then create opportunities for the learners to visit places, interact with people, and reflect on their findings as they explore the questions. Also create opportunities for learners to become involved in appropriate environmental issues and participate actively in the decision-making process.

The key difference between formal learning, primarily schooling, and non-formal learning focuses on who controls the learning objectives and the means of learning.

- In formal learning the institution controls both the objectives and the means of learning.
- In non-formal learning the learners control the objectives but not the means of learning. (Mocker and Spears,1982)

School or club or youth organization, the questions are the same for either venue.

It is however, often difficult for school groups to get out and gather direct evidence from different environments or to interact directly with people in the community. This is much more an option for youth programs. Youth programs are more likely to be able to take actions leading to issue solutions than many school groups.

Awareness of these differences should help those developing youth programs to develop these in ways that do not simply duplicate school efforts but rather to complement them.

The educator has the responsibility of considering the outcome, the methods, the setting, and the learner in constructing the learning opportunities. In non-formal education, construction of the learning is the primary role of the educator; learners

bring with them their own objectives and thus a strong willingness to learn. In non-formal learning, the individual comes to the learning prepared to apply meaning to the information and experiences provided. In the long run, the only learning that truly influences behavior is **self-discovered, self-appropriated learning**. Meaning comes from within an individual, but it is the teacher who constructs a framework for learning from which meaning can be drawn. The non-formal educator can develop programs which by their design includes learner's prior experiences, beliefs, considerations, and aspirations. Thus, the non-formal programs provide a unique opportunity for true learning.

E. HELPING LEARNERS SEEK AND FIND ANSWERS— SHAPING INSTRUCTION

What instructional approaches can I use to develop environmental literacy?

You can use almost any instructional approach with kids to help them work through the answers to these questions— **as long as the learners are free to fully explore the question, and as long as learners are evaluated on HOW they think not on WHAT they think**, particularly if that differs from the ideas of the teacher/leader.

- It is particularly important to arrange for the students to have as much direct contact and experience with their environment as possible.
- The students should be helped to learn basic concepts from a variety of disciplines.
- Students should learn how to access information from a variety of sources such as:
 - internet sources
 - student designed experiments
 - questionnaires and opinionnaires
 - books and magazines
 - interviews with knowledgeable people
 - films and videos

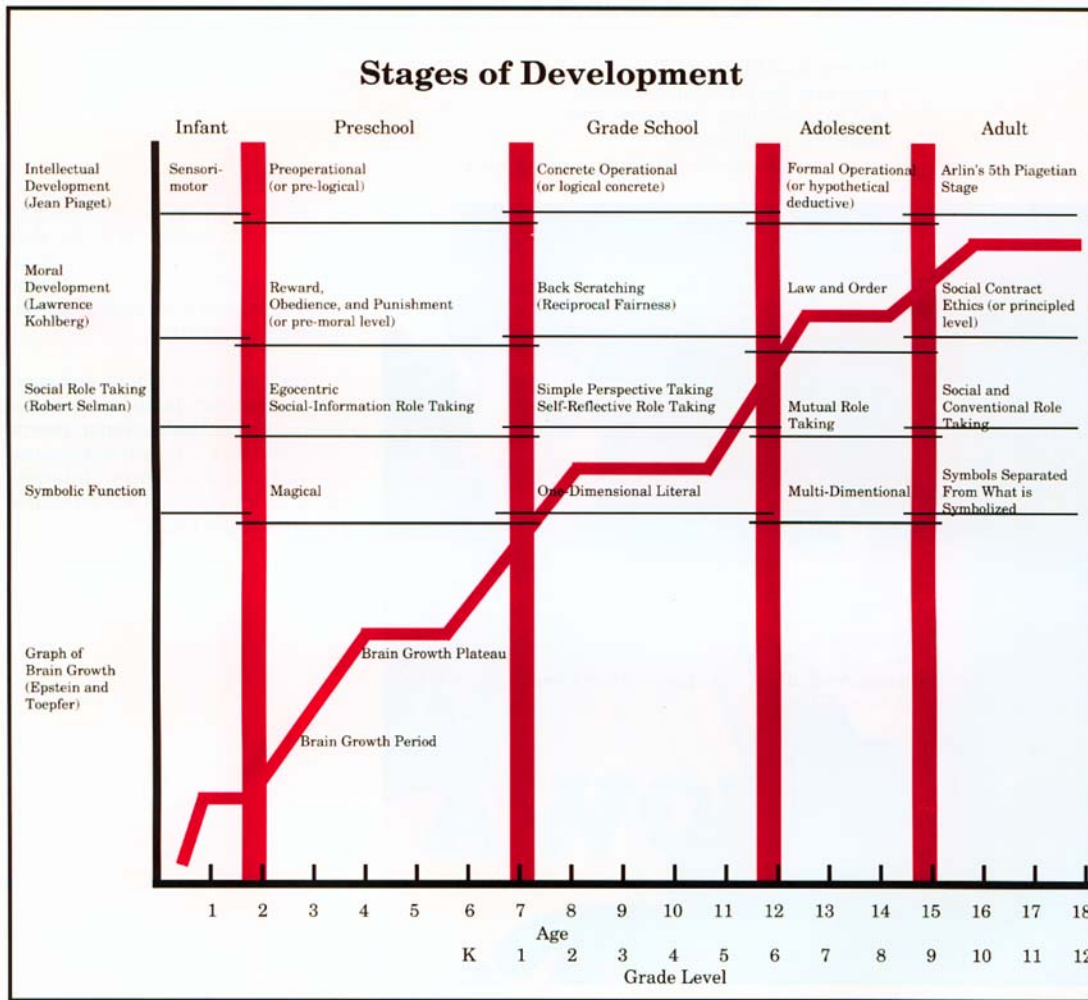
- Student should be taught to evaluate the **validity and reliability** of information they have gathered. Encourage students to have a healthy skepticism about the material they gather before making choices and decisions based on that material.
- Instruction is enhanced by students working in small groups and by providing appropriate interaction between and among these groups.
- **Instruction should have a variety of approaches in order to involve the range of learning modalities within the class or group.**

What theoretical educational approaches underlie the Questioning Framework for Environmental Literacy?

It is not appropriate here to lay out the detail of these theories but you should know that these basic approaches have been incorporated into the development of this framework.

Constructivism— a set of understandings that knowledge is built by the learner from prior experience and new experiences rather than simply by memorizing material developed by others. These understandings are based heavily on the work of a variety of researchers on the function of the human brain.

Life Cycle Development—as humans grow they go through a set of cognitive and physical changes. Each set has characteristic capabilities and limitations both physically and mentally. Although these changes appear most obvious in youth, adults continue to go through changes from adulthood to maturity and decline. Life cycle changes were first outlined by Erik Erikson and have been expanded and refined through the work of people like Jean Piaget.



Above chart by Regnier, Gross, and Zimmerman from the Interpreter's Guidebook 1992. USSP Foundation Press.

Experiential Education—based on providing students with as much direct experience with the environments being studied as possible. Experiential education derives from a variety of educational philosophers such as John Dewey and Lloyd B. Sharp.

Moral Development—based largely on the research of Lawrence Kohlberg, the theory of moral development is based on the understanding that each person moves through a sequence of perceptions of what is right behavior that is largely universal. A person may not proceed through to the highest stages but he/she will proceed through the different stages to the one in which he/she is currently arrested.

Activity Theory—a theory that people learn most effectively engaging in activities that use creative, manual skills as well as cognitive ones. “It is a cross-scientific theory for studying man as an actor in a cultural-historical context and is based on the idea of the dual process of man and artifacts shaping and being shaped by social and physical environment.” (Cole 1996) Activity theory draws on the “learn by doing” philosophy of American education philosopher John Dewey and the research of some Russian psychologists such as Vygotsky, Rubinshtein, Leontjev, and Lurija.

Learning Modalities— individuals have different styles of dealing with questions and information. These styles are essentially preferences for almost everyone is capable of utilizing any one of the modalities. Effective teachers structure activities to address all the different modalities in order to reach the greatest number of students in ways that will stimulate their thought processes and understanding. Significant effort has been made by Dr. Rita Dunn to create an educational model for learning modalities and the work of Bernice McCarthy has brought the work of a number of researchers on learning modalities into the realm of student instruction.

Systems Theory—a basic realization that all things are inter-related and that the world is composed of nesting sets of systems and subsystems that work together for outcomes that are synergistic, that is, the sum of all the activity is greater than the sum of the parts. Any item needs to be explored in terms of the systems and subsystems of which it is a part.

Dimensions of Thinking/Dimensions of Learning—a research and theory-based framework on cognition. Developed by over 90 educators into a practical model that K—12 teachers can use to improve the quality of teaching and learning in any content area. A model supported by the Association for Supervision and Curriculum Development.

How can you use cooperative learning strategies to implement the questioning framework?

Within a class or youth organization you will have youngsters with a variety of abilities and learning modalities. By arranging the learners into cooperative groups (pairs, triads, or groups of four) the different abilities and experiences of the variety

of students can be brought to bear on the questions and a wider range of alternatives or solutions can be developed. Most of the questions in the Framework have more than one appropriate answer. In small groups the learners can gain a better perspective of the variety of ways people perceive things and learn to value differing views. Cooperative learning is an important component of constructivist educational approaches.

F. RESOURCES

Books

Designing & Implementing an Integrated Curriculum: A Student-Centered Approach by Edward T. Clark, Jr. Brandon, VT: Holistic Education Press, 1997

Using Computers in Environmental Education: Interactive Multimedia and On-Line Learning (EE Toolbox,) by W.J. "Rocky" Rohwedder and Andy Alm.

Open-ended Questioning: A Handbook for Educators by Robin Lee Harris Freedman. Menlo Park, CA: Addison-Wesley Publishing Company. 1994

Environmental Inquiry For Students and Teachers: A Sourcebook for question-driven planning and teaching. By Robert R. Graef. Grassroots: Resources for Education. Distributed by Paragon Books, PO Box 1708, Marysville, WA 98270-1708. 1994.

A Different Kind of Classroom: Teaching with Dimensions of Learning by Robert J. Marzano. Alexandria, VA: American Association for Supervision and Curriculum Development (ASCD). 1992

Project Wild, Project Learning Tree, and Project WET. Excellent materials but only available by taking a sponsored workshop in use of the materials.

Leopold Education Project Materials. As with the above, Leopold Education Project are only available through sponsored workshops.

ERIC Documents

Classroom Questions. Author: Brualdi, Amy C. 1998-02-00 Source: ERIC Clearing house on Assessment and Evaluation, Washington, DC. ERIC/AE Digest. ERIC Identifier ED422407

Lifelong learning: Formal, Non-formal, Informal, and Self-directed Mocker, D.W. & Spear, G.E. (1982). Columbus, OH:ERIC(CE).
(ERIC Document Reproduction Service Number ED 220 723)

Web Sources

Strategic Questioning: An Approach to Creating Personal and Social Change by Fran Peavey. A paper from the WEB. 1997

<http://www.jobsletter.org.nz/vivian/stratq97.htm>

"Open Response Questioning Strategies" from Kentucky PRISM: Partnership for Reform Initiative in Science and Mathematics.

<http://www.mursuky.edu/prism/kyprism/openrp1.htm>

Inquisitory Presentation (Questioning)

<http://www.ed.psu.edu/nasa/inquis.html>

Mathematics TEKS Toolkit: Mathematics Center for Educator Development

<http://www.tenet.edu/teks/math/assess/isquestion.html>

A Questioning Toolkit, From Now On: The Educational Technology Journal

<http://www.fno.org/nov97/toolkit.html>

Filling the Tool Box: Classroom strategies to Engender Student Questioning.

Jamieson A McKensie and Hilarie Bryce Davis, 1986. From Now On.

<http://www.fno.org/toolbox.html#Class>

The question IS the answer. By Jamie McKensie.

<http://www.fno.org/oct97/question.html#anchor128766>

Questioning Strategies. University of Delaware/Center For Teaching Effectiveness.
<http://www.udel.edu.cte.97book/question.html>

Higher Level Objectives! Effective Questions! Examples of Higher Level Questioning! Using Sequencing Question! Taba's Model
<http://www.ehhs.cmich.edu/~dnewby/questions.html>

Methods For Assessing Questioning Skills
<http://www.oir.uiuc.edu/did/booklets/question/quest4.html>

Nonformal Environmental Education: Toward a Working Definition by Joe E. Heimlich. CSMEE Bulletin 93.3 May 1993
<http://www.ericse.org/Bulletins/SEB93-3.html>

Philosophical Considerations for Curriculum Development in Environmental Education by Robert L Horton & Susan Hanes. CSMEE Bulletin 93-4, July 1993
<http://www.ericse.org/Bulletins/SEB93-4.html>

The Meaning of Sustainability: Biogeophysical Aspects by John P. Holdren, Gretchen C. Daily, and Paul R. Ehrlich. 1995. Dist. By The World Bank.
<http://www.dieoff.org/page113.htm>

Environmental Inquiry Curriculum

- Environmental Toxicology
- Wastes to Resources
- Ecological Effects of Alien Invasions
- Watershed Dynamics
- Urban Ecosystem Modeling

<http://ei.cornell.edu/curric/>

About Classroom Assessment (Q&A)
<http://www.aac.ab.ca/class.html>

Miscellaneous Publications

Green Teacher

Acorn Publications

The following KEYWORDS are used in the CEE web site to help focus in on particular questions by subject.

lithosphere
hydrosphere
atmosphere
ecology
economics
survival of living things
terrestrial biomes
aquatic biomes
bio-geo-chemical cycles
photosynthesis
respiration
exponential growth
airborne pollutants
limiting factors
carrying capacity
competition
symbiosis
natural selection
soil types
climate patterns
food chains and webs
energy transformations
watershed
drainage systems
goals
values
needs
energy usage
resource impact
belief systems
environmental issues
environmental problems

environmental solutions
producers
consumers
resources
environmental materials
energy flow
entropy
human impacts on
nature
choice
environmental
challenges
human players
costs & benefits
systems & subsystems
functional / dysfunctional
systems
personal roles
risks & benefits
war
environmental stress
human / environment
interactions
biophilic
biophobic
communities & habitat
adaptation
environmental change
biodiversity

Section 4: **K-4 Environmental Literacy Question Framework**

These questions are set up in multi-age/grade groupings on the idealized assumption of a K-12 program for developing environmental literacy. We know that there are few if any places where such exists in reality. Leaders/teachers cannot automatically assume that their learners have developed the appropriate exploration of questions at an earlier age or grade level. This means that one has to explore and choose questions not only from those listed in a particular age/grade group but also from groups of questions below and/or above the categories you initially select.

—I Exploration of Non-human Surroundings—

A.Nominal Environmental Literacy

2. Questions About How the Earth and Living Things Function and Interact

What plants and animals live near me?

- Where can I look for plants and animals in my area?
- What kinds of books will help me identify any plants or animals I see?
- Who are people in the area who would help me identify local plants and animals?

(IA1a—s)

How does the moon change over a month's time?

- What time does the moon rise in my area?
- Does it rise at the same time every day?
- Is the moon ever visible during the day?
- What is the shape of visible moon during full moon?
- What is the shape of the visible moon during new moon?
- When does the crescent moon curve upwards?
- When does the crescent moon curve downwards?

(IA1a—s)

What is the pattern of temperature change over a week's time?...a month's time?

- How do I read a thermometer?
- How can I make a chart to record my temperature readings each day?

(IA1a—s)

Where does the water go during and after a rain?

- Does water run uphill or downhill?
- Does water run faster on steep slopes or shallow ones?
- When and where does water collect in puddles?
- When the rain is over, what happens to the water in puddles?
- Does all the rain reach the ground?
- Does water sink into sandy soil faster than into clay soil?
- When rainwater in gutters goes into drains, where does it go?
- What happens to the rain that falls near plant roots?
- How much rain falls here each year?

(IA1a—s)

What happens to dirt and soil during and after a rain?

- If you shake up some soil in a jar of water then let it settle, what patterns do you find?
- What size rock and soil particles are carried by water flowing at different speeds?
- After the rain stops can you find collections of rock and soil particles in the gutter?
- What is meant by erosion?
- What evidence of erosion can you find in your area?

(IA1a—s)

What birds stay in my area all year long? Which ones are here only for the spring and summer?

- What different kinds of birds can I find in my area?
- Can I find each of these kinds every month of the year?
- Which ones are found only in a few seasons of the year?
- What is meant by migration?
- What are the major reasons that some birds migrate?
- What kinds of foods do the birds eat that stay around all year?

(IA1a—s)

What lives in a pond or stream?

- What adaptations do animals have that live all their lives in water?
- Can you find some animals that live on the surface of water rather than in it?
- Can you find some animals that live both on land and in water?
- What plants can you find that have their roots underwater but their leaves up in the air?
- What plants can you find that live entirely underwater?
- Do animals that live in still water have different adaptations than animals living in flowing water?

(IA1a—s)

How do plants, insects, frogs, birds, and mammals change from birth to death?

- In what ways do young animals look different from adult animals?
- In what ways do young plants look different from adult plants?
- What animals have at least four different kinds of bodies as they grow from birth to adulthood?
- What other patterns of development can you find?
- What is the basic pattern of change for humans as they grow from babies to adults?
- What animals seem to have a pattern of change much like ours?

(IA1a—s)

Where do things go when you throw them “away”?

- What happens to papers when you throw them “away”?
- What happens to plastic bags and other plastic when you throw them “away”?
- What happens to glass when you throw it “away”?
- What happens to garbage when you throw it “away”?
- How do the things you “throw away” help or harm other living things?
- What choices do you have for getting rid of trash and garbage?

(IA1a—s)

In what kinds of places can you find bird’s nests?

- Which birds nest in trees?
- Which birds nest on the ground?
- Which birds nest on buildings?
- Which birds nest in chimneys?
- Which birds nest in holes or bird houses?

(IA1a—s)

How can you get plants and animals to let you know the things they prefer even though they can’t talk?

- What kind of experiment could you set up so that insects could tell you if they prefer damp ground or dry ground?
- What kind of experiment could you set up to let birds that come to a feeder tell you what kinds of seeds they prefer?
- What kind of experiment could you set up to find out which house plants like frequent watering or less frequent watering?
- What kind of experiment could you set up that would let a caterpillar tell you what kind of food plant it prefers?

(IA1a—s)

What evidence can you find that a variety of animals are in your area even when you can’t see the animals themselves?

- What do we mean by evidence?
- What do animal tracks tell you?
- What do clusters of seeds, cones, or nuts tell you?

- What do cast-off snake skins tell you?
- What do lone feathers tell you?
- What do empty sea shells tell you?
- What do gnawed antlers tell you?

(IA1a—s)

How does light affect color?

- What happens to light when it passes through a prism?
- Where do the colors of rainbow come from?
- Why is the sky basically blue?
- Why is a shirt or dress the color it is?

(IA1a—s)

What roles do these other animals and plants play in the environment?

- What do these other animals and plants do to make a living?
- What non-living things do animals and plants need in their environment?
- What are these non-living things needed for?
- How to they help other things live?

(IA1a—s)

What are some of the key systems in our environment?

- What are systems?
- What are parts of systems called?
- Into what groups could you organize systems?
- What are the rules of membership in each group?
- What are the defining characteristics of each group?
- How do groups of living things interact with each other as a system?

(IA1a—s, ss)

What makes up a habitat?

- What is a habitat?
- What are the important parts of a habitat for plants and animals?
- What are the major habitats where I live?
- What creatures live in these habitats?
- Into what groups could you organize these habitats?
- What are the rules of membership in each group?
- What are the defining characteristics of each group?
- What basic things do living things need to survive?

(IA1a—s)

What are the key sources of energy in our environment?

- What is energy?
- What are some sources of energy?
- What are some receivers of energy?
- What are the major fuels for energy in our world?
- What are the major kinds of energy in human social systems?

(IA1a—s)

What are the most important long and short-term changes that regularly occur in our environment?

- How do you define long and short term?
- What are the long-term changes in your environment?
- How long do you consider long-term to be?
- What are the short-term changes in your environment?
- How long do you consider short-term to be?
- What evidences of change can you find around your?
- What changes happen quickly?
- What changes take weeks, months, or years to happen?
- Why do you think these changes are important?
- How do you define long and short term?

(IA1a—s)

How have local plants and animals adapted to the environment?

- What special ways do animals have for getting food?
- What special ways do plants have for getting food?
- How do plant seeds get to new places to grow?
- How are human inventions a kind of adaptation?
- What adaptations do local plants and animals have to protect themselves?

(IA1a—s)

2. Questions About How People Interact with the Environment

How does the weather affect the games you play?

- Why is ice hockey played mostly in winter?
- Why is football basically a fall sport?
- What kind of weather is best for kite flying?
- Why are baseball and stickball usually played in spring and summer?

(IA2a—s)

How does the weather affect what kinds of clothes you wear?

- What do you wear in rainy weather?
- What do you wear in snowy weather?
- What do you wear on a hot muggy day?
- What do you wear on cold, wintry days that you don't wear on hot summer days?
- How do you protect your skin from strong sunshine?

(IA2a—s)

What do you look for in a place to build a fort or play house?

- Do you like a sunny or a shady site and why?
- Do you like a damp or a dry site and why?
- Do you look for a private site or one where lots of people will find it and why?
- Do you look for a site that has lots of materials you could use to build with or would you haul in the materials you need?

(IA2a—s, g)

What do you look for when you look out a window?

- Do you look to see what the weather is outside?
- Do you look to see who might be coming to visit you?
- Do you look for wild creatures that live around you?
- Do you look to enjoy the changing sky and clouds?
- Do you look to enjoy the sun, stars, and moon?
- Do you just enjoy the view?

(IA2a—s)

How is the place outside the window different from the place inside the window?

- Is the weather more pleasant inside than outside?
- Does the place outside the window give more freedom than inside the building?
- Does the world outside change faster and more drastically than your world inside the building?

(IA2a—s)

What things from the environment do we use to make the things we use?

- What things from the non-human environment are needed to provide us with food?
- What things from the non-human environment do we use to make paper, or plastic?
- What things from the non-human environment do we use to make things of metal?
- What materials from the non-human environment do we use to make clothing?
- What material from the non-human environment do we need to make all these things?

(IA2a—s, g)

What are our basic needs and how do they differ from wants?

- What things do we absolutely have to have to live?
- What things do we want to have but can survive without?
- Where do the things we need to survive come from?
- From what sections of the environment—mind/body, social, bio-geo-physical—do we get the things we want?

(IA2a—s, p)

Which resources that we use are renewable and which non-renewable within human time-frames?

- What things in the environment that we use can be replaced quickly?
- What things in the environment that we use can be replaced but only over long periods of time?

- What things in the environment that we use cannot be replaced when they are used up?
- What things that are growing scarce might be replaced by more abundant materials?

(IA2a—s, g)

What are the natural, human, and capital (economic) resources that help us meet our needs and wants?

- What things do we use from the non-human environment to meet our basic needs?
- What human resources do we use to meet our basic needs?
- What kind of economic capital do we need to meet our basic needs?
- What things do we use from the non-human environment to meet our wants?
- What human resources do we use to meet our wants?
- What kind of economic capital do we need to meet our wants?

(IA2a—s, e, g)

—II Exploration of Society—

A Nominal Environmental Literacy

2. Questions About How People Interact with the Environment

How do the different people around you respond to the weather?

- How do people behave in stormy weather?
- How do people behave in cold weather?
- How do people behave in hot weather?
- How do people behave in muggy weather?

(IIA2a—s, p, g)

What different kinds of activities do people do in a park?

- Do all people do the same things in the park?
- What things do they do that are active?
- What things do they do that are quieter?
- What things do they do alone?
- What things do they do with other people?

(IIA2a—s, p, g)

How do different kinds of clothing affect your inner environment?

- How does wool clothing make you feel inside?
- Is that the same in warm weather as in cold weather?
- How does cotton clothing make you feel inside?
- Is that the same in warm weather as in cold weather?

(IIA2a—s, p, g)

What are the things you need to do to get along with other people?

- How do you feel when others like you?
- How do you feel when others don't like you?
- What can you do to get others to like you?
- What can you do so that others won't dislike you?
- What can you do so that others will want to be in your company?

(IIA2a—ss, p)

How do we go about distributing things that are in short supply?

- How do we know that some things are in short supply?
- How is it determined that an item is in short supply?
- What are the ways we have a distributing any supplies scarce or not?
- Who determines how scarce materials are distributed?

Why do we need to share things that are in short supply?

- If there are more people than things to go around, how can everyone have a turn with the things?
- Should a few kids have all the things and others none?
- What happens when things are not shared?

(IIA2a—p, g)

How can we be fair to each other when sharing things?

- What does it mean to be fair with someone else?
- Who should decide what is fair?

(IIA2a—p, co)

What roles do the jobs of other people play in my life?

- What does the policeman do for you?
- What does the doctor do for you?
- What does the nurse do for you?
- What does the teacher do for you?
- What does the grocer do for you?
- What does the trash collector do for you?

(IIA2a—ss, g)

What is the role of people in the physical environment?

- On what facts do you base this?
- How does what we do affect the environment?
- How does people's activity affect other living things?

(IIA2a—s, ss, g)

How do other people affect us?

- On what facts do you base this?
- What things do other people do that help us?
- What things do other people do that is harmful to us?

(IIA2a—s, p, he, ss)

How do we affect the non-human surroundings?

- What different things do we do to this environment?
- Which of these things improve the non-human environment?
- Which of these things harm the non-human environment?

(IIA2a—s, g)

How does our community depend upon other communities, human and non-human?

- How do we recognize a community?
- What are the different parts of our community?
- What are the jobs performed by different people in our community?
- What do each of these jobs do for other people?
- What facts support dependence of our community on any other communities of living things?
- Into what groups would you organize the different communities?
- What characteristics do all of the groups of communities share?

(IIA2a—s, ss, g)

What are the uses of a functioning community?

- What costs and benefits do individuals receive from belonging to a community?
- When different communities interact, who gains and who loses what?
- What different kinds of costs are there? Are they all measured in money?
- What different kinds of benefits are there? Are they all measured in money?
- Into what groups can you organize the different kinds of costs and benefits?

(IIA2a—s, ss, e, g)

Who are the key players in our community and what do they do?

- What are the different roles people play in our community?
- Who are some of the people that fill those roles?
- What is your role in the community?
- Are some roles in the community more important than others?
- How would you rank the different roles?

(IIA2a—ss, c)

—III Exploration of Self—

F. Nominal Environmental Literacy

2. Questions About How People Interact with the Environment

What things make me feel safe in my surroundings?

- What things make me feel unsafe?
- Do I feel safe around most living things?
- Do I feel safe outside in severe weather like a thunderstorm or tornado?
- Do I feel safe around strangers?
- Do I feel safe around my family?
- Do I feel safe in my room?

(IIIA2a—p)

Upon which of my senses do I depend most?

- How much information do I gather with my eyes?
What kind of information?
- How much information do I gather with my ears?
What kind of information?
- How much information do I gather from touching?
What kind of information?
- How much information do I gather with my nose?
What kind of information?
- How much information do I gather with my tongue and taste buds?
What kind of information?
- What important things have I learned through my other senses?

(IIIA2a—p, s)

How do I react with my surroundings when I am feeling sick?

- Am I alert to my surroundings when I feel sick?
- Am I very social when I am sick?
- Am I sensitive to my mind/body surroundings?

(IIIA2a—p)

How does my body temperature compare with the temperature of the air around me?

- What is my normal body temperature?
- Is the temperature of the air usually warmer or cooler than that?
- How does an infection of germs change my normal body temperature?
- How does an infection from a virus change my normal body temperature?

(IIIA2a—p, s, he)

If I don't drink enough water what happens in my body?

- What does it mean to be dehydrated?
- What causes my body to become dehydrated?
- What are the usual consequences of being dehydrated?
- How will my body let me know I am getting dehydrated?

(IIIA2a—s)

How do unseen things (germs) in my surroundings make me sick?

- If I am in room where others are sneezing and coughing, am I likely to get sick as well? Why?
- If I handle door handles, tools, and other objects touched by sick people am I likely to get sick?
- What are germs?
- Can they be seen with the naked eye?
- In what ways can germs travel?
- How does my body protect me from germs?

(IIIA2a—s, he)

How do people relate to the non-human environment?

- How do different people represent the non- human environment in art and/or music?
- What ways do you see people treat non-human environments?
- On what facts do you base this?

(IIIA2a—s, ss)

In what ways does the non-human environment affect us?

- On what facts do you base this?
- What personal, sensory evidence do you have for this?

(IIIA2a—s)

In what ways do we affect the environment?

- On what facts do you base this?
- How do the things I do every day affect the world around me?

(IIIA2a—s)

What do I like and dislike in the world around me?

- Would I classify the things I like as good, bad, or neutral?
- Would I classify the things I dislike as good, bad, or neutral?

(IIIA2a—p)

What is it about the various items that I like or dislike?

- What is the reasoning or feeling behind each like or dislike?
- What alternative views to my likes and dislikes exist?
- What are the reasonings or feelings behind each alternative?
- What common threads do I see among those things I like and those I dislike?

(IIIA2a—p)

What fears do I have about the environment?

- What general patterns underlie my fears?
- Are my fears primarily rational or emotional?
- What facts support my fears?
- What facts raise doubts about my fears?

(IIIA2a—p)

What is my comfort range for temperature, rain, thunder and lightning, noises, odors, biting insects, drafts, humidity, dampness, other species, other people, neatness?

- Upon what facts and experiences do I base my current comfort ranges?

(IIIA2a—p, s)

What things do I most value about my relationship with the environment?

- How do I rank those values from most to least important?

(IIIA2a—p, co)

What forms of hygiene protect me from invasion by harmful bacteria or viruses?

- What public health practices increase my safety from invasion by diseases?
- What personal hygiene practices help keep me safe and reduce the chances of my spreading infections to myself or others?

(IIIA2a—s, he)

What do I find beautiful about the world around me?

- What are the things you see around you that are beautiful?
- What do you observe that is characteristic of all the things you have described as beautiful?

(IIIA2a—p)

What do I see around in the world around me that are ugly?

- How are all the ugly things alike?
- What could be done to change the ugly to beautiful?
- Who is responsible for the ugly items?
- Who would the players have to be to change the ugly to beautiful?
- What would it cost to make the ugly beautiful?
- If that cost were to be paid, who would benefit, who would lose?

(IIIA2a—p, s, ss, ar)

What fears do I have about the environment?

- What events lead me to that fear?
- Are my environmental fears rational or irrational? Who says?

(IIIA2a—p)

What parts of my surroundings do I pay attention to on a regular basis?

- What senses do you depend on most as you pay attention?
- What senses do you ignore most frequently?
- How often do you have to be exposed to an environmental stimulus before you start ignoring it in general?

(IIIA2a—p)

What parts of the landscape are always there that I am seldom aware of?

- How aware are you of what is happening in the sky?
- How aware are you of the variety of trees and plants around you?
- How aware are you of the nature of the ground under your feet?
- How aware are you of the electrical and telephone wires in your area?

(IIIA2a—p)

What parts of the landscape around me today am I seeing for the first time?

- Are you seeing them because they, or you are new to the area?
- Are you seeing them because someone else is alerting you to their existence?
- Are you now aware of them because they are suddenly having an impact on your health or safety?
- Why are you noticing them today?

(IIIA2a—p)

How does the environment that you see make you feel?

- Does the environment you see make you feel—glad, sad, happy, afraid, comfortable, uncomfortable, at ease, peaceful?

(IIIA2a—p)

How does the environment that you hear make you feel?

- Does the environment you hear make you feel—glad, sad, happy, afraid, comfortable, uncomfortable, at ease, peaceful?

(IIIA2a—p)

How does the environment that you smell make you feel?

- Does the environment you smell make you feel—glad, sad, happy, afraid, comfortable, uncomfortable, at ease, peaceful?

(IIIA2a—p)

What aspects of the environment make you feel glad, sad, happy, afraid, comfortable, uncomfortable, at ease, peaceful?

- Can you determine what things in the environment make you feel a particular way?

(IIIA2a—p)

—IV. Exploration of Connections—

• Nominal Environmental Literacy

1. Questions About How the Earth and Living Things Function and Interact

How do people and other animals and plants get enough water?

- What are the main ways plants and animals get water?
- How does the water get from outside the body to the inside of the body?
- Where do desert dwelling plants and animals get their water from?
- What do creatures forced to use sea water have to get rid of?
- How do people try to make sure there is enough water in the area for their needs?
- How do people and other animals use water to get rid of body wastes?

(IVA1a—s)

What different things do we use for food?

- People are said to be omnivores, what does this mean?
- How does the place we live shape the foods we eat?
- What is the role of cultures in shaping our food preferences?
- What kinds of technologies allow us to have a broader range of foods than were generally available a generation or two ago?

(IVA1a—s, g)

Where does most of our food come from?

- How much of the food you eat comes from your own town?
- How much of the food you eat comes from your state?
- How much of the food you eat comes from your country?
- How much of the food you eat comes from abroad?
- What countries produce most of your favorite foods?

(IVA1a—s,g)

What different parts of the world provide food for us?

- What are some of your favorite foods?
- Where in the world are these different foods grown or raised?
- Are growing seasons the same in the northern hemisphere as the southern hemisphere?

(IVA1a—g)

How do we get food from where it is grown to our table?

- If the food is grown in our own gardens how do we get it to table?
- If the food is grown in a different part of the country, how do we get it to table?
- If the food is grown in different parts of the world, how do we get it to table?
- What different kinds of energy are required in each of these situations to get the food from source to table?

(IVA1a—s, g)

What does food do for our bodies?

- Where do we get the materials for our growth?
- Where do we get the energy for motion and growth?

(IVA1a—s)

What different things does water do in our lives?

- What happens to sugar, salt, and many other things in water?
- How do we quench our thirst?
- How much of the different things we drink is made up of water?
- What is sweat and what does it do for us?
- In what ways do we stay cool in summer and what ways does water play a part in them?
- What is the role of water in snow and ice?
- What other living things need water? What role do these things play in our lives?

(IVA1a—s)

What kinds of things do insects do to and for plants?

- What kinds of things do insects eat?
- How are they adapted for eating different things?
- How does plant pollen get from one flower to another?

(IVA1a—s)

What do earthworms do to and for soil?

- What do earthworms eat?
- What happens to the waste from earthworms?
- As worms burrow what happens to the soil?

(IVA1a—s)

What does soil do for me?

- What different things make up soil?
- What different kinds of soil are there?
- What does soil do for the plants I eat?
- How does soil affect our ability to build buildings and other structures?

(IVA1a—s)

What other living things share our immediate environment and what do they do in that environment?

- What roles do these living things play in the environment?
- How do these other livings affect my life?
- How do the things I do affect the lives of other living things?

(IVA1a—s)

What are the major parts of my local ecosystems?

- What are the major habitats in the place where I live?
- What essential things does a habitat provide living things?
- How are the major habitats where I live connected to each other?

(IVA1a—s)

How does energy move through the environment?

- How do I know that energy is passed from one living thing to another?
- What living things trap energy coming in from the sun?
- What happens to the energy stored in a plant or animal when it dies?

(IVA1a—s)

What are the ways energy is transformed from one state to another?

- What evidence can you find of energy at work?
- What different kinds of energy do you think there are?
- What evidence can you find that one kind of energy appears to change into another kind?

(IVA1a—s)

What are important long and short term changes that regularly occur in our environment?

- What examples of quick changes can you find?
- What examples of changes that have occurred over several weeks, months, or seasons can you find?
- Into what groups could organize these changes?
- What are the defining characteristics of each group of changes?
- Based on your observations of changes what can you conclude?
- In what ways was the environment before X change different from what it is today?

(IVA1a—s)

In what ways have people adapted to the non-human and social environments?

- How does the environment affect us?
- How do we affect the environment?
- What is our environment?

(IVA1a—s, ss, g)

How does our community depend upon other communities, human and non human?

- What other communities share the area where I live?
- What non-human communities share the area where I live?
- What are the connections that exist between the different communities?
- How do individuals benefit from being part of a community?
- What does it cost an individual to be part of a community?

- In what ways does potential solution A differ from potential solution B. In what ways are the two potential solutions similar?

(IVA1a—ss, e)

Who are the key players in our community and what do they do?

- How do the key players inter connect with each other to make a community?
- Are all roles in the community equally important in keeping the community functioning?
- What happens to a community if some jobs (roles) go unfilled?
- In what ways is today's world similar to, and in what ways is it different from, that of your parents, grandparents, great grandparents?

(IVA1a—ss)

What materials from our environment do we use to make the things we use?

- What are our basic needs and how do they differ from wants?
- What are the connections between our wants and needs and the total environment around us?
- In what ways does sunlight interact with our bodies?

(IVA1a—s, g)

What is the relationship between use of environmental capital and the use of environmental interest?

- Does use of capital, or interest, have the greater impact on the environment?
- Can our society survive a long time if we keep using both our environmental interest and environmental capital?
- How would our society change if we lived only on our environmental capital?

(IVA1a—s, e)

How do we share the use of natural resources and energy among people fairly?

- If a use is fair, who benefits and who is hurt?
- Can a use of resources be considered just if anyone is hurt by that use?
- What percentage of people need to be benefited by a particular use of resources for that use to be considered just?

(IVA1a—s, ss, et)

Who are the producers and consumers in our community?

- Are you a producer or a consumer?
- Will you become a producer in the future?
- Will you always be a consumer?

(IVA1a—s, ss, e)

How does scarcity or shortages of basic resources, goods, and services affect our lives? the lives of other people in other parts of the world?

- What items are scarce in this country?
- What items are scarcest in third world countries?
- What factors make these items scarce?
- Are people at all levels of society affected equally by these scarcities or shortages?

(IVA1a—e, g)

Section 5: 5-8 Environmental Literacy Question Framework

These questions are set up in multi-age/grade groupings on the idealized assumption of a K-12 program for developing environmental literacy. We know that there are few if any places where such exists in reality. Leaders/teachers cannot automatically assume that their learners have developed the appropriate exploration of questions at an earlier age or grade level. This means that one has to explore and choose questions not only from those listed in a particular age/grade group but also from groups of questions below and/or above the categories you initially select.

I Exploration of Non-Human Surroundings—

A. Nominal Environmental Literacy

1. Questions About How the Earth and Living Things Function and Interact

What is an ecosystem?

- What things make up an ecosystem?
- What makes things happen in an ecosystem?

(IA1b—s)

What are the key elements of local ecosystems?

- What kinds of living things may be found in an ecosystem?
- What kinds of non-living things are needed in a functioning ecosystem?
- How do living things make a living in an ecosystem?
- What happens to wastes in an ecosystem?
- How do living things share energy in an ecosystem?
- What roles do people have in local ecosystems?

(IA1b—s)

What are the ways energy is transformed?

- What are the major forms of energy?
- What happens when one form of energy changes to another?
- What are the major potential sources of energy on our planet?
- How is energy transformed from potential to kinetic energy?
- How does energy flow through an ecosystem?
- How does entropy affect any system?
- How do our bodies get energy?

(IA1b—s,g)

How do energy forms and transformations drive change?

- What is gained and what is lost when energy changes form?
- What things are changed when energy changes forms?
- What is entropy and how does energy affect it?

(IA1b—s)

How do we categorize living organisms?

- In what key ways do living things differ from one another?
- Into what groups could you organize living things?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?
- What tools are available to help me identify living things?
- How are the rules set for scientific identification of various forms of life?

(IA1b—s, co)

How can we manage a system by changing its variables?

- How do we recognize the variables in a system?
- Based on the following facts (or observations) what can you conclude will happen if the following variable is changed?
- How likely is it that _____ will occur?
- Based on the following generalization (or rule, or principle) what predications can make about what will happen to the system if __X__ variable is changed?
- What are the conditions that make the conclusion inevitable?

(IA2b—s)

How do we choose technologies to make observations regarding complex systems?

- What criteria should we set for making a choice among technologies?
- How does the observation process affect the complex system to be observed?
- What are the errors in reasoning in this information?
- How is the information misleading?
- How could the information be corrected or improved?
- What is the general pattern underlying this information?

(IA1b—s, co)

What happens to systems that do not receive regular inputs of energy?

- What is the basic law of entropy?
- What is an argument that would support the following claim about what would happen to systems that don't receive regular inputs of energy?
- What are the limitations of or assumptions underlying this argument?

(IA1b—s, co)

In what watershed do you live?

- What is a watershed?
- What are the basic divides that bound your watershed?
- How does a drainage basin differ from a watershed?
- What drainage basin is that watershed a part of?
- What are the names of the major rivers of that drainage basin?

(IA1b—g, s)

What is the average annual precipitation in your area?

- What events are included in the term precipitation?
- In what months do you usually get the highest precipitation?
- In what months do you usually get the least precipitation?

(IA1b—g, s, m)

What are the average dates of the first and last killing frosts in your area?

- What is the difference between frost and killing frost?
- What activities are affected by the first and last killing frosts?
- What temperatures are usually present for a killing frost?

(IA1b—g, s, m)

What are the major soil types in your area?

- What factors determine different soil types?
- What soils types of your area are best for growing crops?
- What soils types are best for supporting buildings?

(IA1b—g, s)

What are the 10 most common animals in your area?

- What are the basic characteristics of animals?
- What are the criteria used to determine how common a particular animal species is?
- What are the 5 most threatened or endangered animal species in your state?

(IA1b—g, s)

What are the 10 most common plants in your area?

- In what ways do plants differ from animals?
- What criteria do you use to determine how common a particular plant species is?
- What are the 5 most threatened or endangered plant species in your state?

(IA1b—g, s)

Where does your drinking water supply come from?

- What is the difference between surface and ground water supplies?
- Is your drinking water source nearby or at a significant distance?
- How does the water get from the source to your home?
- In what ways is your water treated to make it safe for drinking?

(IA1b—g, s)

What are the most commonly used energy sources in your area?

- What do each of these energy resources originate from?
- How are the energy resources treated so that people can use them?
- Where are the energy resources geographically located?
- What are the relative costs of each of these energy resources in dollars?
- What are the relative costs of each of these energy resources in environmental impacts?

(IA1b—g, s, e)

2. Questions About How People Interact with the Environment

In what ways is the human community a part of nature?

- What are the facts about the similarities and differences between humans and other parts of nature?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?

(IA2b—s, g, h)

What human activities have impact on our biophysical environment?

- Into what groups could you organize these activities?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IA2b—s, g, co)

What human activities have impact on our social environment?

- Into what groups could you organize these activities?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IA2b—s, g, co)

What human activities have impact on our mind/body environment?

- Into what groups could you organize these activities?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IA2b—s, g, co)

Who makes choices that affect the environment?

- Based on the following generalization (or rule or principle) what predictions can you make or what conclusions can you draw that must be true?
- In to what groups could you organize the different choice makers?
- What are the defining characteristics of each group of choice makers?

(IA4b—s, c, g, co)

How do you describe our local environmental quality based on a net sum equation?

- How do we calculate net sums?
- What is the affect of large and small scale numbers on a net sum equation.
- What aspects of the local environment are increasing arithmetically?
- What aspects of the local environment are increasing exponentially?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?
- If _____, then what can you conclude must happen?
- What are the limitations of or assumptions underlying this argument?

(IA2b—m, s)

B. Functional Environmental Literacy

3. Questions About Problem Identification and Clarification

What school/community environmental challenges can you identify?

- What evidence do you have that these are environmental challenges or problems?
- How would you suggest correcting them?

(IB3b—p, co, c, s)

What is the environmental problem or issue we want to explore?

- How did we identify the problem?
- How were the questions explored phrased? Were they established with a null hypothesis?
- What are the various issues surrounding the problem?
- What biases are involved in the methods and results produced in answering a question?

(IB3b—s, c, ss, co)

What non-human and political and social systems and subsystems are connected to the problem?

- What evidence do you have for the involvement of each system or subsystem?
- What are the possible errors in reasoning in this information?
- In what ways is the information misleading?
- In what ways could the information be improved or corrected?

(IB3b—s, e, co, c)

How did the problem become a problem?

- What were the forces involved?
- What sequence of events led to the problem?
- Over what time period did the problem evolve?
- What human values led to the evolution of the problem?
- What natural or social systems or sub-systems became dysfunctional as the problem developed?

(IB3b—h, s, g, c)

In what ways are ecology and economics similar and dissimilar?

- What is the root word of both words?
- What is the source of energy for each term?
- To what arena of environment does each term belong?

(IC4b—co, s, g)

C. Operational Environmental Literacy

4. Questions About Making Environmentally Responsible Choices.

Can we determine what is "right behavior" toward the environment?

- What are the basic characteristics of "right" behavior toward the environment?
- What arguments support the claim that these are "right" behaviors?
- What are the limitations of assumptions underlying these arguments?
- Why would someone consider these behaviors not to be "right" behaviors?
- What is the reasoning behind their perspective?
- What are the major choices of ethical behavior toward the environment?
- What are the major components of our overall environment?

(IC4b—s, c, co, et)

What are the major belief systems about human/environment interactions?

- What cultures hold what human/environment belief systems?
- Why would someone consider each of these to be good, bad, or neutral?
- What is the cultural reasoning behind each perspective?
- What is your perspective and what is the reasoning behind it?

(IC4b—g, ss, et, p)

In what ways can we ethically address the rights of non-human life?

- Based on the following generalizations (rules or principles) what predictions can you make or what conclusions can you draw that must be true?

(IC4b—et, co)

How do we relate to others that share our ecosystems?

- Do we primarily exploit other living things?
- Do we take a live and let live approach?
- Do we destroy those creatures that compete with us for food and fiber?
- Do we destroy whatever creatures we do not find directly useful as food, medicine, source of fiber or shelter?
- Do we recognize a right for all species to exist while protecting our own species' interests within reason?

(IC4b—et, ss)

How can we determine the quality of our environment?

- What are our criteria for quality in environment?
- What ratings will we use?

- What time frame will we use for our determination?

(IC4b—s, g, co, h)

What are the current environmental issues and problems in our community?

- How do you identify these issues?
- What factors caused these issues and problems?
- How long have these issues and problems existed here?

(IC4b—s, g, co, ss, h, e)

What are some possible strategies for doing something about environmental change?

- What are some of the strategies available to me?
- Which of these strategies can I participate in effectively?
- How can I match the strategy to the types of environmental change?

(IC4b—c, s, ss, h, e, co)

How does technology affect the environment?

- Establish a listing of the positive and negative aspects of each technology.
- Rate the degree of impact of both the negative and positive impacts.
- Choose those in which the positives outweigh the negatives.

(IC4b—p, c, e, s, co)

II Exploration of Society—

A. Nominal Environmental Literacy

2. Questions About How People Interact With the Environment

How do human consumption patterns affect environments?

- What are our major patterns of consumption?
- What is the impact of our patterns of consumption of renewable and non-renewable resources?
- Do some patterns of consumption have greater impact on the environment than others?
- How do different patterns of consumption affect each of the major components of environment—bio-geo-physical, social, and mind/body?
- If _____, then what must you conclude must happen in terms of impact of patterns of consumption?
- In what ways do patterns of consumption affect pollution?

(IIA2b—e, g, ss)

What are the expected economic, social, and ecological costs and benefits of alternative proposals for resolving an issue?

- For any stated proposals for resolving and environmental issue—what are the expected economic costs and benefits?
- For any stated proposals for resolving and environmental issue—what are the

- expected social costs and benefits?
- For any stated proposals for resolving and environmental issue—what are the expected ecological costs and benefits?
- How does one weight all the costs and benefits involved in resolving an issue?

(IIA2b—e, ss)

What factors affect equity of access to resources by people of different economic and social status in our community?

- What are the risks to physical, mental, and economic health posed by any proposals to resolve and environmental issue?
- How is the degree of risk determined?
- Do any groups in the community find themselves at greater risks than the rest of the community?
- Do any groups in the community find themselves bearing a greater share of the costs of the proposal?
- What is the general pattern underlying this information?
- To what other situations does this general pattern apply?
- What steps can be taken to equalize the risk and fairly share the costs?

(IIA2b—e, ss)

What is our local environmental quality based on a net sum equation?

- How do we calculate net sums?
- What is the affect of large and small scale numbers on a net sum equation.
- What aspects of the local environment are increasing arithmetically?
- What aspects of the local environment are increasing exponentially?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?
- If _____, then what can you conclude must happen?
- What are the limitations of or assumptions underlying this argument?

(IIA2b—e, m,)

What are the historical roots of particular environmental issues?

- When and how did the issue become a problem?
- Are the roots of the problem natural or sociological?
- What is the time frame over which the problem developed?
- Did the problem develop arithmetically or exponentially

(IIA2b—h, g)

How do my personal consumption patterns affect the environment?

- What are the causes of human consumption patterns?
- What are the effects of these human consumption patterns?
- Based on the following generalization (or rule or principle)----- what predict can you make or what conclusions can you draw that must be true?
- If-----then what can you concluded must happen?
- What are the conditions that make this conclusion inevitable?

(IIA2b—e, co, s, ss)

What are the expected economic, social, and ecological costs and benefits of alternative proposals for resolving an issue?

- What are the errors of reasoning in this information?
- In what ways do you find some of the information misleading?
- How could the information be improved or corrected?

(IIA2b—s, ss, e, h, co)

Who makes choices that affect the environment?

- Do other animals make choices that affect the environment?
- Do plants make choices that affect the environment?
- Do you and other people make choices that affect the environment?
- What types of choices do you make that affect the environment?

(IIA2b—c, p, s, g)

What questions do you need to ask about artistic and engineering design?

- What does a particular design do for us?
- Do we need it?
- What is the effect of the design on the community?
- Is the design ethical? If yes, for whom?
- Who does what is ethically right?
- Who decides what is ethically right?
- What is the effect of the design on people's self-worth and self-reliance?
- What are the ecological and social consequences of the design?

(IIA2b—g, s, ar, et, ss)

In what ways is artistic and engineering design a part of our day to day environment?

- What kinds of things in our environment are designed by people?
- In what ways does human engineered design affect our environment?
- What types of design do you see in nature?
- What are the consequences of the designs you see in nature and those created by people?

(IIA2b—g, s, ar, ss)

What has to be done to assure good environmental design?

- How do we recognize good environmental design?
- Who chooses good environmental design?
- What is the role of cost in creating good environmental design?
- In what ways are people affected by bad environmental design?
- What in our community are examples of good environmental design?
- What in our community are examples of bad environmental design?
- How much did each of these examples cost?
- How much are the bad designs costing us on a regular basis?

(IIA2b—a, s, g, e)

How much are the bad designs costing us in healthfulness?

- In what ways does bad design affect our health?
- What are some of the health costs of the consequences of bad design?
- Who pays the costs of health risks from bad design?

(IIA2b—s, e)

Who makes the decisions about how your environment looks and sounds?

- What examples can you find of government activities that affect how your environment looks and sounds?
- What examples can you find of family activities that affect how your environment looks and sounds?
- What examples can you find of how nature affects how your environment looks and sounds?
- What examples can you find about how your activities affect how your environment looks and sounds?

(IIA2b—s, c, co)

What things can you do to change the way your environment appears?

- Can you do these by yourself?
- Who do you need to work with to bring about such change?

(IIA2b—c, ss)

What is my role in building public awareness of environmentally damaging design and it is implemented?

- What messages do I want to communicate to others?
- What tools do I need to communicate these messages?
- Which of these tools best suits my role in building public awareness?

(IIA2b—p, co)

How has the natural world shaped our national history?

- What natural resources led to our ability to develop our country?
- How have natural events helped or hindered specific historical events?
- How have the differing cultural views of the natural world affected the settlement of our country?
- How has access to natural resources affected our global relationships?

(IIA2b—h, ss, g, et)

III Exploration of Self—

A.Nominal Environmental Literacy

2.,Questions About How People Interact With the Environment

What do I like and dislike in the world around me?

- Would you classify the things you like as good, bad, or neutral?
- Would you classify the things you dislike as good, bad, or neutral?

(IIIA2b—p, s, co)

What is it about the various items that I like or dislike?

- What is the reasoning or feeling behind each like or dislike?
- What alternative views to my likes and dislikes exist?
- What are the reasons or feeling behind each alternative?

(IIIA2b—p, s, co)

What fears do I have about the environment?

- What general patterns underlie my fears?
- Are my fears primarily rational or emotional?
- What facts support my fears?
- What facts raise doubts about my fears?

(IIIA2b—p)

What is my comfort range for temperature, rain, thunder and lightning, noises, odors, biting insects, drafts, humidity, dampness, other species, other people, neatness, personal and social space?

- Upon what facts and experiences do I base my current comfort ranges?
- What are the causes of my discomfort?
- What are the effects of my discomfort?

(IIIA2b—p, s)

What things do I most value about my relationship with the environment?

- How do I rank those values from most to least important?

(IIIA2b—p)

How can I work cooperatively with others to improve the environment?

- What attitudes do I need to demonstrate to work cooperatively?
- How can I convince others of the need for cooperate efforts?
- What types of environmental efforts demand cooperative efforts?
- What types of environmental efforts can I do by myself?

(IIIA2b—c, s, ss, co)

How does my body respond to invading microbes?

- How do I feel when I am ill?
- When I am ill do I feel like working with others to solve problems?
- When I am ill do I feel like going to meetings?
- When I am ill can I give my all physically?
- When I am ill am I able to focus fully on activities?

(IIIA2b—p, s)

How does my body respond to allergens?

- What are allergens?
- Where do allergens come from?
- How do allergens affect the body?
- How do I feel during an allergy attack?

(IIIA2b—s, p)

How do environmental conditions affect my moods?

- Do my moods change with changes in weather conditions?
- Do my moods change with changes in the social environment?
- Do my moods change with changes in the mind/body environment?
- How do my moods affect my ability to work cooperatively with others?
- How may people's health and inner feelings be enhanced or crippled by the physical and/or social environments?

(IIIA2b—p, s)

How do people's inner feelings affect their day to day actions?

- In what ways do moods affect how people act?
- In what ways do illnesses affect how people act?
- In what ways do peoples inner feeling affect how they act toward the social, and non-human environments.
- How may people's health and inner feelings be enhanced or crippled by the physical and/or social environments?

(IIIA2b—p, s, c, co)

In what ways does good design, particularly in the built environment, affect people's mental and physical health?

- How do the different designs of the built environment make me feel?
- Which designs make me feel comfortable or good?
- Which designs make me feel uncomfortable or bad?
- Which kinds of designs make me physically ill?

(IIIA2b— ar, s)

In what ways am I rich in non-monetary ways?

- What things in nature may me feel good and happy?
- What activities do I enjoy that cost little or no money?
- What relationships with other people make me happy?
- What relationships with other people make me sad or angry?
- What natural resources do I need to keep me happy?

(IIIA2b—ar, s)

IV Explorations of Connections—

A. Nominal Environmental Literacy

1. Questions About How the Earth and Living Things Function and Interact

What is an ecosystem?

- How are the parts of an ecosystem interconnected?
- How do systems and subsystems interact?

(IVA1b—s, g)

How are materials recycled in nature?

- What happens when plants or animals die and decay?
- What evidence do you have that this happened?
- What do plants need in order to grow?
- Where do plants get these materials?
- What are the connections between the death and decay of living things and the birth and growth of living things?

(IVA1b—s)

How do organisms respond to changes in environmental conditions?

- If _____, then what can you conclude must happen?
- What are the conditions that make this conclusion inevitable?
- What are the errors of reasoning in this information?
- How is the information misleading?
- What is the general pattern underlying this information?

(IVA1b—s, co)

How do births, deaths, and migrations affect local populations?

- What constitutes a local population of any living thing?
- What are the affects of births and deaths of the local population of any living things?
- How does emigration of individuals from other populations affect the local population?
- How does immigration of people from other countries affect the population of the United States?

(IVA1b—s, ss, g, h)

How does energy type and way of use drive change?

- What are the major forms of energy?
- What are the major states of energy?
- What changes occur when energy changes state or form?
- What are the scientific laws of thermodynamics that govern these changes?

(IVA1b—s)

How can we manage a system by changing its variables?

- What is the connection between specific variables and the functioning of a particular system?
- What can we conclude is likely to happen to the system if specific variables are changed?
- How can this information be used to manage the system?
- What criteria could be used to determine how to change which variables to what ends in managing the system?

(IVA1b—s, ss)

What happens to systems that do not receive regular inputs of energy?

- What is needed to keep systems organized?
- How are the laws of entropy related to functioning systems?
- What evidence can you find for this?

(IVA1b—s)

What are the routes that pathogens and allergens use to invade our bodies?

- What are pathogens?
- * What are allergens?
- What parts of the body have the most intimate connections to the physical environment?
- In what ways do social contacts affect the spread of pathogens and allergens?
- How do we make contact with the common cold virus?
- What pathogens are spread by insect and animal bites?
- What can you do to prevent the spread of pathogens?

(IVA1b—s, he)

2. Questions About How People Interact With the Environment

How do human consumption patterns affect the different types of environments —non-human, social, and mind/body?

- What are the relationships between the things humans use to make things and resources needed to make them?
- How do the numbers of people buying any given product affect the availability of the resources needed to make the product?
- In what ways does the process of making of product from raw resources affect the environment?
- In what ways does transporting resources and finished products from their source to consumers affect the environment?
- In what ways does energy availability affect the production and consumption of materials and goods?

(IVA2b—g, e, s, ss)

What are the expected economic, social, and ecological costs and benefits of alternative proposals for resolving an issue?

- What are the connections between these different types of costs and benefits?

(IVA2b—e)

What affects equity of access to resources by people of different walks of life in our community?

- What are the different social strata of our community?
- Which strata have greater access to a particular resource and which have less access?
- Why would someone consider this to be good, bad, or neutral?
- What is the reasoning behind their perspective?
- What are alternative perspectives and what is the reasoning behind each?
- What changes in the interconnections would have to change for greater equity to exist in access to basic resources?

(IVA2b—et, g, co, ss)

What is our local environmental quality based on a net sum equation?

- What are the plus and minus interconnections that result in net sum environmental quality judgements?

(IVA2b—s)

What are the historical roots of particular environmental issues?

- When and how did the issue become a problem?
- What are the connections between the past and present status of the issue?
- What are the probable connections between the present and future status of the issue?
- How do the origins and development of the issue point to possible solution?
- What are the affects of crowding and lack of space on human activities and states of mind?

(IVA2b—h)

What are the basic interconnections among the three basic components of environment—non-human, social, and mind/body?

- How does the physical environment affect my health and well being?
- How does the social environment affect how I deal with the physical environment?
- How does the mind/body environment affect the way I deal with the social and physical environments?

(IVA2b—s, g, he)

How does any given issue affect other aspects of the environment?

- Choose an issue you are interested in.
- Create a concept map showing connections to various aspects of the environment.
- What connections and interconnections do you find?

(IVA2b—s, co)

Section 6: 9-12 Environmental Literacy Framework

These questions are set up in multi-age/grade groupings on the idealized assumption of a K-12 program for developing environmental literacy. We know that there are few if any places where such exists in reality. Leaders/teachers cannot automatically assume that their learners have developed the appropriate exploration of questions at an earlier age or grade level. This means that one has to explore and choose questions not only from those listed in a particular age/grade group but also from groups of questions below and/or above the categories you initially select.

—I Exploration of Non-human Surroundings—

A. Nominal Environmental Literacy

1. Questions About How the Earth and Living Systems Function and Interact

How do the major layers of the planet, from lithosphere, to hydrosphere, to atmosphere, affect the maintenance and survival of living things?

- What are the major layers of the planet?
- In what ways does each layer impact the different life forms?
- In what ways are various life forms restricted to particular layers of the planet and why?
- In what ways do living things adapt to different layers of the planet?
- In what ways do humans adapt to various features of each layer of the planet?

(IA1c—s, g)

What are the key features and locations of the terrestrial biomes of this planet?

- Into what groups can you organize the key features of the planet?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?
- Where, on a map of the planet, are each of the major terrestrial biomes located?
- What are the major resources of each biome?

(IA1c—s, g)

What are the key features and locations of the aquatic biomes of this planet?

- Into what groups can you organize the key aquatic features of the planet?
- What are the rules for membership in each group?

- What are the defining characteristics of each group?
- Where, on a map of the planet, are each of the major aquatic biomes located?
- What are the major resources of each aquatic biome?

(IA1c—s, g)

What is the role of the major bio-geo-chemical cycles in the health and survival of living organisms and their habitats?

- What resources do these cycles provide to living things?
- What systems principles underlie these cycles?
- What are the inputs and outputs of each cycle?

(IA1c—s)

How do the processes of photosynthesis and respiration work together to allow continuation of life on earth?

- What is the process of photosynthesis?
- What is the process of respiration?
- Based on your understanding of the two processes, what predictions or conclusions can you draw about the relationship between these two processes?
- What is the general pattern underlying this information?
- What is the carbon cycle?

(IA1c—s)

What are the causes and consequences of exponential growth on different populations of living things?

- In what ways do arithmetical and exponential growth differ?
- What factors affect whether population growth will be arithmetic or exponential?
- How does arithmetic population growth impact natural resources?
- How does exponential population growth impact natural resources?

(IA1c—s, m)

How do global weather and climate patterns affect the distribution of airborne pollutants?

- What are the major weather and climate patterns?
- What are the sources of airborne pollutants?
- In what ways do airborne pollutants move from one place to another?
- In what ways can sources of airborne pollutants be reduced or eliminated?

(IA1c—s, g)

How does distribution of moisture in watersheds affect plant and animal communities?

- How do moisture requirements vary among species?
- To what extent is moisture a limiting factor for each species?
- How does moisture vary within the topography of a watershed?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?

(IA1c—s, g)

How does the concept of “carrying capacity” relate to both ecological and economic issues?

- What is the concept of carrying capacity?
- What is likely to happen if the carrying capacity of an area is exceeded?
- How does the idea of carrying capacity work in economic terms?
- Are human populations subject to consequences of exceeding carrying capacity?

(IA1c—s, g, e, et)

How do competition and symbiosis contribute to the so-called balance of nature?

- In what ways do living things compete with one another?
- How does symbiosis affect the competition among living things?
- How does parasitism alter the competition or symbiotic factors among living things?

(IA1c—s,)

What is the role of “natural selection” in biological change?

- What is the process of natural selection?
- In what ways does natural selection guide change among living things?
- Are humans subject to the process of natural selection?
- In what ways have people altered natural selection to develop domesticated plants and animals?

(IA1c—s,)

In what biomes do ecosystems have the greatest biodiversity?

- What are *keystone species* and why are they so important in ecosystems?
- Why can *generalist species* be found in more places than *specialist species*?
- Which existing species are most likely to adapt to environmental changes brought about by man?
- What relationships exist between density of human population and local biodiversity?
- What is the impact of habitat destruction on biodiversity?
- Are all species of equal importance to an ecosystem or are some more important to an ecosystem than others?

(IA1c—s,)

How long does it take for air from one place to be thoroughly mixed over the surface of the planet?

- What forces contribute to mixing air masses?
- Can natural forces cause widespread air pollution?
- What human illnesses are caused or worsened by poor air quality?
- What are thermal inversions and how do they work to worsen air quality?

(IA1c—s, g)

B. Functional Environmental Literacy

2. Questions About How People Interact With the Environment

What is the capacity of different soils for human use and the survival of all living things?

- What are the major soil types of each biome?
- What are the characteristics of each major soil type?
- What are the major uses and limitations for each major soil type?
- In what ways are soil types formed and altered?
- What are the major components of any soil?

(IA2c—s)

How large a population can the world's agricultural acreage support?

- What are the major categories of agricultural production?
- What are the relative environmental impacts of large scale corporate farming vs subsistence farming?
- What are the costs and benefits of large scale vs small scale farms?
- Will the trend toward large corporate farms work for or against good land use practices?
- What farming lessons can we learn from subsistence societies where plots of land have been intensively farmed for hundreds of years without losing their fertility and productivity.
- What is the overall effect on world food production and longterm land conservation of chemical vs organic fertilizers and pesticides?

(IA2c—s ,g, e, ss)

What factors, human and non-human, affect changes in climate patterns?

- How does climate differ from weather?
- What factors affect long term weather patterns?
- Which of these factors is affected by human activities?
- If _____, then what can you conclude must happen?
- What are the conditions that make this conclusion inevitable?
- What is the general pattern underlying this information?

(IA1c—s, g)

What are the flow patterns of energy in functioning ecosystems?

- What constitutes a food chain?
- In what ways does a food web differ from a food chain?
- What energy transformations take place in a food chain or web?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?
- What are examples of energetically closed and energy open systems?

(IA1c—s)

What are the boundaries of the watershed and drainage system in which I reside?

- What factors determine the boundaries between watersheds?
- What pattern of relationship relates watersheds to drainage systems?
- As water runs off the land from my school and/or home where does it flow to?
- If my watershed is my ecological address, how do I write that address?
- Who else in my school or youth group shares this address?
- What is the topography and geography of the watershed in which I live?
- What other living things live in my watershed?

(IA1c—s, g)

—II Exploration of Society—

3. Nominal Environmental Literacy

2. Questions About Problem Identification and Clarification

For any given environmental issue what human goals, values and needs are at stake?

- Who are the key players and their viewpoints?
- What are the alternative solutions and their potential consequences?
- What are the interconnections between goals, values, and attitudes about environmental issues?

(IIA2c—s, ss, c, et, e)

What are the major relationships, energy usage, and resource impact of humans of any culture on their environment?

- What is the general pattern underlying this information?
- Based on the following generalization (or rule or principle) what predictions can you make or what conclusions can you draw that must be true?
- If X , then what can you conclude must happen?
- What are the conditions that make the conclusion inevitable?
- In what ways is today's world similar to and in what ways is it different from that of your parents, grandparents, great grandparents?

(IIA2c—g, ss, s, e)

How do environmental problems and solutions change over time?

- For each environmental problem, when did it begin to be a problem?
- For each environmental problem, how long has it been a problem?
- How long is it projected to take to correct the problem?

(IIA2c—h, e, g)

In what ways are producers and consumers interdependent in your community?

- What do producers provide to consumers?
- What do consumers provide to producers?
- In what ways are producers also consumers?
- What are the various linkages between producers and consumers?

(IIA2c—s, g, e)

How do economic decisions in one region affect the environment in other regions?

- What are the relationships between where products are produced, raw resources secured, and where products are consumed?
- Where do the resources for a product I buy originally come from?
- Where do the wastes from producing the product end up?
- Where do the wastes from my consumption of the product go?
- How do the resources get to the places where they are manufactured?
- How do the manufactured products get to the markets?

(IIA2c—e, g,)

What are the relationships between environmental materials and energy flow?

- In what direction does energy flow through a system?
- How does matter (material) move in systems?
- What is “material throughput”?

(IIA2c—s, e)

What does the law of entropy indicate to us about the costs of environmental management?

- What is the law of entropy?
- How does this law affect the amount of energy available to a system?
- What has to happen in order for the organization in a system to be maintained.

(IIA2c—s, e)

What are the most current projections of human population growth?

- Who keeps such records?
- How do they gather the information?
- Roughly how accurate is this information?
- What countries are having the greatest growth?
- What countries are having the smallest population growth?

(IIA2c—s, m, ss, p, he)

What are the impacts of exponential human population growth on the non-human, social, and mind/body aspects of environment?

- What do we mean by exponential population growth?
- How does exponential growth differ from other kinds of growth?
- How does exponential human population growth impact the non-human environment?
- How does exponential human population growth affect the social environment?
- How does exponential human population growth affect our mind/body environment?

(IIA2c—s, m, ss, p, he)

4. Questions About Making Environmentally Responsible Choices.

In what ways is the human community a part of nature?

- What are the facts about the similarities and differences between humans and other parts of nature?
- What is the general pattern underlying this information?
- To what other situations does the general pattern apply?
- What are the sources for your answer to these questions?

(IIA4c—s, ss)

What human activities have impact on our non-human, social, and mind/body environments?

- Into what groups could you organize these different activities?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IIA4c—s, e, p, ss, h, he)

What individuals and groups make choices that affect the environment?

- Based on the following generalization (or rule or principle) _____ what predictions you make or what conclusions can you draw that must be true?
- Into what groups could you organize the different choice makers?
- What are the defining characteristics of each group of choice makers?

(IIA4c—ss, co, c)

4. Functional Environmental Literacy

What school/community environmental challenges can you identify?

- What are the interconnections that exist between the challenges and issues we identify?
- How are these challenges connected to issues at the state, national, and global scales?

(IIA3c—co, s, ss, et)

How would you suggest dealing with these challenges?

- What interconnected systems need to be adjusted to correct the problem or issue you perceive?
- Who needs to be involved in dealing with the challenges?
- What level of involvement will be needed to meet the challenges?
- What is the time frame you think will be needed to achieve the desired results?
- How would you measure the effectiveness of your strategy?

(IIA3c—s, ss, c, h, et)

What is the environmental problem or issue we want to explore?

- How did we identify the problem?
- How were the questions explored phrased? Were they established with a null hypothesis?
- What are the various issues surrounding the problem?
- What biases are involved in the methods and results produced in answering a question?
- What bio-geo-physical and social systems and subsystems are involved with the problem?
- How did the problem become a problem?
- What were the forces involved?
- What systems or subsystems were made dysfunctional?

(IIA3c—s, ss, h, co)

Who are the human players involved with the problem?

- How did you determine who the players were?
- What were the facts that helped you determine that each was a player?

(IIA3c—ss, c, co)

What values and beliefs do each of the major player groups hold?

- What evidence do you have that the player groups hold particular values and beliefs?
- In to what categories would you place the different beliefs and values?
- What are the defining characteristics of each group?
- Based upon the various values and beliefs of a group what predictions can you make or what conclusions can you draw about the position each group is likely to make about any particular action alternative?

(IIA3c—ss, c, co)

What are the costs and benefits, both ecological and economic, created by the problem?

- What are the sources of your information on projected costs and benefits?
- What is the reliability and validity of each of these sources?
- What are the errors in reasoning in this information?
- In what ways is any of the information misleading?
- How could the information be corrected or improved?

(IIA3c—ss, c, co, e, s)

What can possibly be done to make the dysfunctional subsystems functional again?

- How did you determine which systems or sub-systems were dysfunctional?
- Based on the following generalizations (or rule or principle) what predictions can you draw that must be true?
- If _____, then what can you conclude must happen?
- What are the conditions that make this conclusion seemingly inevitable?
- What is an argument that would support your claim of an action position?
- What are the limitation of or assumptions underlying this argument?

(IIA3c—ss, c, co)

What are the costs and benefits involved in correcting the dysfunctional systems?

- What are the sources of your information on projected costs and benefits?
- What is the reliability and validity of each of these sources?
- What are the errors in reasoning in this information?
- In what ways is any of the information misleading?
- How could the information be corrected or improved?

(IIA3c—ss, c, co)

Who would have to take the actions to correct the dysfunction?

- What is an argument in favor of the following individuals or groups having to be involved in the corrective action?
- What are the limitation of or assumptions underlying the argument?

(IIA3c—ss, c, co)

What changes would these people have to make in order to take those actions?

- What behaviors would they have to change?
- What values would they have to change?
- What beliefs would they have to change?
- Would the players likely see these changes as good, bad, or neutral?
- What would be the reasoning behind their perspective?
- What would be the easiest first steps?
- What would be a logical sequence for these steps?

(IIA3c—ss, c, co)

What is my role in bringing about the necessary changes?

- What actions would I need to take?
- What beliefs and/or values would I need to change?
- What is my degree of commitment to the needed changes?
- What connections would I have to make with others to be most effective?
- How important is this issue to me and why?

(IIA3c—ss, c, co)

What are the assumed risks and benefits of the potential consequences of all proposed alternative solutions to environmental issues?

- For each alternative, who benefits and who loses?
- What are the ripple effects of each alternative?
- What potential new problems are generated by each alternative?
- What are the projected long and short range consequences of each alternative?

(IIA3c—s, ss, g, e)

For any given environmental issues what human goals, values and needs are at stake? Who are the key players and their viewpoints? What are the alternative solutions and their potential consequences?

- What are the causes of these environmental issues?
- What are the consequences of these environmental issues on us? on other living things? on the functioning of ecosystems?
- Based on the facts obtained what can you conclude about the alternatives and their solutions?
- How likely is it that any of the proposed solutions will be accepted?
- How likely is it that any of the proposed solutions can be implemented?

(IIB3c—s, ss, e, co)

5. Operational Environmental Literacy

What are the effects of war on the culture and environments of all parties in that war?

- What are the connections between technology of warfare and natural resource?
- What are the connections between social and mind/body environments and the impacts and consequences of warfare?

(IIC3c—s, ss, e, et, g)

How do we determine what is "right behavior" toward the environment?

- What are the major components of our overall environment ?
- What are the basic characteristics of "right" behavior toward the environment?
- What arguments support the claim that these are "right" behaviors?
- What are the limitations of assumptions underlying these arguments?
- Why would someone consider these behaviors not to be "right" behaviors?
- What is the reasoning behind their perspective?
- What are the major choices of ethical behavior toward the environment?

(IIC4c—et, co)

In what ways are ecology and economics similar and dissimilar?

- What are the interconnections between ecology and economics?
- What do the root words of both tell you about their relationships?
- How is energy represented in both terms?
- The concepts of which word are most important in decision making?

(IIC4c—s, e, et, co)

What are the major belief systems about the people/environment interactions?

- What cultures hold what human/environment belief systems?
- Why would someone consider each of these to be good, bad, or neutral?
- What is the cultural reasoning behind each perspective?
- What is your perspective and what is the reasoning behind it?
- How do religious beliefs affect the environment?

(IIC4c—g, et, co)

How should we treat the organisms and systems that make up our planet?

- What choices do we have about how to treat other creatures and ecosystems?
- How can we select among those choices?
- What criteria will help us decide how we should treat others?
- Are there actions that are acceptable in some situations, but not in others? How can you tell?

(IIC4c—et, s, ss)

—III Exploration of Self—

G.Nominal Environmental Literacy

2.Questions About How People Interact With the Environment

In what ways are human activities, including mine, stressing local ecosystems?

- What are the consequences of these activities on ecosystems?
- Based on the following generalization (or rule or principle) what predictions can you make or what conclusions can you draw that must be true?
- If _____ then what can you conclude must happen?
- What are the conditions that make this conclusion inevitable?
- How does the number of people in a fixed space affect the quality of the three categories of environment—mind/body, social, and non-human?

(IIIA2c—s, ss, g)

In what ways are stressed ecosystems affecting my and other human's health and well being?

- What are the consequences of stressed ecosystems on human health?
- What are the errors of reasoning in this information?
- In what ways do you find some of the information misleading?
- How could the information be improved or corrected?
- How does the number of people in a fixed space affect the quality of the health of the mind/body, social, and bio-geo-physical environments?

(IIIA2c—s, he, ss, g)

What human values, including mine, result in behaviors that stress ecosystems?

- Why would someone consider these values to be good, bad, or neutral?
- What is the reasoning behind their perspective?
- What is an alternative perspective and what is the reasoning behind it?
- What is an argument that would support each claim?
- What are the limitations of or assumptions underlying each claim?
- Where did those values come from?

(IIIA2c—s, ss, g, et, co)

B. Functional Environmental Literacy

2. Questions About How People Interact With the Environment

What do I like and dislike in the world around me?

- Would you classify the things you like as good, bad, or neutral?
- Would you classify the things you dislike as good, bad, or neutral?
- What is it about the various items that I like or dislike?
- What is the reasoning or feeling behind each like or dislike?
- What alternative views to my likes and dislikes exist?
- What is your reasoning or feeling behind each alternative?

(IIIB2c—p, co)

What fears do I have about the environment?

- What general patterns underlie my fears?
- Are my fears primarily rational or emotional?
- What facts support my fears?
- What facts raise doubts about my fears?

(IIIB2c—p, co)

What is my comfort range for temperature, rain, thunder and lightning, noises, odors, biting insects, drafts, humidity, dampness, other species, other people, neatness?

- What causes my discomfort?
- What are the consequences of my discomfort?
- Upon what facts and experiences do I base my current comfort ranges?

(IIB2c—p, s, co)

What things do I most value about my relationship with the environment?

- How do I rank those values from most to least important?

(IIB2c—p, co)

How do you describe the way you feel about your surroundings right now?

- How did you feel about your surroundings when X happened earlier?
- What made you feel that way?

(IIB2c—p, co)

What things in your environment make you feel sad, anxious, scared, or angry?

- What do you do when you feel any of these ways?
- Does what you do make you feel any better?
- What other things can you do to make you feel better?
- How do you think other people feel in similar situations?
- How do you think your actions affect other people around you?

(IIB2c—p, co)

What things in your environment make you feel happy, relaxed, joyful ?

- What do you do when you feel any of these ways?
- Does what you do make you feel any better?
- How do you think other people feel in similar situations?
- How do you think your actions affect other people around you?

(IIB2c—p, co)

How do events in each environmental arena affect your health?

- How do air pollutants affect your health?
- How does stress from the social environment affect your health?
- How does available sunlight affect your mind/body moods?
- How does your personal health affect the social environment?

(IIB2c—p, s, ss, co)

3. Questions About Problem Identification and Clarification

What school/community environmental challenges can you identify?

- What evidence do you have that these are environmental challenges or problems?
- What are the causes of the challenges you perceive?
- What are the likely effects on the community of these challenges or problems?

(IIB3c—s, c)

How would you suggest correcting them?

- What is the environmental Problem we want to explore?
- How did we identify the problem?
- How were the questions explored phrased?
- Were they established with a null hypothesis?
- What are the various issues surrounding the problem?
- What biases are involved in the methods and results produced in answering a question?

(IIB3c—s,ss, co)

What non-human and social systems and subsystems are involved with the problem?

- What are the causes of the problem?
- What are the likely consequences of the problem?
- In to what groups could you organize these things?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?
- How are these systems alike and how are they different?
- What is the general pattern underlying each system and subsystem?
- How did the problem become a problem?
- What were the forces involved?
- What systems or subsystems were made dysfunctional?

(IIB3c—s, ss, c

Who are the human players involved with the problem?

- How did you determine who the players were?
- What were the facts that helped you determine that each was a player?
- What is the role of each of the players in the problem?

(IIB3c—ss)

What values and beliefs do each of the major player groups hold?

- What evidence do you have that the player groups hold particular values and beliefs?
- Into what categories would you place the different beliefs and values?
- What are the defining characteristics of each group?
- Based upon the various values and beliefs of a group what predictions can you make or what conclusions can you draw about the position each group is likely to make about any particular action alternative?

(IIB3c—ss)

What are the costs and benefits, both ecological and economic, created by the problem?

- What are the sources of your information on projected costs and benefits?
- What is the reliability and validity of each of these sources?
- What are the errors in reasoning in this information?
- In what ways is any of the information misleading?
- How could the information be corrected or improved?

(IIB3c—e, s, co)

What can possibly be done to make the dysfunctional subsystems functional again?

- How did you determine which systems or subsystems were dysfunctional?
- Based on the following generalizations (or rule or principle) what predictions can you draw that must be true?
- If _____, then what can you conclude must happen?
- What are the conditions that make this conclusion seemingly inevitable?
- What is an argument that would support your claim of an action position?
- What are the limitation of or assumptions underlying this argument?

(IIB3c—s, ss)

What are the costs and benefits involved in correcting the dysfunctional systems?

- What are the sources of your information on projected costs and benefits?
- What is the reliability and validity of each of these sources?
- What are the errors in reasoning in this information?
- In what ways is any of the information misleading?
- How could the information be corrected or improved?

(IIB3c—e, s, co)

Who would have to take the actions to correct the dysfunction?

- What is an argument in favor of the following individuals or groups having to be involved in the corrective action?
- What are the limitation of or assumptions underlying the argument?

(IIB3c—c, ss, co)

What changes are necessary in order to take those actions?

- What behaviors would they have to change?
- What values would they have to change?
- What beliefs would they have to change?
- Would the players likely see these changes as good, bad, or neutral?
- What would be the reasoning behind their perspective?

(IIB3c—p, ss, et, co)

What is my role in bringing about the necessary changes?

- What actions would I need to take?
- What beliefs and /or values would I need to change?
- What is my degree of commitment to the needed changes?

(IIB3c—p)

4. Questions About Making Environmentally Responsible Choices.

Do I think I am primarily biophilic or biophobic?

- What is biophilia?
- What are the general consequences of biophilia?
- What is biophobia?
- What are the general consequences of biophobia?
- Which tends to be more prevalent in our society—biophilia or biophobia?

(IIIB3c—s, ss, et)

What human activities impact our non-human, social, and mind/body environments?

- Into what groups could you organize these activities for each of the environmental arenas?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IIIB4c—s, ss, e, g)

Who makes choices that affect the environment?

- Based on the following generalization (or rule or principle) ————what predictions can you make or what conclusions can you draw that must be true?
- Into what groups could you organize the different choice makers?
- What are the defining characteristics of each group of choice makers?

(IIIB3c—s, ss)

How do we determine what is "right behavior" toward the environment?

- What are the major components of our overall environment?
- What are the basic characteristics of "right" behavior toward the environment?
- What arguments support the claim that these are "right" behaviors?
- What are the limitations of assumptions underlying these arguments?
- Why would someone consider these behaviors not to be "right" behaviors?
- What is the reasoning behind their perspective?
- What are the major choices of ethical behavior toward the environment?

(IIIB3c—et, co)

How do we show proper respect to the systems of the planet?

- What behaviors that we choose show respect for the planet and its life forms?
- What criteria will help us decide what is proper respect?

(IIIB3c—et, co)

C. Operational Environmental Literacy

3. Questions About Problem Identification and Clarification

In what ways are ecology and economics similar and dissimilar?

- What are the language roots of the two terms?
- What is the currency used in each subject?
- Who makes the rules in each subject?

(IIC3c—s,e, co)

What changes would you need to make in your life style to live in a highly energy efficient society?

- As world population continues to increase and per capita energy demand increases, how do we gain access to enough energy?
- What is the history of cultural changes in the primary sources of energy for human use during the past five centuries?
- How have the costs of accessing energy changed during that period?
- How can we assure equitable and just access to adequate energy for all people?
- In what ways has per capita energy been increasing in recent years?
- Who gains and who loses in this trend?
- If this trend is not sustainable how will your life be affected?

(IIC3c—s, ss, h, g, e, et)

What are the major belief systems about the human/environment interactions?

- What cultures hold what human/environment belief systems?
- Why would someone consider each of these to be good, bad, or neutral?
- What is the cultural reasoning behind each perspective?
- What is your perspective and what is the reasoning behind it?

(IIC3c—ss, et)

How do stressed environmental systems affect our health?

- How do systems function when they are stressed?
- If a particular system is stressed how does it affect interrelated systems?
- What things stress working body systems?
- How do you recognize healthy bodies or healthy environments?

(IIC3c—h, e, ss)

How can I go about getting others involved in resolving environmental problems?

- What turns people off to the environment?
- What kinds of issues excite interest in the environment?
- What kinds of things move people from awareness to understanding and action?
- What personal changes do I need to make to motivate others?

(IIC3c—co, e, ss, et)

What role do you have in how your environment looks?

- How do my actions affect the appearance of the environment?
- Are my actions affecting the look of the environment in positive or negative ways?
- What do I have to do to be sure most of my actions have a positive affect on the environment?

(IIC3c—h, e, ss, et)

What is your role in the design of your life? Who else affects that design?

- What do I have to do to take charge of the direction of my life?
- What factors affect the direction of my life?
- Over which factors do I have the most control? ...the least control?
- Where can I get help in shaping the direction of my life?

(IIC3c—p, c, s, h, ss)

—IV. Exploration of Connections—

• Nominal Environmental Literacy

2. Questions About How People Interact With the Environment

What are the major relationships, energy usage, and resource impact of humans of any culture on their environment?

- Based on the following generalizations (rules or principles)_____what predictions can you make or what conclusions can you draw that must be true?
- If_____, then what can you conclude must happen?
- What are the conditions that make this conclusion inevitable?

(IVA2c—s, ss)

In what ways are human activities stressing local ecosystems?

- What are the interconnections between human activities and the health of local ecosystems?
- How might human activities be changed in ways to improve the health of ecosystems and their human components?
- What is an argument to support your claims of how human activities might be changed?
- What are the limitations of or assumptions underlying this argument?
- What human values result in behaviors that stress ecosystems?

(IVA2c—s, ss, e)

What is the role of the major bio-geo-chemical cycles in the health and survival of living organisms and their habitats?

- What arguments would you offer to support your claims about the role of these cycles?
- What are the limitations of or assumptions underlying these arguments?
- What evidence of the connections do you have to support your arguments?

(IVA2c—s,he)

How do the processes of photosynthesis and respiration work together to allow continuation of life on earth?

- What connections exist between these two processes?
- What connections exist between these processes and the existence of living things?
- If either of these process was seriously disrupted what can you conclude must happen to living things?
- What are the errors in reasoning in this information?
- What are the limitations of or assumptions underlying this argument?

(IVA2c—s)

What are the causes and consequences of exponential growth on different populations of living things?

- Why would someone consider this to be good, bad, or neutral?
- What is the reasoning behind their perspective?
- What is an alternative perspective and what is the reasoning behind it?
- Do these perspectives apply equally to humans and other living things? What are the arguments that support your view?

(IVA2c—s, m)

How does biological succession work to change living communities and habitats?

- In what ways does one stage of succession create changes that favor the next stage?
- What changes favor a predictable next stage and what one set the stage for an unpredictable next stage?
- What principles of biodiversity affect the predictability of the living community that will follow its predecessor?
- In what ways has the area of your community changed with settlement? What remains from pre-settlement times? What plants and animals of pre-settlement times are no longer present?
- What is the function of succession in ecological systems?

(IVA2c—s)

How do global weather and climate patterns affect the distribution of airborne pollutants?

- What are the connections between airborne pollutants and global weather and climate patterns?
- What factors, human and non human, affect changes in climate patterns?

(IVA2c—s, g, he)

In what ways are stressed ecosystems affecting human health and well being?

- What are the relationships between human activities and the environment?
- What human activities affect the environment in ways that affect human health?

(IVA2c—s, he)

What things should we consider in designing indoor environments?

- What are common air pollutants associated with tightly sealed buildings?
- What electrical or mechanical devices create noise levels that degrade the quality of indoor environments?
- According to psychologist's tests, which decorating colors seem to be able to decrease people's anxieties?
- What kinds of light and intensities of light, are best for different indoor activities?
- How do different people and different cultures relate to the amount of space they need and different layouts of those spaces?
- What effects do masses of green plants have on the quality of indoor environments?

(IVA2c—s, he, p)

What kinds of information are asked for in an Environmental Impact Statement (EIS) ?

- What is the purpose of conducting an EIS?
- In what ways do building codes protect the environment as well as the home buyer?
- What new building materials are now replacing scarce or costly traditional materials?
- What substitute materials are replacing environmentally dangerous traditional materials?
- What new problems are created when building are tightly sealed to minimize heat loss?
- Which building and decorating materials give off gases which are dangerous to people with chemical sensitivities?
- What happens if a project receives a negative EIS ?

(IVA2c—s, he, p)

What human values result in behaviors that stress ecosystems?

- What are the connections between human values, behaviors, and environmental consequences?

(IVA2c—s, ss, g, et)

3. Questions About Problem Identification and Clarification

For any given environmental issues what human goals, values and needs are at stake?

- Who are the key players and their viewpoints?
- What are the alternative solutions and their potential consequences?
- Why would someone consider these to be good, bad, or neutral?
- What is the reasoning behind their perspectives?
- What is the relationship between ozone in the air and skin cancers?
- How do chemical toxins affect human bodies?
- What are the connections between chemical toxins and industrial activities?

(IVA3c—ss, c, et, s, co)

What human activities have impact on our biophysical, social, and mind/body environments?

- Into what groups could you organize these activities?
- What are the rules for membership in each group?
- What are the defining characteristics of each group?

(IVA3c—s, ss, he)

• Functional Environmental Literacy

2. Questions About How People Interact With the Environment

In what ways are ecology and economics similar and dissimilar?

- What subject matter does ecology deal with?
- What subject matter does economics deal with?
- What role does energy play in each?
- How is energy represented in ecology?
- How is energy represented in economics?
- In what ways might you suggest that economics is the ecology of mankind?
- In what ways might you suggest the ecology is the economics of nature?

(IVB2c—s, e)

How does technology affect our lives and the environment?

- What is technology?
- What technologies are most prominent in your life?
- In what ways does any particular technology improve your life?
- Upon what resources does that technology depend?
- What is the ecological ripple effect of that technology?
- What are the costs of the technology to the social and non-human environments?
- Who pays those costs in the present and in the future?
- How can we compare the costs and benefits of old and new technologies?

(IVB2c—s, ss, e)

What goods and services do people receive from the non-human environment—other living things, soil, water, sunlight, atmosphere, water, fossil fuels?

- How do other living things recycle materials and shape the flow of energy?
- What services does water in its many forms provide to people?
- How does the atmosphere affect our breathing?
- How do plants affect the energy supply?
- How do plants help to remove contaminants from soil and water?
- How do the physical laws of thermodynamics impact your lives and those of all creatures in the biosphere?

(IVB2c—s, e)

4. Questions About Making Environmentally Responsible Choices.

How do we determine what is "right behavior" toward the environment?

- What are the basic characteristics of "right" behavior toward the environment?
- What arguments support the claim that these are "right" behaviors?
- What are the limitations of assumptions underlying these arguments?
- Why would someone consider these behaviors not to be "right" behaviors?
- What is the reasoning behind their perspective?
- What are the major choices of ethical behavior toward the environment?
- What are the major components of our overall environment?

(IVB4c—et, co)

What are the effects of war on the culture and environments of all parties in that war?

- What are the causes of war?
- How do different kinds of warfare affect the bio-geo-physical, social, and mind/body environments?
- Based on the following generalizations (rules or principles) what predictions can you make or what conclusions can you draw that must be true?
- If _____, then what can you conclude must happen?

(IVB4c—s, ss, et, he)

What are the conditions that make this conclusion seem inevitable? What human values result in behaviors that stress ecosystems?

- What evidence do you have that the behavioral consequences of particular values put stress on particular ecosystems?
- If _____, then what can you conclude must happen?
- What are the conditions that make this conclusion inevitable?
- What are the errors in reasoning in this information?
- How is the information misleading?
- How could it be corrected or improved?
- Why would someone consider this to be good (or bad or neutral)?

(IVB4c— s, ss, et, he)

- **Operational Environmental Literacy**

4. Questions About Making Environmentally Responsible Choices.

Can we conceive an ethical system that encompasses the rights of non-human life?

- Based on the following generalizations (rules or principles) what predictions can you make or what conclusions can you draw that must be true.
- What are the items we generally consider to be worthy of ethical treatment?
- What kinds of things have legal standing?
- What are the cause effect relationships between humans and non-humans?
 - Based on the following generalizations (rules or principles) what predictions can you make or what conclusions can you draw that must be true?

(IVC 5 44c— s, ss, et, he)

Section 7: Some Overarching Essential Questions for the Environmental Literacy Framework

These questions suggest the rationale for developing real environmental literacy. These are not questions with simple answers. They are questions that can be answered, if at all, only over time and with experience. All are based on the understanding that environment has at least three major components—bio-geo-physical (non-human surroundings), social, and mind/body (psycho-physiological). These three components, in combination, can be thought of as "skin in" and "skin out" surroundings. Environmental literacy involves understanding that these three components have ongoing interactions, interconnections, and feedback mechanisms that determine the overall health and sustainability of each component.

These are questions that will need to be revisited throughout life and are not limited to any particular age group or grade level. They are part of life-long, continuing education.

—I. Exploration of Non-human Surroundings—

- In what ways are the non-human environments important to my life?
(IB1d—s, g)
- What aspects of the non-human environment have the greatest impact on my life?
(IB1d—s, g)
- How can we preserve the healthy functioning of our non-human environmental systems into the indefinite future?
(IB1d—s, c)
- What roles do these other living things play in the environment?
(IB1d—s, g)
- What are key long and short-term changes that regularly occur in our environment?
(IB1d—s, g)
- How has the natural world shaped our history?
(IB1d—s, g, h)
- How are we responsible to and for living and non-living things?
(IC4d—s, g)

—II. Exploration of Society—

- What prices do we pay, now and in the future, for damaging our environments?
(IIB1d—s, g)
- In what ways can I find answers to the environmental questions I have?
(IIB1d—s, g, co,e)

- What are my responsibilities to other people and other living things?
(IIC1d—s, ss, et)
- How can I ensure that my environments are healthy enough to keep me healthy and productive?
(IIB1d—s, g, he)
- What are the past and present political views on conserving our resources and protecting our natural environment, and how will these affect my future actions?
(IIB3d—s, h, ss)
- How can we make built environments ecologically sound and aesthetically pleasing?
(IIB3d—s, a)
- In what ways are human activities putting stress on ecosystems?
(IIB2d—s, g)
- In what ways do human activities help ecosystems function?
(IIB2d—s, g)
- How can we assure people from all walks of life equal access to the world's natural resources?
(IIC4d—s, g, ss)
- How do human consumption patterns affect interconnected systems?
(IIB2d—s, g, e, ss)
- What is the historical development of any environmental problem that affects me now?
(IIB2d—h, ss)
- How do we share the use of natural resources and energy among people fairly?
(IIB4d—s, g)
- How is my community dependent upon other communities, human and non-human?
(IIB2d—s, g)
- How does economic scarcity or shortages of resources affect our lives and/or the lives of other people in other parts of the world?
(IIC2d—s, g)
- What are the basic processes of choice-making that allow people to satisfy their basic needs
(IIA4d—s, ss)
- What is the relationship between use of environmental capital and the use of environmental interest?
(IIB2d—e, g)
- How is my community dependent upon other communities, human and non-human?
(IIB1d—s, ss)

- How do economic, political, and social systems work and interact?
(IIA1d—s, g, e, ss)
- How does one live responsibly in the local, national, and global communities?
(IIC4d—s, g, c, e)
- In what ways can my family and community minimize our “ecological footprint”* on the planet?

—III. Exploration of Self—

- How can I influence others to respect and enhance each aspect of environment?
(IIIB4d—co, c)
- In what ways can I minimize my “ecological footprint”* on this planet?
Impacts created by your life activities
(IIIC4d—s, ss, e, et)
- What can I do to help restore damaged aspects of my environments?
(IIIB4d—s, c, e, ss)
- How can I separate fact from fiction or myth?
(IIIA2d—co, c)
- What ecological ripples do I set in motion with each choice and action?
(IIIB2d—s, e)
- What is my role in this world?
(IIIB4d—s, ss, e, g)
- How do my environmental choices affect my self worth and self reliance?
(IIIB3d—p, ss, he)
- How do my environments contribute to my reaching and maintaining this role?
(IIIB2d—co, c)
- How do my responsibilities for others extend to maintaining the health of my environments?
(IIIB4d—co, c, ss, he)
- How can I see my environments, understand what I see, and enjoy what I understand?
(IIIA2d—co, c)
- In what ways does the environment affect the health of me and my family and how do our actions affect the environment?
(IIIB4d—co, c, he, s, g)
- What are my basic needs and how do these differ from wants?
(IIIA1d—s, e, ss)

- What are the best questions I can ask and seek answers to about people's relationships with the biosphere?
(IIIA1d—s, et, e)
- In what ways am I a citizen of the biotic community?
(IIIA1d—s, e, et)
- How do I determine what is "right behavior" toward our environment?
(IIIB4d—et, s, ss)
- What can I do for ecological restoration?
(IIIB1d—s, g, h, et)
- What is my role in bringing about the necessary changes?
(IIIB4d—co, c, ss, p)
- What is my place in my community?
(IIIB4d—ss, c, s)
- How do my experiences affect the decisions/choices I make and my role as a citizen of the global community?
(IIIB2d—p, c, ss)
- How do I relate to others?
(IIIB4d—p)
- How am I part of any system?
(IIIB4d—s, e, ss)
- What is my personal responsibility as a citizen of the world?
(IIIC4d—p, c, ss)

—IV. Exploration of Connections—

- In what ways do all things connect and interconnect?
(IVC1d—s, g, e, ss)
- In what ways are natural communities like social communities?
(IVA1d—s, g, e, ss)
- How do my actions and those of others affect each of the different arenas of environment?
(IVB2d—s, g, e, ss)
- How does the solution to one environmental problem affect other concerns, environmental and otherwise?
(IVC1d—s, g, e, ss)

- How can we balance ecological integrity and economic development?
(IVC1d—s, g, e, ss)
- How do we determine what is right behavior toward the environment?
(IVC1d—et, s, g, e, ss)
- How should we treat our non-human friends?
(IVA14d—et, s, g, e,)
- How do present civilizations relate to their past and future?
(IVB1d—s, h, g, e, ss)
- How are we responsible for living and non-living things?
(IVC1d—et, s, g, e, ss)
- How do humans interact with non-living things?
(IVC1d—s, g, e, ss)
- In what ways am I part of any particular system?
(IVA1d—s, g, e, ss)

Some of the most essential, ongoing questions

- What does it mean to be human?
(critical and creative thinking)
- Who am I?
(critical and creative thinking)
- What do I want my life to be?
(critical and creative thinking)
- What are the ecological and social consequences of my choices and actions?
(critical and creative thinking)
- What kind of communities do I want to be a part of?
(critical and creative thinking)
- How do I fit into my community?
(critical and creative thinking)
- How can I make my community more functional and less dysfunctional?
(critical and creative thinking)
- As I move through life where do I want to lead?
(critical and creative thinking)

- What kind of world do I want to make?
(critical and creative thinking)
- How can I help get it there?
(critical and creative thinking)
- What are the best sources to provide power to our society?
(critical and creative thinking)
- Can I, and my community, shape a world powered by current sunlight regimes?
(critical and creative thinking)
- Can I use Nature as a standard in making my environmental choices?
(critical and creative thinking)
- How can I work with others to shape a culture that produces little or no non-recyclable waste?
(critical and creative thinking)
- How can I honor the “mystery factor” in life?
(critical and creative thinking)