

EDUCATING
YOUNG PEOPLE
about

Water



A guide to goals and resources

with an emphasis on nonformal and
school enrichment settings



Elaine Andrews and the
Cooperative Extension
National Review Team
Sponsored by the
United States Department
of Agriculture,
Cooperative Extension
Water Quality
Initiative Team

Sponsored by the United States Department of Agriculture, Cooperative State Research Extension and Education Service under the direction of Gregory Crosby, National Program Leader for youth science education, and the Cooperative Extension Water Quality Initiative Team, Andrew J. Weber, Chair.

The USDA Extension Service project to review youth water education needs was developed in support of youth and community water quality education goals of the National 4-H Environmental Stewardship Program and the USDA Cooperative Extension National Water Quality Initiative Team.

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Educating Young People About Water: A Guide to Program Planning and Evaluation

Educating Young People About Water: A Guide to Unique Program Strategies



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Introduction to the guide

Water quality is a critical environmental issue that has received deserved attention from educators in recent years. There are now a variety of educational materials for young people that can be used both in school and in after-school settings.

However, educators and youth leaders often do not have enough training to develop a water education program. They need help in including multiple objectives and information on curriculum activities for specific programs.

The 1992 Water Curriculum Needs Assessment Project addressed this problem. We summarized information about water curricula, provided guidance for federal investments in water curriculum development, and created a network among national groups and agencies which promote youth water education. This assessment project set the stage for the resources in this book.

Who should use this guide?

This guide is for professionals who design and develop water quality training programs and curricula, and for coordinators of water education programs. It will help you select water curricula, education support materials and bibliographies. Coordinators can use it to make initial program decisions or to find complementary materials for a program that is already in place.

HOW TO USE THIS GUIDE

Quick overview

For a quick survey of water curricula useful in a local setting, start at the end of this book with the Water Curriculum Summary Chart beginning on page 48. The Water Curriculum Summary Chart summarizes each curriculum by topic or category.

Understanding subtopics

To understand the subtopics noted in the summary more clearly, see the detailed topic listings on pages. 6 and 11.

Specific curricula

You can learn more about any particular curriculum by finding its brief entry in the annotated "Guide to Reviewed Curricula" on page 17. They are listed alphabetically by title. For details about water topics, environmental education goals, and curriculum format choices in each curriculum, you will need to refer to a computer database developed for the project. (See box on page 3.)

Designing a local program

For help in designing or evaluating a local water education program, you may find the following segments of this book useful:

- *Water Education Goals for Youth*
- *Key Water Quality Education Topics and Major Subtopics*
- *Critical Environmental Thinking Skills*
- *Instructional Format Choices for Youth Water Curricula*
- *Lists of Sources of Curricula Chosen for Review*
- *Unique Support Materials for Youth Water Education*

Also, see the other resources in this series:

- *Educating Young People About Water: A Guide to Program Planning and Evaluation*
- *Educating Young People About Water: A Guide to Unique Program Strategies*





Help us find what's missing

We reviewed many bibliographies and other resources to develop this guide. However, not every curriculum makes it to a regional or national bibliography. We may have missed high quality regional materials as well as curriculum resources that appeared since our study.

We are still collecting water education curricula with activities for youth. If you have a copy of a curriculum that is not reviewed here and it covers topics listed in "Key Water Quality Education Topics" and subtopics we want to know about it.

Please send a copy of the curriculum or a description and ordering information to:

Elaine Andrews
University of Wisconsin-Madison
Environmental Resources Center
216 Agriculture Hall
1450 Linden Dr.
Madison, WI 53706
Fax: 608/262-2031

Thank you for your help.

RETRIEVING YOUTH WATER CURRICULUM INFORMATION ELECTRONICALLY

All curricula reviewed in this guide are summarized beginning on page 17 and in the summary chart starting on page 48. For a more detailed listing of topics included in individual youth water curriculum, refer to the "Almanac" database provided by Purdue University. To get a user's guide to "Almanac," send an electronic mail message to this Internet address:

almanac@ecn.purdue.edu

Type the following message:

send guide

Requesting information via electronic mail

To get a catalog that lists the titles of the youth water curriculum reviewed for this project, send an electronic mail message to this Internet address:

almanac@ecn.purdue.edu

Type the following message:

send youth-water-curriculum catalog

You'll receive the catalog as an electronic mail message soon afterwards. You may request any or all catalog items via electronic mail. Be sure to type your requests exactly as you see them here.

Requesting one or more summaries

To get a summary listed in the catalog, send an electronic mail message to this Internet address:

almanac@ecn.purdue.edu

Type your request. For example, to request summary number 5, enter (abbreviate "youth water curriculum" to "ywc" and "summary" or "sum"):

send ywc sum5

To request several summaries, put each request on a separate line in your message:

send ywc sum6

send ywc sum45

If you send several requests in one message, the requested files will arrive in one message. If you want to receive each request in a separate message, turn on the "separate" option. For example:

set separate on

send ywc sum6

send ywc sum45

You will receive three electronic mail messages. The first will confirm your "separate" option request, while the remaining messages will each contain one of your requested summaries.

Accessing curriculum summaries on the Internet

You can review on screen each curriculum summary in the Almanac database via the Internet. To reach the database:

telnet to:
hermes.ecn.purdue.edu

login: *cerf*

password: *purdue*

Type your internet address

Select *National Water Quality* from the CEMS menu at the Cooperative Extension Reference File System screen

Select SEARCH

Type: *youth water curriculum*

You will see a listing of all the curricula reviewed for this project as of January 1, 1995. Select a curriculum to view the title, author, state of origin, summary and cost. You are given the option to view (V=view) the checklist that corresponds with the checksheets on pages 6 and 11-12 of this guide book. You can also order a hard copy from the publisher or download the curriculum information to your computer.

What is the Internet?

The Internet is a rapidly growing, international computer network. Many institutions, both for-profit and non-profit, now offer services and products to their clients via the Internet.

To access the youth water curriculum summaries via the Internet, you need an electronic mail account on a computer attached to the Internet. All U.S. land grant universities provide computing facilities with electronic mail systems which can interact with the Internet.

Commercial services such as CompuServe and MCIMail also support Internet electronic mail. Ask your computer center's staff for local instructions on how to send and receive Internet electronic mail.

If you don't have access to the Internet, contact your local county or state Extension youth development agent and ask their help in retrieving the youth water curriculum catalog or summaries that you want.



USDA/Cooperative Extension Service

Water curriculum needs assessment project

Background

In 1988 state Cooperative Extension directors and administrators named water quality their highest national priority. These leaders head major county-based outreach programs at all 50 state land grant universities. Cooperative Extension programs offer education to people of all ages in nonformal settings.

Water education became a focus for Cooperative Extension nationally. Leaders recognized that while people of all ages need to understand water quality issues, there were bonuses in working with young people. Young people could also learn about leadership, identify career opportunities, and improve their science knowledge.

The Cooperative Extension National Water Quality Initiative Team soon began to support curriculum development. In 1991, wanting to maximize their investment by targeting the greatest needs, the team began the assessment project and set up a review group of experts from private and federal organizations.

The plan was to guide Cooperative Extension policy and summarize water curricula for national, state, and regional water education leaders. Nonformal education needs were central to the project because that is the type of education Cooperative Extension generally provides.

Review team

Water education is not new. Many government and private organizations have been involved in it for years. To benefit from their experience, we drew members of the National Review Team from these institutions. They are listed in the front of this book.

Team members supplied copies of water quality education materials for young people, provided references, and recommended other resources. They also helped identify appropriate water education goals and key topics, and offered strategies on how to address gaps and needs that we found. Their recommendations are found in *Assessing National Water Quality Education Needs for the Nonformal Youth Audience*, available from USDA Cooperative Extension, Washington, D.C.

Project goals

This study is unique because it begins with national water quality needs and issues rather than specific science or local resource education objectives. From these national resource policy issues we developed national goals and objectives for water quality education.

Water education materials are so many and varied it could take years to do a thorough assessment. To quickly meet educators' immediate needs for resources, we developed a short-term, initial project. The objective was to review and classify a selection of available curricula as a basis for understanding what was missing and needed. The results from the six-month study provided a strong beginning for future work.

The 1995 edition of *Educating Young People About Water* provides additional materials and resources.

The specific objectives of this study were to:

- 1) Use national water quality issues to identify key water quality topics and learning goals for youth in a nonformal setting such as 4-H.
- 2) Categorize a selection of water quality curricula according to the identified goals.
- 3) Classify relevant curriculum materials, delivery styles, and model programs in an easily understandable and accessible format.
- 4) Determine the strengths and weaknesses of available curricula, establish objectives for 4-H and youth water quality education, and provide direction for Cooperative Extension investment in curriculum development.

National water education needs

To determine national water education needs, we reviewed a number of federal and state Extension reports and national plans of work. We also reviewed reports from the U.S. Department of Agriculture, the EPA, the Great Lakes National Program Office, and the U.S. Geological Survey. Members of numerous federal agencies contributed to our National Review Team (see team list at beginning of book).

We sought the perspective of private organizations through a report by the Freshwater Foundation. Members of private organizations also served on the Review Team.



This process produced four critical national water resource issues that nonformal education could address, and a list of nine key water quality education topics.

Critical water quality issues¹

- 1) Interaction of human activities and water quality.
- 2) Use and disposal of agricultural, industrial, and household chemicals.
- 3) State and local water problems such as drought-induced shortages, declining water tables, increased pumping costs, and increased production and treatment costs.
- 4) Protection for community water resource quality.

¹Adapted from: *Extension Review*. Vol. 59, No. 3, Fall 1988. Water quality issue

Key water quality education topics and major subtopics

A wide variety of water education material has been available for the last ten years. It has not been easy for the educator, however, to choose the topics that help society meet its water quality goals or to find materials that teach those topics and concepts.

The National Review Team identified the nine key topics in the box below. Discussion also produced a set of important subtopics. These add detail that the educator can use and that we used in reviewing curricula. They are listed on the following page.

In reviewing curricula for this book, we looked only at whether the topics were present in the activities and information. We did not evaluate the quality of the activity or its relevance to the particular topic.

If you want to find activities about a specific topic, check the summary chart beginning on page 48. There we indicate which topics are present in each curriculum. A computer database has a detailed listing of topics included in each curriculum. (See page 3 for instructions on how to use it.)

KEY WATER QUALITY EDUCATION TOPICS

1. The science of water
2. Water related ecosystems
3. Drinking water supply: quantity and quality
4. Water use
5. Sources of water pollution/contamination
6. Water quality: risk assessment and reduction
7. Management and protection strategies for specific uses
8. Government and citizenship issues
9. Water-related careers



Water quality education topics and major subtopics

As you select or develop activities and curriculum materials, consider these topics. This list will also help you to understand the curriculum summary chart and details provided by the electronic database, which lists subtopics.

Science of water

- Properties
- Importance to living things
- Hydrologic cycle
- Geology/hydrology dynamics
 - surface water
 - groundwater
 - regional supply

Water related ecosystems

- Types of ecosystems
 - lakes
 - wetlands
 - estuaries
 - rivers
 - watersheds
 - ephemeral systems (intermittent)
 - ponds
 - oceans
 - streams
 - riparian
- Major regional resource (insert name)

Ecological concepts

Drinking water supply: quantity & quality

- Delivery
 - community/public
 - private
 - treatment of drinking water
 - public drinking water
 - home treatment
- Water quality control
 - well concerns
 - testing
 - public
 - private
- Lifestyle impacts/conservation

Water use

- Use of water by many groups
 - agricultural
 - commercial
 - domestic
 - industrial
 - municipal
 - power production
 - recreation
- Conservation by user groups
- Issues/conflicts between user groups

Sources of water pollution/contamination

- Point source
 - agricultural sources
 - public and/or private wastewater
 - industrial and business hazardous wastes
 - energy production wastes
- Nonpoint source
 - atmospheric deposition
 - agricultural
 - forestry
 - mining
 - urban

Water quality: risk assessment & reduction

- Curriculum addresses the concept of how risk decisions are made
- Impact of water quality on health
- Impact of water quality on human food sources
- Impact of water quality on plant and animal communities

- Understanding and reducing risks for specific contaminants
 - bacteria
 - nitrates
 - pesticides
 - sediments
 - salinity
 - other chemicals
- Water quality indicators

Management & protection strategies for specific uses

- Agricultural management practices
- Chemical spills and emergencies
- Chemical/fuel storage
- Development issues/pressures
- Natural disasters
- Recreational use
- Solid waste management decisions
- Wastewater treatment
- Wildlife habitat/land stewardship management
- Zoning strategies
 - shorelands/floodplains
 - wetlands
 - wellhead/groundwater recharge areas

Government & citizenship issues

- Policy issues
 - water quality
 - water quantity
- Role of local government in developing protection strategies
- Citizen involvement and participation
- Legislation, regulation, incentives/disincentives

Water-related careers

- Technical: _____
- Professional: _____



Water education goals for youth

Young people and their families have an important role in protecting and enhancing the nation's water quality. To do so, they need opportunities to develop and apply two key understandings: water is vital to natural processes and human activities; and, it is critical to the health of all living things.

The sample education goals which follow (grouped by key water education topic) are designed to help develop this understanding. They are a product of the curriculum review and deliberations by the National Review Team.

The goals are intended for nonformal education—learning that takes place outside school. In this setting the water education experience is based on the youth's personal or community life. While the formal school setting is probably a better place to teach the underlying science principles, nonformal activities offer a range of important experiences and skills:

- *Learning by doing*
- *Applying investigation skills*
- *Evaluating alternative solutions to problems*
- *Applying what is learned in real life situations*

These activities also contribute to a youth's general understanding of science, ecology, and human interaction with water systems.

Programs based on these goals can stand alone. They can also complement school programs or support a school enrichment activity. To determine how to fit goals to the age and developmental level of their youth audience, educators should refer to the chart *Science/Process Content and Developmental Stages*² which follows the goals.

1. Science of water

Youth will:

- Explore observable physical and chemical properties of water and relate how those properties work together in the hydrologic cycle.
- Identify where and in what conditions water is stored on the earth, recognize local water storage formations, explain the hydrology of any local formations, and recognize their interconnections. (For example, youth should be able to describe sources of water for a local estuary and identify characteristics that make an estuary a unique water storage area.)
- Practice using observation, measurement, data recording, prediction, and inference skills in studying the science of water. (Refer to the Science Process/Content chart for more detail on science skills.)

2. Water related ecosystems

Youth will:

- Investigate and evaluate the environmental characteristics of a given water ecosystem, describe the plants and animals that inhabit the ecosystem, and research the importance of that ecosystem to those all living things.
- Identify sites in their community where the "natural" clean water cycle, including dissipation, biodegradation and filtration, is functioning.
- Locate areas in their community where natural or human influences have changed a local water ecosystem for better or worse and document those changes. (Change can include anything from beaver dams or floods to pollution discharges or improvement from pollution prevention techniques.)

- Practice using observation, measurement, data recording, prediction, and inference skills in studying a water related ecosystem

3. Drinking water supply quantity and quality

Youth will:

- Trace the path that water travels in order to serve humans in the local community. Steps include water's origin in surface and ground sources, movement to home wells or public storage facilities, to home treatment systems or public treatment plants, to home and industry uses, and eventually to its return into the natural environment.
- Acquire and apply the skills needed to investigate the relationship between drinking water quality and human health and explain why private and public drinking water supplies must be tested for quality.
- View residential or public drinking water facilities and explain how treatment techniques help meet regulatory standards applied to water before its use.
- Demonstrate their awareness of personal water use habits and provide leadership to involve their families and community in water conservation efforts.

4. Water use

Youth will:

- Identify water related products and recreation experiences that are part of their lives.
- Experience the aesthetic impact of a water resource on their lives.
- Analyze how local water use decisions affect human lifestyles, quality of life, and standard of living.

² Prepared by the Science Curriculum Framework and Criteria Committee under the direction of the California State Board of Education, Curriculum Development and Supplemental Materials Commission and adopted by the California State Board of Education.



- Summarize the evolution of a local use of water, and interpret the impact of that evolution on the environment. Investigation of the local water use should identify any local doctrines of water ownership that apply to water use in their area and local use conflicts caused by changes in water demand. (Water uses which could be considered include: the historical increase in an urban population, evolution of commercial fishing or textiles industry, or use of water in food production processes over time.)

5. Sources of water pollution and contamination

Youth will:

- Identify categories and sources of information about human actions which affect water quality in their community, giving special attention to those which provide major sources of pollution.
- View residential or public wastewater treatment facilities and explain how treatment techniques help meet regulatory standards applied to water after its use.
- List local environmental factors which affect the potential of pollution sources to contaminate groundwater and predict land uses appropriate to protecting those factors. (Environmental factors might include soil types, geologic formations, proximity of water sources, height of water table, potential for flooding, climate factors, etc.)
- Demonstrate their awareness of products used in home life which can contribute to water pollution if managed inappropriately and provide leadership to involve their families and community in efforts to protect water from contamination by those products.

6. Water quality: risk assessment and reduction

Risk assessment is used here in its broadest definition, rather than as the scientific assessment process used to develop pollutant regulations.

Youth will:

- Meet with representatives of regulatory agencies to learn about likely causes and effects (on humans, fish and wildlife) of pollutants found in their community.
- Investigate how people measure water quality changes over time and summarize what those measurements have indicated about local water quality. Understanding the change should include knowing how human behavior affects degradation, as well as historical improvement of local water quality.
- Assess the relative environmental quality of a local body of water based on water quality parameters and the diversity of living organisms.

7. Management and protection strategies for specific uses

Youth will:

- Identify local and regional agencies which monitor and control pollution caused by humans and observe the strategies and equipment they use to identify water quality problems and sources in their community.
- Identify local and regional agencies which monitor and control natural disasters; interview professionals from these agencies to learn how to prepare for and prevent natural disasters related to water.
- Demonstrate their understanding of best management practices which minimize the risk of water contamination from crop protection chemicals, by making farm visits and through farm management simulations.

- Evaluate the effects of different kinds of land use on water habitats then describe and evaluate lifestyle change and community planning options that could minimize damaging effects.

8. Government and citizenship issues

Youth will:

- Identify steps that they can personally take to prevent water pollution.
- Identify appropriate questions and sources of information for evaluating a local water issue.
- Practice using observation, measurement, data recording, prediction, inference, classification and problem solving skills to enhance their understanding of the science, community values, and policies of a local water issue.
- Develop their own ideas about solutions to a local water issue by studying the science, community values, and policies that relate to that issue.
- Demonstrate that they understand how, when, and where to communicate what they have learned about any positive or negative impacts of changing local conditions on the water resource.
- Practice skills that enable them to act in direct response to what they have learned about water.

9. Water-related careers

Youth will:

- Identify and describe several careers related to the water resource and explain what they would need to do to prepare themselves for at least one.
- Investigate the working conditions and salary level for two different water resource careers.



Science process/content and developmental stages

Grade level content				Processes	Learners' developmental stages
9-12	6-9	3-6	K-3	Observing <ul style="list-style-type: none"> • Seeing • Hearing • Feeling • Tasting • Smelling 	Sensory motor
Usable applicational principles	Explanatory—predictive, theoretical principles	Active—relational, interactive principles	Static—organizational principles	Communicating <ul style="list-style-type: none"> • Silent • Oral • Written • Pictorial 	Preconceptual
				Comparing (includes measuring)* <ul style="list-style-type: none"> • Sensory comparisons • Relative positive comparisons • Linear comparisons • Weight comparisons • Capacity comparisons • Quantity comparisons 	Intuitive
	Organizing* <ul style="list-style-type: none"> • Data gathering • Data gathering • Sequencing • Grouping • Classifying 	Concrete operational			
	Relating* <ul style="list-style-type: none"> • Using time-space relationships • Formulating experimental hypotheses • Controlling and manipulating variables • Experimenting 	Formal operational			
	Inferring* <ul style="list-style-type: none"> • Synthesizing, analyzing • Generalizing • Recognizing and predicting patterns; stating laws • Formulating explanatory models and theorizing 				
	Applying* <ul style="list-style-type: none"> • using knowledge to solve problems • Inventing (technology) 				

*These processes include the application of appropriate mathematical concepts and skills in interpreting data and solving problems.

Prepared by the Science Curriculum Framework and Criteria Committee under the direction of the California State Board of Education, Curriculum Development and Supplemental Materials Commission and adopted by the California State Board of Education.



Environmental thinking skills, instructional format choices and academic disciplines

Environmental education

In addition to learning about water, young people also need broader environmental problem solving skills, general science literacy, and awareness of water career options. The best way to learn these is through action and experience.

Because each person's choices and actions affect the environment, it is particularly important for young people to learn to think critically about and solve environmental problems. The Review Team based its choice of environmental education goals on the international effort to identify environmental education needs³ and on two taxonomies of environmental education objectives.^{4, 5} We also used Gardella's inventory forms to help verify the environmental education goals we selected.⁶

Environmental education goals adapted for use here include:

- *Ecological foundations*
- *Conceptual awareness of environmental issues and skills*
- *Investigation skills*
- *Evaluation skills*
- *Environmental action skills*

Many skills listed for these areas also describe science literacy skills.⁷

Instructional format choices

Learning through experience is both vital to critical environmental thinking skills and easier to achieve in nonformal education. Furthermore, nonformal educators serve a diverse audience. We reviewed curricula for their attention to these needs.

Curriculum Development for Issues Programming,⁸ helped us develop a checklist for the instructional formats of curricula by offering a philosophical frame of reference. This document stresses experiential learning and is one of the few available that provides guidance on appropriate strategies for nonformal education. We also adapted ideas about practical strategies for experiential learning and environmental education from materials by the Minnesota Department of Education⁹ and Cornell Cooperative Extension.¹⁰

The following aspects of the instructional formats are important for teaching about water:

- *Applicable to diverse audiences (including gender, socioeconomic class and ethnic group)*
- *Clear, accessible education goals and instructions*
- *Student materials are varied and available*

- *Uses indoor and outdoor/ community environments*
- *Types of activities are varied*

Other disciplines

Academic disciplines other than science are relevant to understanding water's importance in our lives. For this reason, we noted whether social studies, math, language arts, and arts activities were present as we reviewed the curricula. When these disciplines are addressed, they are noted in the summary chart.

Curriculum review for these topics

We searched the reviewed materials for environmental education thinking skills. We noted them in the curriculum summary chart (on page 48) only if an environmental education topic or subtopic was present. We did not evaluate the quality of the activity or whether it was relevant to a particular audience.

Packaging styles, whether activities are designed for indoor or field use, and the disciplines addressed are also summarized in the chart. However, for a thorough assessment, we recommend you review the electronic database described on page 3 for more information.

³Tbilisi Intergovernmental Conference on Environmental Education. 1978. "Toward an Action Plan: A Report on the Tbilisi Conference on Environmental Education." A paper developed by the FICE Subcommittee on Environmental Education. Washington, D.C., U.S. Government Printing Office, Stock No. 017-080-01828-1.

⁴Hungerford, Harold, R. B. Peyton and R. J. Wilke. 1980. "Goals for Curriculum Development in Environmental Education," *Journal of Environmental Education*, 11(3):42-47.

⁵Roth, Charles. 1990. Definition and Clarification of Environmental Literacy, a working paper, ASTM Environmental Literacy Project, 1916 Race St., Philadelphia, PA, 19103-1187.

⁶Gardella, Ronald. 1986. "Environmental Education Curriculum Inventory Forms A and B." Northern Kentucky University, Highland Heights, Kentucky, 41076.

⁷Project 2061, American Association for the Advancement of Science. 1989. "Science for All Americans, Summary." American Association for the Advancement of Science, 1333 H Street, N.W., Washington, D.C. 20005.

⁸Cantrell, Joy. 1991. *Curriculum Development For Issues Programming*, U.S.DA Cooperative Extension. Draft.

⁹Minnesota Department of Education. 1991. *Model Learner Outcomes for Environmental Education*.

¹⁰Cornell Cooperative Extension Service. 1989. *Water Wise*.



Environmental education goals for youth water curricula

As you select or develop activities and curriculum materials for water education, consider these environmental education skills. This list will also help you better understand the curriculum summary chart and details provided by the electronic database.

Ecological foundations (materials focus on...)

- Individuals and populations
- Interactions and interdependence
- Environmental influences and limiting factors
- Biogeochemical cycling
- Community and ecosystems concepts
- Homeostasis (balance of nature)
- Succession
- Humans as ecosystem component
- Ecological implications of human activity

Conceptual awareness: issues & values (materials encourage recognizing...)

- Ecological impact of human culture on environment
- Ecological impact of individuals on environment
- Ecological and cultural implications of environmental issues
- Alternative solutions
- Cultural implications of alternative solutions
- Investigation as prerequisite to decision-making
- Role of human values and need for personal values clarification in decision making
- Need for responsible citizen action in environmental issue remediation

Investigation skills (materials provide opportunities to...)

- Shape questions
- Formulate hypotheses
- Make observations and measurements
 - natural science settings
 - social science settings
- Perform tests
- Analyze results with respect to:
 - ecological implications
 - cultural implications

Evaluation skills (materials provide opportunities to...)

- Identify alternative solutions
- Identify values associated with alternative solutions
- Evaluate alternative solutions with respect to cultural and ecological implications
- Identify and clarify personal values and positions as they relate to issues and solutions
- Change personal values and positions given new information

Environmental action skills (materials guide development of...)

- Skills to work towards ends consistent with individual values
 - community problem solving
 - consumerism
 - ecomanagement
 - education
 - legal action
 - persuasion
 - political action
- Decision-making regarding environmental action strategies
- Opportunities to apply environmental action skills
- Evaluate influence of actions taken to effect balance between quality of life and quality of environment



Instructional format choices for youth water curricula

The instructional format choices below will help you select curriculum materials most appropriate to your youth group. They will also help you better understand the information in the summary chart. Please note that the organization of this list does not correspond exactly with that found in the electronic database.

Grade level(s) _____

Applicability to diverse audiences (materials are relevant to diversity with respect to...)

Gender

- examples
- illustrations
- language

Socioeconomic class

- examples
- illustrations
- vocabulary

Geographic region

- national audience
- regional audience:

Ethnicity

- examples
- illustrations
- language: _____

Special learning needs:

Instructional environment

Indoor

- classroom
- home
- laboratory

Field

- community facility/agency
- natural site
- neighborhood

Instructional materials for instructors

Content

- answer keys
- background information
- further study suggestions
- glossary
- lesson plan/teacher script
- resource list
- stated goals & objectives

Presentation style

- booklet: # pages _____
- computer software
- videotape

Quality of printed materials

- clearly organized
- typed

Instructional materials for students

Content

- activity instructions
- worksheets
- tests
- text
- game materials

Presentation style

- booklet: # pages _____
- comic book
- magazine or newspaper
- teacher-made photocopies
- other:

Quality of printed materials

- age-appropriate visual layout
- clearly organized

Lesson type(s)

Seatwork

- audio/visual material
- computer software
- demonstration/observation
- discussion/debate
- individual work
- instructor/guest lecture
- letter writing/essays
- reading text
- team work
- worksheet
- special equipment needed:
_____ (list)

Activities

- artwork/models
- community project
- drama
- fairs and festivals
- field observation/measures
- games/puzzles
- home project/observations
- individual work
- laboratory experiment
- student presentations
- team work
- special equipment needed:
_____ (list)

Subject area(s)

- Art
- Language arts
- Math
- Science
- Social studies



Curriculum review: choice and process

There is a tremendous volume of material supporting youth water education. The first step was to develop a process for choosing those we would review.¹¹

A curriculum was included if it:

- *Addressed one or more of our general or specific goals*
- *Presented a planned education experience*
- *Improved representation of: regional water concerns, varied water topics or environmental education goals.*

There were some materials which repeated much of another curriculum. We did not review these, but they are listed among supporting materials.

In reviewing materials, we looked for whether the water topics, environmental education goals, and preferred formats were present. We did not review particular activities for their quality. The Youth Water Curriculum Summary is intended to show overall strengths and gaps in the body of available curricula.

The summary will also help instructors find curricula to meet their particular needs. One curriculum may have an outstanding selection of water science activities, for example, but little relating to water careers. A leader or instructor searching for water career activities would need to search further.

Another curriculum's activities may cover a broad overview of water topics but involve few environmental education skills. That curriculum may be fine for a science classroom, but may not be suitable for a school enrichment program.

Sources of curricula chosen for review

The curricula we selected to review are listed alphabetically by title in the curriculum summary chart. They are also listed separately in two categories: state/regional materials (including state Cooperative Extension materials), and national materials. Unique materials which were not reviewed are listed separately.

State and regional curricula come from 33 states and Canada. They include materials developed by Cooperative Extension 4-H programs, state agencies, and regional agencies or groups. All regions are represented by at least one state. Many state-based curricula have a regional scope. They may adequately serve a nearby state which is not represented here or does not have its own materials.

National materials were prepared by national organizations or businesses or were designed to be used anywhere in the country. Such groups as American Water Works Association, Water Environment Federation, National Wildlife Federation, Project Wild, and the LaMotte Company, were among those producing these materials.

Unique programs, or program support materials which did not meet curriculum review criteria, were not reviewed in detail. Promising materials are listed as an additional reference. They may help provide a needed support piece, or form the basis for an innovative water education program.

¹¹For details on the selection process and inclusion criteria see: Andrews, E. 1992. *Assessing National Water Quality Education for the Nonformal Youth Audience*, USDA, Cooperative Extension.



How to use curricula to create a youth water education program

Members of the National Review Team have a number of suggestions for professionals who create youth water education programs or experiences. The suggestions are based on the members' considerable experience in the area and not on a separate study of what makes nonformal water education effective.

A successful water education program should:

- *Publicize available materials to appropriate educators*
- *Train the educators*
- *Package a selection of materials to meet local needs*
- *Meet environmental education goals with creative programming strategies*
- *Empower youth through communicating that improvement is possible*
- *Create opportunities to learn environmental stewardship, not just human stewardship*

Publicity and training

In general, water curricula are available but not well known. Most water topics are addressed in at least one curriculum, but you might have to spend considerable time searching for activities on each particular topic or skill. Instructors need help in identifying which water topics to emphasize and how to find suitable materials.

Instructors, be they volunteer leaders, 4-H agents or teachers, need time to learn about the materials. Most materials require some understanding of water science. Instructors also must be willing to read a lot of material before they choose a specific activity.

Home and community settings are excellent sites for studying water and many activities can be carried out there. Unfortunately, it is not easy for a home or community leader to adapt curricula for this use.

You will get the best results if leaders have training. It should focus not only on content, but also on the process of leadership and instruction.

Packaging materials

An ideal water education package might be based on one well-rounded curriculum, but complemented by several support pieces. The basic curriculum should offer a variety of activities, topics and levels.

Complementary pieces could include two types of resources:

- 1) materials specific to a regional water resource; and
- 2) drinking water quality materials (which are generally missing from most water education packages).

To introduce water-related careers, risk assessment or other concerns, you may have to develop supplementary materials locally.

As you choose materials, be sensitive to gender equity. Keep the socioeconomic and ethnic characteristics of your audience in mind. And consider any special learning needs.

Meeting environmental education goals

While school materials provide opportunities to learn ecological principles and practice investigation skills, the available curricula do not show young people how to apply what they have learned to their personal life decisions. You will need to find ways to bridge this gap.

Many curricula suggest home or school environmental actions, but few help young people take those actions.

Most curricula do not help young people ask their own questions about the impact on the environment of what they do at home or in the community. For example, youth should be encouraged to ask and investigate questions about their own lives such as: "Does being on a soccer team have anything to do with water quantity or quality?" or "Does playing with squirt guns have anything to do with water quantity or quality?"

It will take creative programming to address these and other needs for experiential education.

Empowerment and stewardship

As you design your water education experience, the National Review Team recommends that you think about two philosophical perspectives. First, the experience should encourage a sense of hope and empowerment to affect the future of our water quality. Second, it should encourage youth to understand that water is fundamental to the total living community, not just the human community.

One way to develop a sense of empowerment is to help young people appreciate their place in the historical context. They can visualize how their community has managed water quality in the past, what changes have already been made to improve future management, and what other changes may still be necessary to protect water quality. This should help them understand how human actions can improve environmental quality, not just cause damage.



The holistic perspective, which includes questions about implications for plants, animals and their ecosystems, can be enhanced by ensuring that youth go beyond the question of “What does this mean to me?” When they are done, they should be curious enough to ask “What does this mean to the future of our society and the earth?”

Choosing curricula for the nonformal setting

The nonformal or out-of-school setting offers excellent opportunities for young people to learn about water through real experience and action projects. There are many such nonformal settings: after school clubs, summer camp, nature center visits, church youth groups, and organized youth programs like Boy and Girl Scouts and 4-H.

Unfortunately, with few exceptions, most water curricula and support materials are not designed for nonformal settings. Some can be used with minimal preparation and modification. A few may be good models: they take the youth group through most of the nine water topics listed in this guide in a way that is appropriate to the nonformal setting.

To help you decide whether a particular curriculum can be used in the nonformal setting, refer to the questions listed here. These questions were suggested by practitioners of nonformal education who reviewed and discussed the curricula we selected. They have not been formally evaluated.

QUESTIONS TO ASK ABOUT CURRICULA FOR THE NONFORMAL SETTING

Does the format:

- *Provide instructions in a brief form?*
- *Allow easy separation of instructions from the activity?*
- *Provide appropriate packaging to ensure that instruction materials are portable and long wearing?*

Are concepts taught through a hands-on activity?

Does the activity provide a “hook” or appeal to a “teachable moment”?

Does the activity relate to the “world” of the youth who will do the activity?

- *Is it appropriate to the interests, age, sophistication, gender, culture, socioeconomic status, and learning needs of the youth?*

Can activities be provided independent of each other—can they stand alone?

Is the time required for the activity appropriate to the attention span of the age group and the time available in the nonformal setting?

Does the activity produce a product or result that enables the youth to communicate the concept that is learned?

Is the activity fun? Is there a reward, tangible or intangible, for the learner?

Does the activity have a good probability of changing or influencing behavior?

Are materials easily available to most people?

- *Are special required resources packaged with the materials?*
- *Do the materials assume ownership of special equipment such as a video cassette recorder, tape recorder, or computer?*

Are the instructional methods easy to understand, organize and carry out?

Can they be conducted without any special training or knowledge on the part of the leader?

Is the language used to describe the activity “user friendly,” without educational jargon?

Does the activity actually work?

Is the purpose for any support items, such as charts, graphs, or illustrations, self explanatory and clearly related to the activity?

Is the activity appropriate to the setting where the activity will be used? The best use of a computer-based learning program would be in a setting with few distractions and the opportunity to spend time with the materials.



Suggested curricula for nonformal education

To help you narrow your search for curriculum materials to adapt to the nonformal setting, we offer a few examples. The list is not exclusive and we have not tested the materials. See the curriculum summary chart for details about what topics each curriculum includes.

Easily adapted

Aquatic Wild

Be Water Wise

Connections to the Sea

From Ridges to Rivers

Hands-On Save Our Streams

Local Watershed Problem Studies

Our Great Lakes Connection

Pond and Stream Safari

The Story of Drinking Water

Water Resources Education. Critical Issue: Water. You Can Make a Difference!

Water Riches, Indiana version

Water Magic

Water Wizards

Adaptable with some effort

4-H Sportfishing Aquatic Resources Education Program

Groundwater: A Vital Resource

The Groundwater Adventure

Instructor's Guide to Water Education Activities

Stop, Look, and Learn

Surface Water

Teaching Aquifer Protection

Water Wise

Water Worlds

Unique resources

The following provide an easily transferred model of a regional or statewide nonformal education program:

Nebraska Groundwater Foundation:

Groundwater Festival and Children's Groundwater Festival Outreach packet

Some NatureScope activities are ideal for self-learning. Others provide an excellent basis for designing a nature center or summer camp experience.

Ranger Rick's NatureScope, "Wading Into Wetlands" and "Diving Into Oceans"

Unique resources or program support materials—not reviewed

These materials were either designed for the nonformal setting or could be adapted with minimal effort. We provide information on how to get these materials starting on page 36.

The Changing Chesapeake

Fishing for Fun and Learning

Fishing...Get in the Habitat

Friends—Special Water Edition, A Magazine for Young Readers From Georgia 4-H Clubs

My Wetland Coloring Book

Project Earthcare

Responsible Angling. The Oregon Angler Education Manual

Ranger Rick's NatureScope. Pollution: Problems and Solutions

Water Can Be Fun! How to Create a Successful Science Fair

Water Fun for You

Designing your water education experience

To assist youth leaders with program design and project ideas, see two other publications in this series, *Educating Young People About Water: A Guide to Program Planning and Evaluation*, and *Educating Young People About Water: A Guide to Unique Program Strategies*. Both guides, along with this document, will be available in fall 1995 at the ERIC Clearinghouse for Science, Mathematics and Environmental Education, 1729 Kenny Rd., Columbus, OH 43210. For ordering information, call 614/292-6717.



A guide to reviewed curricula

This section is a brief annotated bibliography of each curriculum reviewed for the project. In addition to finding quality curricula, we tried to represent current water education themes such as watersheds, wetlands, groundwater and oceans. We attempted to provide a geographical representation of states' water issues and their efforts to educate youth. In reviewing these curricula, we looked only for the presence or absence of specific water topics, environmental goals, or instructional format options. However, the process gave us an overview of each set of materials.

To find a curriculum about any particular topic or skill:

1. Scan the Water Curriculum Summary Chart starting on page 48 under the appropriate subject category.
2. Check related information such as age range or regional ecosystem addressed to eliminate inappropriate ones.
3. Review the annotated entry listed in this guide starting on page 17. Curricula are listed alphabetically.

For further details about subtopics, environmental goals, etc., access the computer database for the individual checksheets as explained on page 3. Use the curriculum's identification number (001, for example).

Curricula summaries

Some of these materials are no longer available to order, but are listed here because of their quality. These resources may be available in local libraries. The number above each title refers to the curriculum identification number in the electronic database described on page 3.

081
Active Watershed Education Curriculum Guide, It's AWESome! (formerly, The Pawcatuck Watershed Curriculum) 1993
Cost: \$40 plus \$5 shipping/handling

Southern Rhode Island Conservation District
Depot Bldg., 5 Mechanic Street
Hope Valley, RI 02832
401/539-7767

This guide takes a thematic approach to teaching about watersheds. Authors address several components of watersheds, including wetland ecology, soils, point and non-point source pollution, and cultural and historical land uses. Text includes pre- and post-tests for students. Curriculum is well-organized and provides thorough background information for educators. Also includes an appendix that provides suggestions on how to adapt the program activities to other watersheds.

068
An Activity Guide for Teachers: Everglades National Park 1991

Cost: \$14.95 plus shipping and handling
Everglades National Park
4001 State Road 9336
Homestead, FL 33034
305/242-7700

This unit-based, multi-resource guide provides 4th to 6th grade teachers with the tools to teach about the varied Everglades ecosystem. The curriculum addresses many of South Florida's water issues—human popula-

tion growth, water diversion from the Everglades, water quantity regulated to the Everglades, overharvesting of fish and shrimp, and disruption of the estuarine food chain. The five appendices include background information, supplemental classroom materials, songs, vocabulary, bibliography, and resource lists.

069
Adopt-A-Stream 1993
Cost: \$15 plus shipping

Friends of Environmental Education Society of Alberta (FEESA)
10150 100th Street, 9th floor
Edmonton, Alberta T5J 0P6
403/421-1497

Written for grades 7–10, this curriculum emphasizes land use within a watershed. Activities encourage youth to apply observational skills when monitoring a stream and rely less on quantitative results from test equipment. Includes a detailed section on how to manage and promote a stream project. Provides thorough background information for teachers and students. Packet includes the curriculum notebook plus an angler education program guide, aquatic plant guide, and macroinvertebrate guide and poster.

001
The Adventures of Wally, the Water Molecule 1991
Cost: not available

Chem Kids
25658 Ericson Dr.
Moreno Valley, CA 92553

A resource to aid in teaching about water chemistry. Materials are designed to provide active learning opportunities for grades K–3. An accompanying video assists instructors in learning to use active learning strategies. Some concepts and vocabulary contained in the learning activities may be too abstract for young children; e.g. volume, mass and density.



002

Always a River: Supplemental Environmental Education Curriculum on the Ohio River & Water

Cost: free

EPA Office of Research and Development

26 West Martin Luther King Drive
Cincinnati, OH 45268
513/569-7562

This curriculum includes four primary objectives: 1) to demonstrate that the Ohio River is part of a total ecosystem; 2) to introduce the science of water and its importance to living things; 3) to explore human use and environmental impacts of human activity; and 4) to examine the influence of the river on historical and modern culture. The “Careers on the River” activity is unique—authors suggest holding a “career day.” Includes appendices on making aquaria, guidelines for interviewing people, and field ethics.

097

Aquatic Environmental Education: School Enrichment 1992

Cost: cost of printing

Langston University, Cooperative Extension Program
P.O. Box 730
Langston, Oklahoma 73050
405/466-3836

Primarily a guide rather than a curriculum. These materials support a university Extension program. In addition to the curriculum guide, the program includes videos, an aquarium stocked with fish, and 12 facts sheets to support a fish culture project. The program strategy offers a unique opportunity to connect youth with actual experience with a natural resource professional. Video content was not reviewed. Materials can be used independent of videos, but will require teachers to develop their own activities.

003

Aquatic Wild 1992 (updated yearly)

Cost: free; available only to those attending a workshop

Project Wild

P.O. Box 18060
Boulder, CO 80308-2390
303/444-2390

Activities in this guide emphasize water habitats that support wildlife. Authors summarize each activity with student age, subjects, skills, duration, group size, setting, conceptual framework reference, and key vocabulary. The background section addresses the main concepts. Materials include suggestions for aquatic extensions of existing Project Wild instructional activities. Exceptional appendix materials including:

- *Extensions to existing Project WILD activities*
- *Use of outdoors as a classroom*
- *Maximizing use of local resources*

004

Be Water Wise 1988

Cost: Instructor’s Guide, \$3; Activity Guide, \$1.25 (includes shipping). Make checks payable to Virginia Tech.

Virginia Water Resources Research Center
617 N. Main St., VA Tech
Blacksburg, VA 24060-0444
703/231-8036

Written for grades 7-8, this curriculum helps users understand that water plays a critical role in our daily lives; why water should be used wisely; and the importance of conserving water. Designed for flexibility either as a school supplement or as a resource for other groups interested in water conservation.

005

Caring for Our Lakes: A Curriculum on the Yahara Watershed 1990

Cost: free (one copy only)

University of Wisconsin–Madison
Water Resources Management
Institute for Environmental Studies
550 N. Park Street, 15 Science Hall
Madison, WI 53706
608/263-3064

A local resource that demonstrates how a curriculum can be designed to further educational goals about a local water resource—lakes. Includes aspects that are applicable to any community with small lakes in its watershed. Goals for students to achieve include: understanding lakes as part of a larger ecosystem; ability to identify problems and issues concerning the Yahara lakes; familiarity with geography of the watershed; and recognition of human activities related to lake problems.

053

Captain Hydro 1992

Cost: Student Handbook
50¢, 1-150 copies
43¢, 151-1500 copies
(plus shipping)

Cost: Teacher’s Guide
\$2, 1-150 copies
\$1.75, 151-1500 copies
(plus shipping)

Innovative Communications
Publications Information
PO Box 24055
Oakland, CA 94623
510/944-0923

Designed as a comic book for middle school students, Captain Hydro covers the water cycle—natural and built, water use, and water conservation and management. *The Further Adventures of Captain Hydro*, for grades 8–10, concentrates on world history and geography. Field experiences are provided as “homework.” Two simulation exercises in Captain Hydro help develop community problem solving skills.



006
Children's Festival Outreach
Packet 1992

Cost: \$12 (includes shipping except
for Nebraska residents)

Nebraska Groundwater
Foundation
P.O. Box 22558
Lincoln, NE 68542-2558
402/434-2740

These materials help prepare
4th–6th graders for the annual Nebraska
Children's Groundwater Festival.
Activities were adapted from other cur-
ricula and put into a framework suitable
for Nebraska water education needs.
Includes activities which emphasize the
effects of human activity on water
resources, both above and below
ground. Packet includes: "groundwater
basics," an instructional packet and 2
video supplements which provide addi-
tional activities. Viewing video tapes is
not an essential precursor to the supple-
mental activities.

072
Clean Water, Streams and
Fish: A Holistic View of
Watersheds Elementary and
Secondary Editions

Publication date not provided

Cost: \$15 each (includes shipping)

Washington State Office of
Environmental Education
17011 Meridian Avenue, North,
Room 16
Seattle, WA 98133
206/542-7671

Both curricula are written to help
elementary (grades 6–9) and secondary
(grades 9–12) youth understand water-
sheds, the effects of human activities
within watersheds, and how to mini-
mize those effects. Week-long, interdis-
ciplinary lesson plans focus on fish life
cycles and habitat, stream dynamics,
natural and human activities. Youth are
then exposed to various controversies
and issues that occur in the Pacific
Northwest such as private and commer-
cial fishing, Indian Treaty Rights, devel-
opment and logging. The "Solutions"
unit suggests ways to address problems
within the watershed.

067
Coastal Issues:
A Wave of Concern 1991

Cost: \$15

Sea Grant Extension Program
University of New Hampshire
Kingman Farm
Durham, New Hampshire 03824
603/749-1565

Activities written for high school
students focus on decision-making
skills as they relate to coastal develop-
ment, recreation, tourism, and aesthetic
concerns. Case studies represent real
coastal community issues.

044
The Comprehensive Water
Education Book, Grades K–6
(formerly Water Education)

1985 reviewed, revised in 1994

Cost: \$8.75 includes shipping

International Office for Water
Education
UMC 82
Utah Water Research Laboratory
Logan, UT 84322
1-800/922-4693

Activities for school setting seek to
develop water literacy through active
learning. Activities stress comprehen-
sion of water concepts, attitudes about
water issues, and skills to solve water
issue problems. Concepts/vocabulary
may be difficult for some K–6 graders
(e.g., porosity, saturation, volume,
density).

064
Connections to the Sea, a 4-H
Guide to Marine Education 1990

Cost: \$2 plus shipping

University of Maine Cooperative
Extension
Room 105
5741 Libby Hall
Orono, ME 04469-5741
207/581-3185
1/800/287-0274

Materials focus on ocean ecology,
hydrology, and pollution sources
through student field investigations.
Unique activities cover mapping and
map reading, and sensory awareness in
the ocean environment. An extensive
"related activities" section includes
activities for the visual arts, sea food,
impact of the ocean on people's lives,
environmental issues, and plant collec-
tions. Also includes a small field guide
to Maine Atlantic organisms. Materials
do not specify an age, but appear to be
designed for middle school through
high school youth.

068
Creek Watchers:
Exploring the Worlds of
Creeks and Streams 1993

Cost: \$5 plus shipping

CASEC California Aquatic Science
Education Consortium
Graduate School of Education
University of California
Santa Barbara, CA 93106
805/893-2739

Creek Watchers aims to encourage
youth groups and leaders to explore
creek and stream ecosystems. Youth get
hands-on experience with activities in
stream habitat, inhabitants, and the
effects of surrounding land use.
Activities are designed to help youth
apply basic science concepts such as
observing, comparing, inferring, and
analyzing. Students receive "Task
Cards" and "Lab Notebook" sheets to
record their findings. Authors provide
ideas for stream action projects and list
local California resources to contact for
those projects. This curriculum is one in
a series of five by the California Aquatic
Science Education Consortium
(CASEC).



007

Decision-Making: The Chesapeake Bay 1985

Cost: \$14.95 (includes shipping)

Maryland Sea Grant
Univ. of Maryland
0112 Skinner Hall
College Park, MD 20742
301/405-6376

This curriculum centers on students' ability to identify and analyze conflicting interests and public policies concerning the Chesapeake Bay. Youth determine their resulting decisions based on people and their environment. Instructional time can range from 15 class sessions to an entire semester. Through the 5 educational components (introduction, videotape, simulation, reference source and application), educators may choose to use the materials independently or incorporate into existing instructional units. Instructor training is required.

008

Discover Wetlands 1988

Cost: \$11.50 (includes shipping)

Washington State Dept. of Ecology
Wetlands Section
Mail Stop PV-11
Olympia, WA 98504
206/438-7538

These materials were developed to enhance the ability of the Washington State Department of Ecology in preserving and managing wetlands in Washington. Activities cover typical wetland topics such as definition and functions, field studies, and human effects. The materials were designed as a unit or integrated into existing curricula. Materials are activity-based and applicable to other regions of the country. Authors prompt the idea that both action and inaction affect the outcome of environmental issues.

073

EARTH: The Water Planet 1992

Cost: \$16.50.

National Science Teachers
Association
1742 Connecticut Ave. NW
Washington, DC 20009
202/328-5800

A collection of water activities to encourage problem-solving and critical thinking skills for middle elementary students. Activities focus on the earth science aspect of water, but highlights water issues throughout. Primarily indoors science activities. A "Guide to Activity" and detailed background "Readings" sections provided for each module. The overall curriculum theme is equity and scientific literacy for everyone.

065

Florida 4-H Marine Science Program 1990

Cost: Copies no longer available; duplication permitted.

University of Florida
Rolf's Hall
Gainesville, FL 32611
904/392-3261

Curriculum objectives center on how to teach youth to use simple field gear to understand the relationships between ecosystem components. Materials include a leader's guide, member's guide, project guide and project record book. Leader and member guides provide instructions for conducting and evaluating field guides to 6 marine ecosystems. The member's guide provides background material on organisms found in ocean ecosystems. The project guide and record book complement the curriculum and are meant to be used while visiting an oceanarium. Authors do not specify a target audience, but seem designed for 6th grade and older. Activities are dependent on leader direction.

074

Freshwater Guardians: Defending Our Precious Supply 1991

Cost: \$5 plus shipping

California Aquatic Science
Education Consortium (CASEC)
Graduate School of Education
University of California
Santa Barbara, CA 93106
805/893-2739

Developed for 10-15 year olds, this CASEC guide is one of five in a series. Activities help youth understand the sources and effects of freshwater pollution. "Task Cards" and "Lab Notebook" sheets are provided for students to record their results. The overall activity objective is that students learn science by doing. Students are encouraged to make predictions and explore alternative perspectives to problems, issues and questions.

075

From Ridges to Rivers: Watershed Explorations. 1993

Curriculum available to workshop participants only

4-H Watershed Project
San Luis Obispo County
4-H Youth Development Program
2156 Sierra Way, Suite C
San Luis Obispo, CA 93401
805/781-5944

Written for youth, ages 9-12, this curriculum begins with the watershed concept by helping students develop a "sense of place" within their watershed. The activities then quickly move to a close-up view of soils. Activities provide the opportunity for youth to discover the role that soils play in capturing and storing water within a watershed. The curriculum is designed around the learning cycle. The activities are sequential and primarily written for indoors with some adaptability to the outdoors. Activities are often taught by 4-H teen leaders.