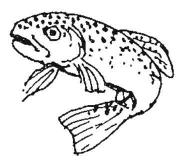
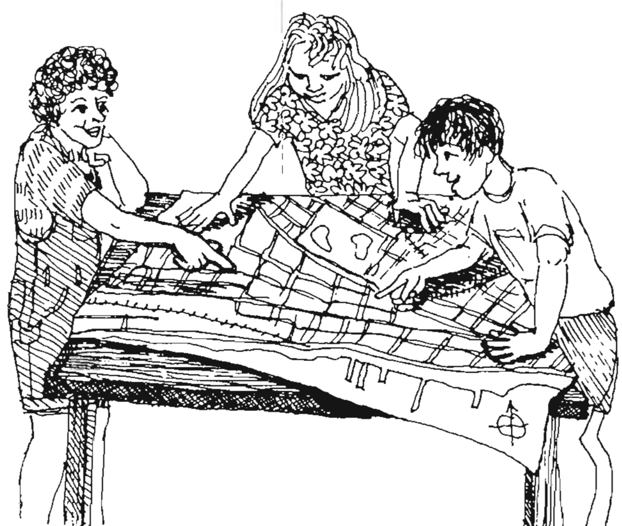
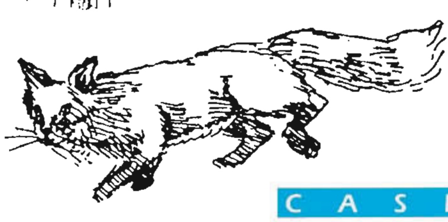


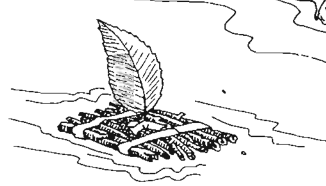
Learning Activities for
Youth Groups, Age 10-15

CREEK WATCHERS

Exploring the Worlds of Creeks and Streams







CASEC
California Aquatic Science Education Consortium

UNIVERSITY *of* CALIFORNIA
Agriculture & Natural Resources
Publication 21606

CREEK WATCHERS

Exploring the Worlds of Creeks & Streams

These materials were developed by the California Aquatic Science Education Consortium

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The initial formation of the California Aquatic Science Education Consortium (CASEC) in 1990 was undertaken by the Graduate School of Education at the University of California at Santa Barbara with funding provided by the National Science Foundation. In 1995, CASEC moved to the Department of Human and Community Development at the University of California, Davis with the 4-H Youth Development Program taking leadership for its ongoing activities.

The mission of CASEC is to promote a greater scientific literacy, a more thorough understanding of the value and workings of freshwater and marine ecosystems, and an enhanced awareness of scientific, environmental and policy aspects of California water issues. CASEC continues as part of the Division of Agriculture and Natural Resources Science, Technology, and Environmental Literacy Workgroup in the development, and evaluation of community-based aquatic science literacy projects.

Dedicated to
the youth of California
and their care of the earth.

C A S E C
California Aquatic Science Education Consortium

University of California Agriculture & Natural Resources
Publication 21606

California Aquatic Science Education Consortium

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**University of California
Davis**

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Introduction

Creeks and streams have long been ideal places for young people to play, dream, learn, and explore. This set of activities is designed to encourage youth groups and their leaders to enjoy and explore the creek and stream habitats in their communities, and thereby come to more fully appreciate the worth and workings of these unique areas.

A **creek habitat** includes the water, plants, trees, animals, soils, rocks, branches, and twigs along the stream's banks, as well as the water itself. The vegetation that grows along streams is a distinctive group, and these plants support a specific range of wildlife species. Creek and stream environments have several characteristics which make them unique habitats for wildlife: leaves and insects that fall from nearby vegetation and into the creek are a source of nourishment for small aquatic animals; streamside trees and shrubs provide food and shelter for animals as large as deer and as small as insects and all sizes in between; trees and marshy areas near creeks provide shelter for nesting birds; river banks provide homes for burrowing animals. Streamside vegetation also provides shade from the sun for aquatic plants and animals and small mammals and reptiles that live at the water's edge.

Compared to more arid areas of California, creek and stream habitats provide different and more abundant vegetation, resulting in a higher percentage of shade, higher humidity, and more diversity in plant and animal life. The U.S. Council on Environmental Quality has said about creeks that "no eco-system is more essential to the survival of the nation's fish and wildlife."

A number of conditions typify streams and creeks in their natural states. These include: cool, clear, oxygen-rich water that is free of contaminants and excess algae; plenty of clean gravel for fish spawning; and aquatic insects. Other conditions include a balance of fast water riffles (for spawning and feeding) and slow pools (for rest), sufficient summer flow, and lush streamside vegetation to stabilize banks and provide shelter and food for the animals that live there.

However, not all creeks are allowed to remain in their natural state. In California, 95 percent of streamside habitats have already been lost. From the 1940s through the early 1970s "channel improvement" and "flood control" projects were completed throughout the United States. These projects typically straightened creeks, removed all nearby vegetation, and lined the creek beds with concrete, destroying existing creekside habitat and its ability to support wildlife.

Today, many people have come to appreciate the value of maintaining creeks and streams in their natural form. These people are working to restore lost habitats, particularly in urban areas. There are currently an estimated 300 projects around the state to preserve or restore **urban creeks**. Urban creeks are particularly important because they provide the only water available for wildlife during dry weather months, and they provide the only areas of dense vegetation within urban areas. The basic life-giving conditions of food, water, and shelter that are required for the survival of all animals are provided by creek and stream habitats. In urban areas, creeks and streams often serve as trails or migration corridors along which animals travel.

The health of creeks and streams can be easily damaged by the actions of humans, and the health of a stream reflects conditions throughout its watershed, not just those along its banks. A **watershed** is the area of land that drains its run-off water into a certain creek, stream, or other body of water. Any activity within the watershed, such as construction, industry, logging, agriculture, recreation, or automobile traffic, can affect the quality of nearby creeks and streams.

Pollution that occurs anywhere in a creek or stream's watershed will always be washed into the creek, eventually. **Urban run-off** is the term for the water and other substances that get washed from urban watersheds into bodies of water. Urban run-off is made up of things like dripping engine oil, cleaning solvents, pesticides, and other toxins all mixing together with water. This urban run-off is a major source of pollution and poses a threat to the health of creeks and streams and the plants and animals that live in them.

Another great danger for creeks and streams is the problem of erosion. Improper management or misuse of stream banks results in erosion of soil that gets washed away by the water's flow, being deposited downstream in the form of sedimentation. This sedimentation fills the creek pools and covers the gravel that many fish species require for spawning. The result is often a drastic decline in species diversity within the creek and a loss of aesthetics in the creek's habitat.

An opportunity to learn. The need to protect California's creek and streamside habitiats presents young people with many interesting scientific and societal issues to study, and numerous opportunities to become involved in citizen action and natural resource protection. Specifically, this set of activities is designed to:

1. Teach basic scientific concepts related to the characteristics of creek and stream habitats.
2. Involve young people in hands-on science activities.
3. Stimulate and give guidance to young people as they work to help their community recognize and protect the value of creeks and streams.

"Doing" Science

Science is more than learning facts about the physical and natural worlds. Scientists do things that help them discover and understand. The *California Science*

Curriculum Framework suggests eight separate kinds of thinking processes that characterize scientific activity. These are:

- Observing
- Communicating
- Comparing
- Ordering
- Categorizing
- Relating
- Inferring
- Applying

Studying science should emphasize these same processes of *doing* science that practicing scientists use. Science students need the opportunity to go beyond the simple study of what scientists have learned. These students need the experience and practice of *doing* science as scientists do it.

The various activities in this package engage youngsters in the thinking processes and actions typical of those used by scientists. The young participants have the opportunity to organize and classify data, predict outcomes, verify their predictions, collaborate with others in the pursuit of solutions, and create new and different approaches to doing common things. Each activity description in this guide contains science exercises and identifies the particular thinking processes that youngsters will use to carry them out.

Which Activities to Use

For the most part, these are all independent activities and do not require use in any particular order. However, some may be more appropriate to begin your work on this topic, while others can serve as final activities. Further, some activities require more time to develop or multiple meetings to conduct.

What to Expect

Each activity presented in this book begins with a question to be answered, a summary, and a list of materials needed for the activity.

The "Instrument Panel"

At the upper left of each activity sheet is a shaded box with specific information about the activity that can be viewed quickly. This includes:

- An estimation of the activity's Academic Demand. Some activities require considerable thought and analysis on the part of youngsters. Others are less intellectually demanding.

- An estimation of the Physical Exertion Required by the activity. Some activities require considerable movement or exertion to complete, while others are quieter activities that may require less physical effort.

- A suggestion for the Number of Participants and how to group them most appropriately for the activity. Some activities may require a large group, while others are best accomplished by individuals working alone, in pairs, or in small groups. The following symbols signify different groupings:

= Youngsters working individually

= Youngsters working in pairs or small groups

= Youngsters working in large groups

Note that it is often possible to use more than one grouping method with the same activity.

- An approximation of the <u>Time Needed</u> for the activity. All of the activities in this package require sessions of less than one hour to complete. Some activities may take less time while a few require multiple sessions. Estimates are given to the nearest quarter hour.

- A suggestion as to the <u>Setting</u> that would be most appropriate for the activity. Two settings are presented:

= The home or club room

= The out-of-doors

Some activities may be accomplished in either setting.

Question

The topic of the activity is presented in question form so that youngsters might more easily see that their task, like that of practicing scientists, is to seek answers for themselves, not merely to learn answers acquired by others.

Summary

A one- or two-sentence summary of the activity is presented as an overview. This should assist the leader in selecting activities and in planning for their use.

Materials

Each activity requires certain materials, many of which are included in this package. For example, most activities make use of included task cards and data sheets that can be photocopied and distributed to the youngsters to guide them through the activity. Additionally, some activities require other items that generally can be found around the home. All necessary materials are listed in this guide.

Purpose

Particular educational goals for each activity are listed in this guide to assist leaders in planning and executing the activity.

Activities

The learning actions of each activity are presented as a series of steps to be directed by the leader. These actions are often mirrored or elaborated on the Task Cards used by the youngsters. It is important to recognize that the activities are presented as suggestions. Individual group leaders should feel free to make alterations that they think might improve the experience for their particular group.

Keys to Success

This section offers suggestions derived from past experience that might help the group leader derive the maximum benefit from each activity.

Use by Youth Groups

The activities in this package have been designed to fit comfortably into a wide variety of educational programs offered by youth-service agencies. Below are specific suggestions concerning how they might be used in particular organizations.

Boys and Girls Clubs of America

These learning activities may be used as a guide for club activities in environmental education, one of the six core services provided by the Boys and Girls Clubs programs. The activities may also complement individual clubs' existing programs in recycling, conservation, or marine science.

Girl Scouts

Within the Junior Girl Scout Program, these learning activities can be used for:

- Working toward badges in the World of Today and Tomorrow (Science in Action; Water Wonders) or in the World of the Out-of-Doors (Eco-Action; Outdoor Surroundings).
- Participating in the Contemporary Issues Program, "Earth Matters," and earning the participation patch.
- Participating in environmental badge activities at Girl Scout summer day camp or long-term camp.
- Developing activities, under the Council Patch Program Plan, that involve community improvement projects and investigative and hands-on environmental awareness activities for a troop or council-wide event.

4-H Youth Development Program

These learning materials incorporate the science processes and the learning cycle method of instruction. The materials can be used by adult volunteer and teen leaders working with youth 10-15 years of age involved in 4-H projects focusing on environmental science as well as marine and freshwater science projects. The materials include activities to prepare the youngsters for their experience, on-site activities, and debriefing activities. In addition, individual activities can be led by teens at summer and day camps, fairs and other public events, used as a basis for 4-H demonstration projects, and National 4-H week events.

Camp Fire

These activities complement several projects in the Camp Fire Adventure, Discovery, and Horizon programs, including:

- Try-Ad projects and Action Crafts.
- Torch Bearer projects in Environmental Issues or Special Interest.
- Components for the national Project Good Earth.
- As one of the three issues explored in an individual's WoHeLo Medallion project.

The curriculum can also be used in resident and day camp programs located near beaches, lakes, and rivers.

Resources: Curricula

Adopting a Stream: A Northwest Handbook, 1991. Adopt-a-Stream Foundation, Northwest Stream Center, 600-128th Street SE, Everett, WA 98208-6353. (425) 316-8592. Online at <www.streamkeeper.org>.

Be A Part of Something Big: Adopt-A-Stream Youth Activities Packet, including activities for stream clean-up, restoration, and water quality assessment. Available from Save Our Streams, 791 Aquahart Rd., Suite 100, Glen Burnie, MD 21061. (410) 766-9443. Online at <www.saveourstreams.org>.

Clean Water, Streams, and Fish, Washington State Office of Environmental Education, 2800 NE 200th Street, Seattle, WA 98155. (206) 365-3893.

Dipping Into Creeks, contains an excellent adopt-a-stream packet. Sacramento Urban Creeks Council, 4855 Hamilton Street, Sacramento, CA 95841. (916) 482-8377.

Izaak Walton League educational materials: stream monitoring equipment, videos, and books, including the *Hands-On Save Our Streams* teacher's manuals and student project packets, and *A Citizen's Streambank Restoration Handbook.* Contact: Izaak Walton League of America, 707 Conservation Lane, Gaithersburg, MD 20878. (800) 284-4952. Online at <www.iwla.org>.

River Cutters, Great Explorations in Math and Science (GEMS), Lawrence Hall of Science #5200, University of California, Berkeley, CA 94720. (510) 642-7771.

The Stream Scene: Watersheds, Wildlife, and People, Oregon Dept. of Fish and Wildlife, Information and Education, PO Box 59, Portland, OR 97207. (503) 872-5264 ext. 5528.

Resources: Field Guides

Creek Life & Creek Ecology: A Quick Guide. Urban Creeks Council, Sacramento Chapter, 4855 Hamilton St., Sacramento, CA 95841. (916) 482-8377.

National Audubon Society Field Guide to Northern American Fishes, Whales, and Dolphins, New York: Alfred A. Knopf.

National Audubon Society Field Guide to Northern American Insects and Spiders, New York: Alfred A. Knopf.

National Audubon Society Field Guide to Northern American Reptiles and Amphibians, New York: Alfred A. Knopf.

Pond Life: A Golden Guide, Golden Books, New York.

Resources: Other Materials

The Layperson's Guide to Environmental Restoration, Water Education Foundation, 717-K Street, Suite 317, Sacramento, CA 95814. (916) 444-6240.
Online at <www.water-ed.org>.

The Riverwork Book, Rivers & Trails Conservation Assistance, National Park Service, 600 Harrison Street, Suite 600, San Francisco, CA 94107. (415) 427-1446.
Online at <www.nps.gov/pwro/rtca>.

The Streamkeeper, a 1996 video starring Bill Nye, "The Science Guy," and the *Streamkeeper's Field Guide: Watershed Inventory and Stream Monitoring Methods*, 1999. Both available from the Adopt-a-Stream Foundation, Northwest Stream Center, 600-128th Street SE, Everett, WA 98208-6353. (425) 316-8592.
Online at <www.streamkeeper.org>.

Streamwalk — A Stream Monitoring Tool for Citizens, Environmental Protection Agency (EPA),Region 10, 1200 Sixth Avenue, Seattle, WA 98101. (206) 553-1200.
Also available online under the heading of *Stream Habitat Walk* at
<www.epa.gov/owowwtr1/monitoring/volunteer/stream/vms41.html>.

Funding Information for Stream Restoration Projects

Urban Stream Restoration Program, California Department of Water Resources, P.O. Box 942836, Sacramento, CA 94236. (916) 327-1617. Online at <www.dwr.ca.gov>.

Urban Creeks Council of California, 1250 Addison St., Suite 107, Berkeley, CA 94702. (510) 540-6669.

To report water pollution in a creek or stream

1. Contact the nearest office of the California Regional Water Quality Control Board:

North Coast Region
5550 Skylane Blvd, Suite A
Santa Rosa, CA 95403
(707) 576-2220

San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612
(510) 622-2300

Central Coast Region
81 Higuera, Suite 200
San Luis Obispo, CA 93401
(805) 549-3147

Los Angeles Region
320 West 4th Street, Suite 200
Los Angeles, CA 90013
(213) 576-6600

Central Valley Region: Sacramento
3443 Routier Rd.
Sacramento, CA 95827
(916) 255-3000

Central Valley Region: Fresno
3614 East Ashlan Ave
Fresno, CA 93726
(559) 445-5116

Central Valley Region: Redding
415 Knollcrest Drive
Redding, CA 96002
(530) 224-4845

Lahontan Region
2501 Lake Tahoe Blvd.
South Lake Tahoe, CA 96150
(530) 542-5400

Victorville Branch Office
15428 Civic Dr., Suite 100
Victorville, CA 92392
(760) 241-6583

Colorado River Basin Region
73-720 Fred Waring Dr., Suite100
Palm Desert, CA 92260
(760) 346-7491

Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-3339
(909) 782-4130

San Diego Region
9771 Clairemont Mesa Blvd, Suite A
San Diego, CA 92124
(858) 467-2952

2. Contact the Environmental Health Department in your county. Look in the county government listings at the beginning of the white pages in your telephone book to find the phone number of your local office.
3. Contact the California Department of Fish & Game office nearest you or obtain their *Directory of Public Resources*,1999 by calling (916) 653-6420. Online at <www.dfg.ca.gov/>.

    Region 1, Redding (530) 225-2300
    Region 2, Sacramento (916) 358-2900
    Region 3, Yountville (707) 944-5500
    Region 4, Fresno (559) 243-4005
    Region 5/6, Long Beach (562) 590-5132, San Diego (619) 467-4200

4. Contact the Urban Creeks Council affiliate in or near your community:

Aquatic Outreach Institute, Richmond (510) 231-9507
Carpenteria Creek Committee, Carpenteria (805) 684-7948
Cottonwood Creek Conservancy, Carlsbad (760) 436-5308
Dry Creek Conservancy, Roseville (916) 771-2013
Bay Area Citizens for Creek Restoration, Berkeley (510) 849-1969
Federation of Fly Fishers, San Carlos (650) 592-9595
Friends of Alhambra Creek, Martinez (925) 229-1371
Friends of Baxter Creek, Richmond (510) 237-7968
Friends of Corte Madera Creek, Ross (415) 454-8608
Friends of Creeks in Urban Settings, Walnut Creek (925) 938-6323
Friends of Five Creeks, Albany (510) 528-5758
Friends of Glen Canyon Park, San Francisco (415) 648-0862
Friends of Islais Creek, San Francisco (415) 826-5669
Friends of San Leandro Creek, San Leandro (510) 577-6069
Friends of the Los Angeles River, Los Angeles (213) 223-0585
Friends of the Roseville Parkway, Roseville (916) 331-3360
Friends of the Santa Margarita River, Widomar (909) 677-7341
Friends of Tecolote River, San Diego (619) 291-9308
Golden West Women's Fly Fishers, P.O. Box 22068, San Francisco 94122
L.A. & San Gabriel Rivers Watershed Council, Los Angeles (310) 270-4151
Mission Creek Conservancy, San Francisco (415) 552-4577
Mountains Conservancy Foundation, Malibu (310) 589-2400
Ojai Valley Land conservancy, Ojai (805) 646-7930
Paradise Creek Educational Park, 2143 Cleveland Ave., National City 91950
Patrons of the creek, Pacifica (650) 355-9654
Putah Creeks Council, Davis (530) 758-6983
Redwood Community Action League, Eureka (707) 269-2065
Roland Hauck Urban Creeks council, (707) 763-9335
San Joaquin River Committee & Conservation Trust, Fresno (209) 248-8480
San Joaquin River Committee & Conservation Trust, Fresno (559) 248-8480
San Joaquin Parkway Conservancy, Fresno (209) 292-6284
San Joaquin River Parkway Committee, Fresno (559) 434-3792

Urban Creeks Council affiliates (continued):

San Timoteo Greenway Conservancy, Lake Elsinore (909) 245-2304
Santa Barbara Chapter UCC, Carpenteria (805) 684-6008
Santiago Creek Greenway Alliance, Orange (714) 997-4446
Stream Consciousness, Los Osos (805) 781-5540
Streaminders, Chico (530) 894-1305
Tecolote Canyon Citizens Advisory Cmte, San Diego (619) 278-1617
The Nature School, San Diego (61) 224-2003
Tri-City Ecology Center, Fremont (510) 793-6222

(continued on next page)

Tri County Conservation League, Riverside (909) 686-0554
Union for a River Greenbelt Environment, Murrieta (909) 677-5429
Urban Ecology, Berkeley (510) 549-1724
West Contra Costa Environmental Education Council, Crockett (510) 787-3193
Wild in the City, San Anselmo (415) 459-6915

Resources for Community Action Projects

1. To report pollution or debris in creeks or streams, contact the California Water Quality Control Board, the California Department of Fish & Game, or the Environmental Health Department in your county.

2. The California Urban Creeks Council in Berkeley — (510) 540-6669 — puts out a good newsletter containing ideas and news about urban creeks in California. They and their local chapters and affiliates are good contacts for undertaking creek restoration projects.

3. To help educate streamside property owners about guidelines for protecting the health of creeks and streams, get a copy of *Stream Care: A Guide for Streamside Property Owners*. This guide urges streamside property owners to do the following:
   (a) Check for sources of erosion and treat them promptly. Any spot where flowing water meets unprotectected soil is a potential erosion problem.
   (b) Check their septic system, if they have one, and pump it frequently.
   (c) Leave streamside vegetation intact. A healthy streambank needs undisturbed soil and vegetation; streamside trees, vines, shrubs, grasses, and reeds are an essential part of the stream ecology.
   (d) Dispose of debris properly. Disposing of any material into or near a creek — even clippings or garden waste — can harm the stream. Remove old tires and domestic garbage from the stream.
   (e) Never dispose of antifreeze, waste oil, paint, solvents, detergents or other chemicals anywhere near your stream, no matter how small the amount.
   (f) Use care when using any pesticides, herbicides or fertlizers near the creek. Many yard and garden chemicals are extremely toxic to wildlife.
   (g) Avoid removing natural debris from the creek or stream unless it poses an erosion or flood hazard. Wood debris, such as fallen logs, provides an important source of cover, food and shelter for fish and other stream dwellers.

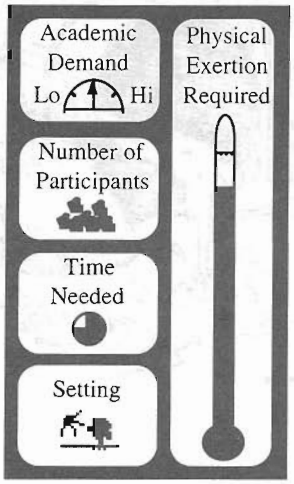
4. For revegetation projects, contact the local office of the U.S. Soil Conservation Service or the Resource Section of your county's planning department to see if there are any revegetation projects are underway in which you can participate. To locate the U.S. Soil Conservation Service Office nearest you, call their main state office in Davis at (530) 757-8200 or one of their three divisional offices, in Red Bluff at (530) 527-2667, in Salinas at (408) 754-1595, or in Fresno at (209) 252-2191. There are over 90 Soil Conservation Offices throughout California, so there is probably one in or near your community.

5. Grants are available from the Urban Stream Restoration Program at the California Department of Water Resources for citizens' groups who want to enhance or restore the health of local streams. Projects must be carried out jointly with a public agency and should be designed to address erosion, sedimentation, or flooding. For information contact: Kurt Malchow (916) 327-1617 or see the department's web site at <www.dwr.ca.gov/>.

6. Adopt-a-Stream projects. There is no one agency or person in California responsible for Adopt-a-Stream projects. You may be able to identify community groups, such as an affiliate of the Urban Creeks Council that would help your group adopt a stream. Or you can do it on your own simply by continuing to visit, clean-up and report on the health of a portion of a creek or stream in your community. See Resources in the Introduction for a listing of adopt-a-stream programs and curricula.

8. Adopt-a-Watershed Program: Contact Kim Stokely, P.O. Box 1850, Hayfork, CA 96041. (530) 628-5334. Online at <www.adopt-a-watershed.org>.

Creeks Begin At Home



Question: Where does the water go that flows into gutters near our homes? What do we do at home that might cause pollution in nearby creeks, streams, or other bodies of water?

Summary: Youth group members consult a local map to locate the creeks, streams, or other bodies of water nearest their homes or meeting place. They then learn about watersheds, storm drains, urban run-off, and how pollution that occurs within a watershed drains into a nearby body of water.

Materials:
- One or more full-color street maps of the area where group members live or hold their meetings. (Full-color maps show creeks, streams, and other bodies of water in blue).
- Task Card #1 (included). Photocopy one for each group of 3-5 people.

Purpose:

To help youth understand:
1. That all land, even urban areas, forms part of the watershed for some body of water.
2. That the health of a creek or stream is affected by things that happen elsewhere in the watershed.
3. That storm drains are **not** connected to the sewer system or to treatment plants, and that they instead flow untreated into creeks, streams, or other bodies of water.
4. That polluting substances discarded around the home can get washed into the storm drain system and pollute the waters of nearby creeks or streams.

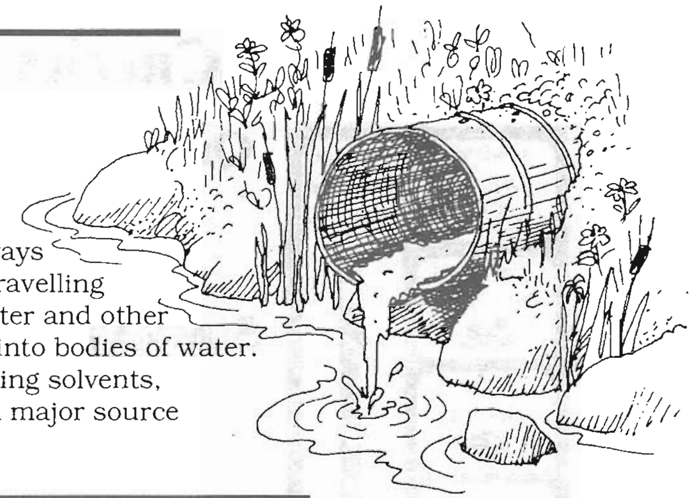
Background

A **watershed** is the area of land that drains its run-off water into a certain creek, stream, or other body of water. For example, the watershed for a hypothetical "Mission Creek" would be all the surrounding area from which water drains and then flows down into that creek.

All land, including urban areas, forms the watershed for some body of water. For example, much of the Los Angeles area forms the watershed for the Los Angeles River and for Santa Monica Bay. Any water that drains off the streets of Los Angeles ends up in these bodies of water.

The problem is that water picks up pollutants as it runs through city streets, gutters, and **storm drains**. Pesticides, oil drippings from cars, lawn clippings, trash, spilled toxic chemicals, and anything else that ends up on the ground, will likely be washed through the *storm drain system* and into a creek or other body of water. Unlike the sewer system, the storm drain system is not connected to a water treatment plant. Water that goes into storm

Background (continued)



drains eventually ends up flowing, completely untreated, into a waterway.

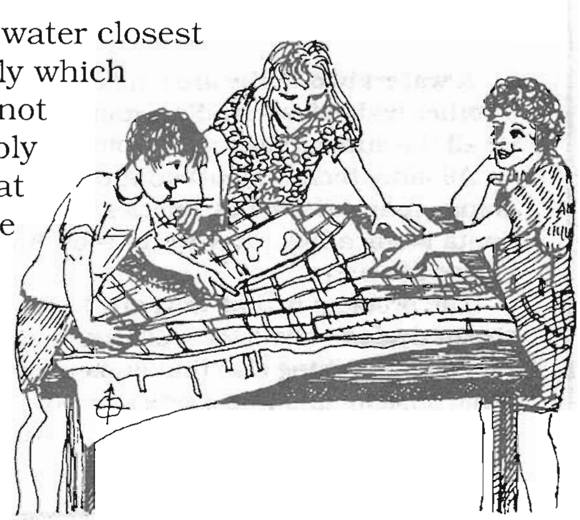
Pollution that occurs anywhere in a watershed always later drains downhill and into a body of water, often travelling great distances. ***Urban run-off*** is the term for the water and other substances that gets washed from urban watersheds into bodies of water. Urban run-off is made up of dripping engine oil, cleaning solvents, pesticides and other toxins, mixed with water and is a major source of water pollution.

Activities: (Observing, Relating, and Inferring)

1. Walk around the neighborhood to find one or more storm drains. Ask for the group members' ideas about where the water goes once it flows down these drains. Ask what would happen if someone spilled or dumped something toxic, like pesticides or motor oil, down the storm drain. Introduce the term **storm drain system**, explaining how it is completely separate from the sewer system, which means that the water and any other substances that go through it end up flowing untreated into a creek or other body of water.

2. Introduce the term **watershed**, using the Background Information as a resource. Explain that everyone lives in the watershed for some body of water. Ask the group members to guess which waterway it would drain to, if you were to dump water into the gutter in front of your meeting place. Chances are it is a nearby creek or stream. Or if you are meeting in a large city near the coast, the water might flow through a long and elaborate system of storm drains and into the bay or ocean. The body of water that the water flows into gives the name to the watershed. For example, if water from a gutter in front of your home drains into Mission Creek, then you live in the Mission Creek watershed.

3. Use a full-color map to identify the bodies of water closest to your meeting place. To determine definitely which watershed you are in may be difficult and is not essential to the success of this activity. Simply choose a body of water, such as the creek that runs nearest your meeting place, and assume that you are in its watershed. Or you can attempt one of the following things to more accurately determine which watershed you are in:
(Optional)
   - Attempt to physically follow the path of the storm drain until it ends at a



body of water. Some storm drains are alternately above and below ground.

- Consult a topographic map (one that shows elevations) and try to determine by reading the elevation lines which direction and into which body of water run-off from your home or meeting place would flow.
- Obtain a map of the storm drain system for your community from the city's Public Works Department or from the county's Flood Control District and figure out where water flows after it leaves your home or meeting place. (Look in the government phone listings in front of the white pages in your local phone book to find phone numbers for city and county offices).
- Contact a local chapter of the Urban Creeks Council or other environmental group in your area to see if they know which watershed you are in.

4. Distribute the Task Cards to each group of 3-5 people. Challenge them to find within the picture ten potential sources of pollution and to trace the pollutant's pathway into a storm drain or waterway.

5. For each polluting incident found in the picture, ask the group members what might have been done to ensure that no pollution was washed away into a nearby creek or stream. Refer to the answer key below for ideas.

Answer Key

Cause	Prevention
1. Pouring oil down storm drain.	1. Recycle or take it to a hazardous waste disposal site.
2. Littering near stream.	2. Throw trash in garbage cans.
3. Car leaking oil or radiator fluid onto driveway.	3. Keep car in good repair. Clean up leaks with absorbent material such as sawdust or hay.
4. Cleaning paintbrushes on lawn.	4. Use water-based paint and wash brushes in a sink.
5. Spilling paint onto the lawn.	5. Take care not to spill paint on lawn. It could soak into ground and water below.
6. Cleaning porch with chemical cleaners.	6. Use only non-toxic cleansers out of doors, such as baking powder, borax, or commercial cleansers labeled as environmentally safe.
7. Using pesticides in the garden.	7. Reduce or eliminate your use of commercial pesticides. Use natural pesticides such as planting marigolds nearby, introducing ladybugs, or using commercial products such as Safer.
8. Car cleanser spilling into street.	8. Wash car with biodegradable soap and take care not to spill undiluted product onto the ground.
9. Gasoline spilling on driveway.	9. Take extra precautions not to spill hazardous products. If spills occur, clean up with absorbent materials such as sawdust, hay, or kitty litter.
10. Littering.	10. Throw litter in trash cans.

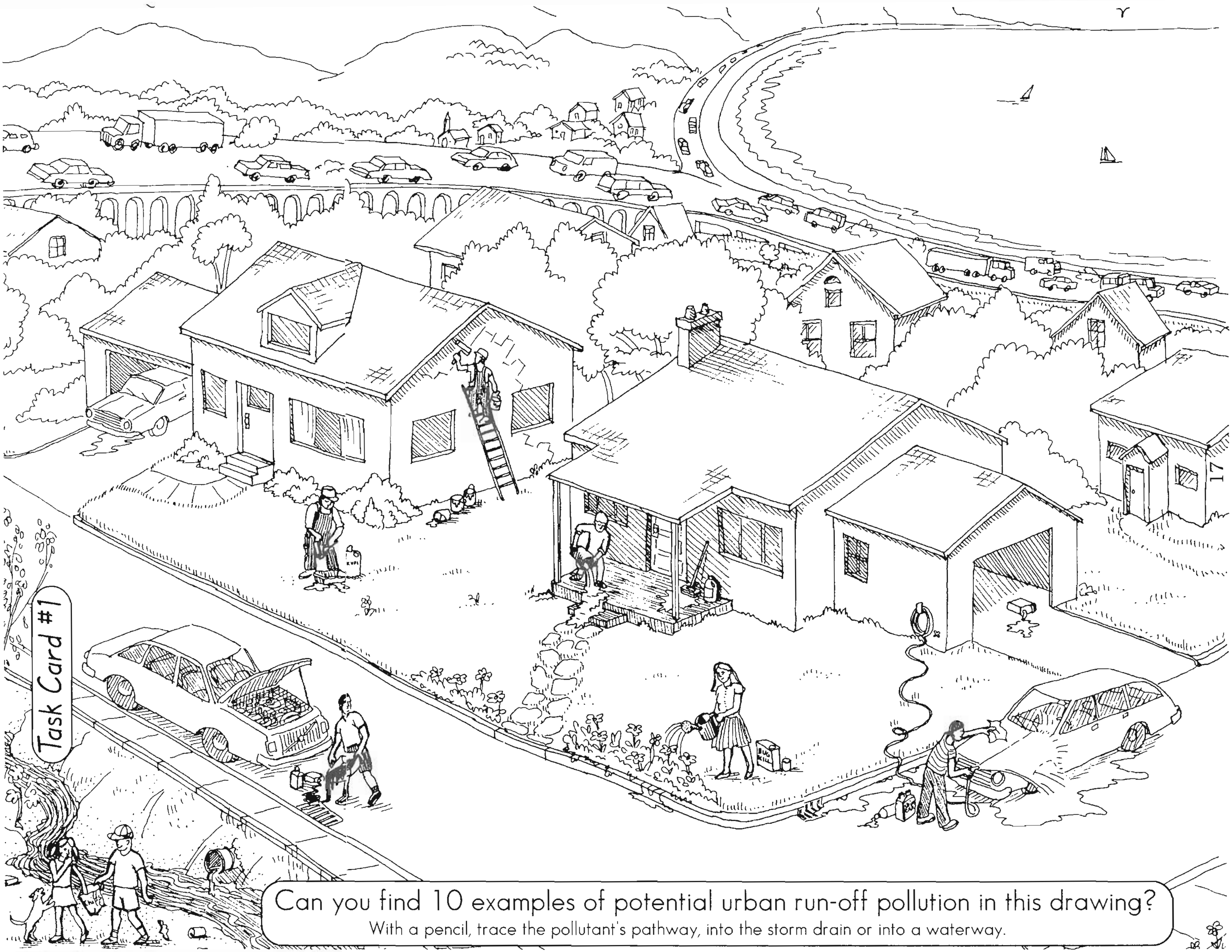
6. Emphasize again that everything that occurs in the watershed affects the water quality of the creek. All substances, such as oil, cleaning solvents, and pesticides, that end up on the ground or the streets are washed into the creek or other nearby body of water when it rains. This urban run-off is a major source of water pollution.

7. In conclusion, look at the full-color map of your community again and ask several hypothetical questions about events that could occur within the watersheds in your community.
   a. If a car leaked oil in this neighborhood, and then it rained, where might the oily water flow to?
   b. If a carpet cleaning business located on this street flushed cleaning solvent into the storm drains near the shop, where might the water flow?
   c. If an automobile repair shop in this neighborhood flushed radiator fluid into the gutter, where might the water flow?

Optional Follow-up Activity

- Go out and visit the creek or other body of water in whose watershed your meetings take place. Usually this will mean stopping at the bridges that go over the creek rather than walking along its banks. Do you see evidence of wildlife? Does the water look polluted? Are the stream banks eroded? Is there garbage or other litter in the creek? You may want to revisit the creek to carry out further activities in this book, such as **Creek Walk** (Activity #3) or **Be A Friend of Your Local Creeks** (Activity #10).

Task Card #1

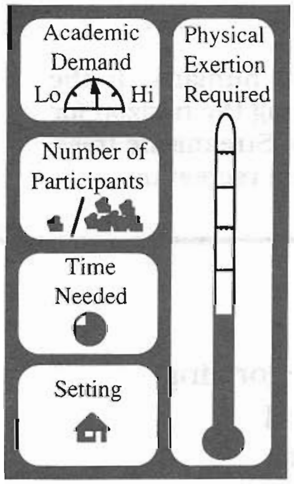


Can you find 10 examples of potential urban run-off pollution in this drawing?

With a pencil, trace the pollutant's pathway, into the storm drain or into a waterway.

Activity #2

These Sheltering Trees



Question: What are the names of some of the trees that grow along creeks in California, and why are trees beneficial to the other creatures of the creek?

Summary: At the meeting place, youth group members identify trees by comparing gathered leaves to a silhouette identification guide of California streamside trees. They share their own knowledge about the ways trees benefit other creatures, and then participate in a charade-type game acting out these benefits.

Materials:

- Pens
- Scissors
- Paper
- Small bag or cup
- Masking tape or small peel-off labels
- Any field guide to trees in the western states
- Copies of the *Mini Field Guide to Trees of California's Creeks and Streams* (included). Photocopy one for each person.
- A bag of tree leaves collected from typical California riparian trees (trees living near water). Attempt to gather a wide variety of leaves, including some that will match the leaf silhouettes in the mini field guide. Fall is a good time to gather leaves, since many of these trees lose their leaves in the winter. (Leaves can be gathered by group leaders prior to the meeting, or by youth group members during an outing where they complete one of the other activities in this guide.)

Purpose:

To help youth:

1. Understand the role trees play in the overall health of a streamside habitat.
2. Learn to identify common trees that grow along California creeks and streams.

Background

Streamside trees play a critical role in the creek or stream habitat, helping to support a vast array of other life. They provide food and shelter for birds, insects, fungi, mammals, and plants. Leaves dropping from trees into the creek decompose and add nutrients which feed the tiny aquatic organisms, which in turn feed the larger organisms. Branches and twigs dropping into the creek help slow the flow of water and create pools that make good habitat for the young of many fish species. Trees shade and cool the water, making it more habitable for many organisms, and also create constant moving shadows which provide good camouflage for small animals. Finally, tree roots stabilize the stream banks, preventing erosion which can harm many species. The water in creeks permits a more dense growth of trees at the streamside than is

Background
(continued)

found in most parts of arid California. These streamside trees are beneficial to humans. In the old west, a Native American or settler could find surface water just by scanning the horizon for the distinctive vegetation of a creekside habitat. This can still be done today. Streamside trees also provide people with shade, shelter, oxygen, and a place for relaxation and recreation.

Activities: (Observing, Communicating, Comparing, and Categorizing)

1. Spread the leaves out on a table or in the middle of the floor and allow time for the group members to explore and compare them.

2. Pass out the photocopies of the *Mini Field Guide to Trees of California's Creeks & Streams.* Give instructions and offer assistance when necessary on cutting and folding the page to create a small book. (See pages following for instructions). Explain that the mini field guide can be kept and taken along when visiting creeks for some of the other activities.

3. Explain that the goal is to identify the leaves by comparing them to the silhouettes in the field guide. Once group members have identified the leaves, they should label them with pens and masking tape or peel-off labels. (You may want to divide into smaller groups of 3-5 people to carry out this step.) Consult a field guide to western trees to identify the leaves that are not found in the mini field guide.

4. Once the leaves have been identified, explain that they are all from trees that were very important to Native Americans and early settlers in California. Just by scanning the horizon, early Californians would see these trees from a great distance and know there was drinking water to be found there because these trees grew only along creeks and streams. Explain that these trees also provided (and continue to provide) people with shade, shelter, oxygen, and a place for relaxation and recreation.

5. Explain that these trees are also very important to the creatures that live along the creeks. Trees, being the largest living things in a creek's environment, have a big affect on the health and well-being of other creek organisms. Encourage the group members to think of possible ways that trees benefit the creatures of the creek.

6. As the group comes up with ideas, have someone write them down on separate small squares of paper. If necessary, consult the list below and offer prompts such as, "How might trees help birds get their food?" or "Trees shade and cool the water. Which animals might this help?"

Some Ways Trees Benefit Other Creek Organisms

Trees drop leaves into water. These leaves decompose and add nutrients that feed tiny creek animals.

Trees drop leaves and branches that block the flow of the water, forming creek pools that are good places for young fish to live.

Trees provide shelter for small mammals who burrow in their trunks, roots, and branches.

Tree branches provide nesting places for birds and places for birds to perch to escape predators.

Trees provide feeding places for birds — branches from which to perch and dart for food, and insects that inhabit the tree to feed on.

Tree leaves provide food for insects. Insects then fall into the creek, providing food for fish.

Tree roots stabilize banks and prevent erosion. Erosion causes water to become cloudy, which can harm fish and other animals.

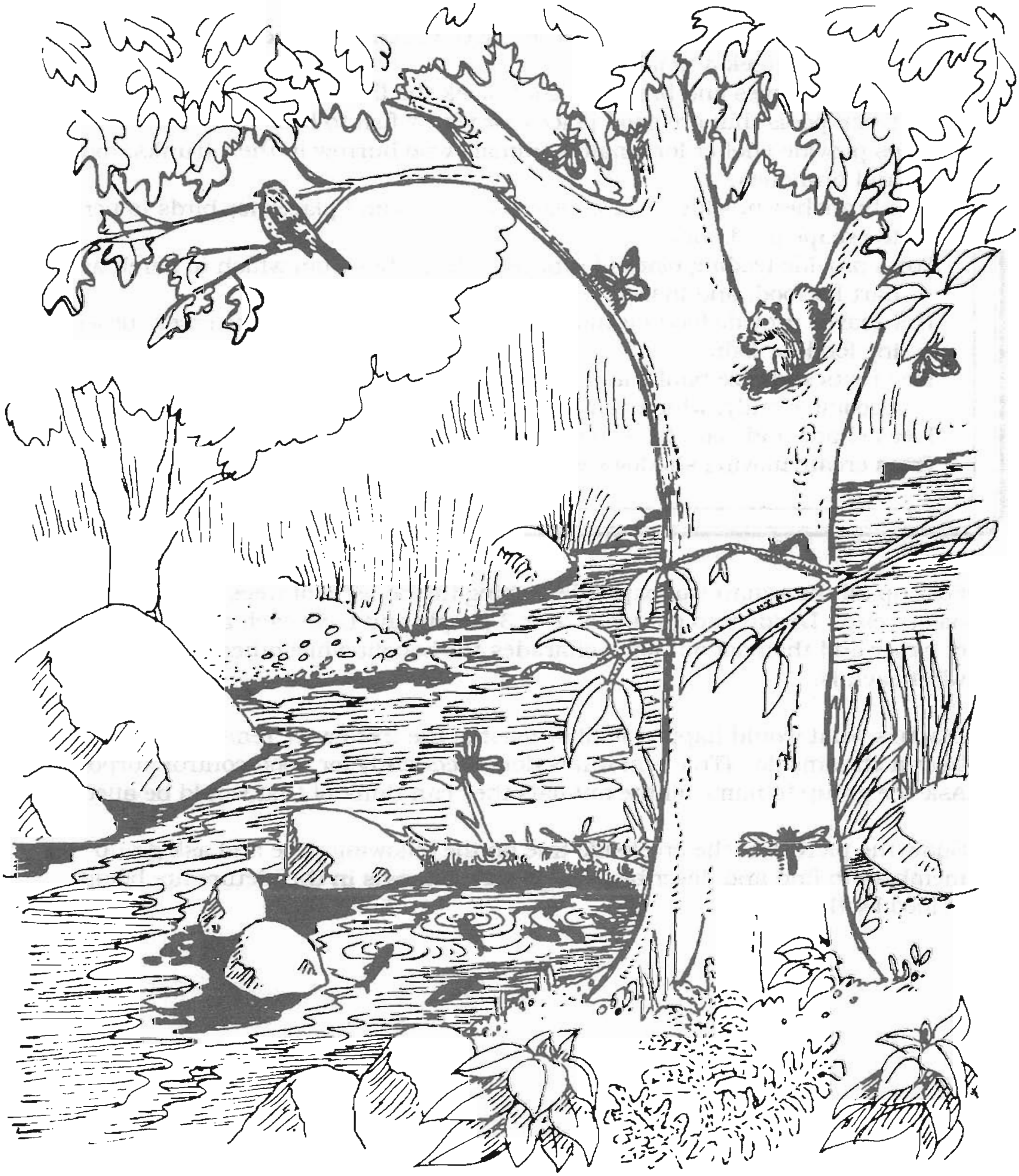
Trees shade and cool the water making a better habitat for young fish.

Trees create moving shadows which provide camouflage for small animals.

7. Fold up all the squares of paper describing the benefits of trees and put them in a bag or cup. Divide into groups of 2 or 3 people and have each group draw a piece of paper and then act out as in charades the benefit while others try to guess what each is.

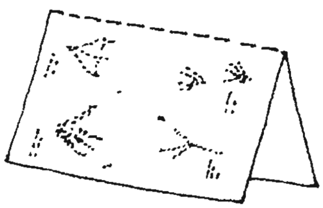
8. Discuss what would happen if all or most of the trees were removed from a streamside. (Tree removal is done frequently for flood control purposes.) Ask the group to name all the animals they can think of that would be affected.

9. Show the picture of the creekside tree on the following page and ask group members to find and describe the ways the animals in the picture are being helped by the tree.

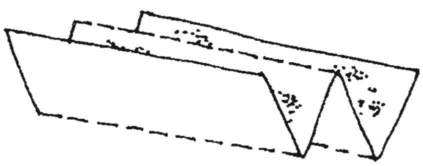


Instructions for Folding Mini Field Guide to Trees of California's Creeks and Streams

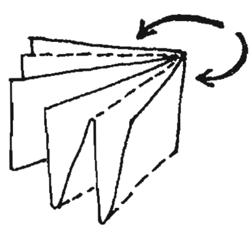
1. Fold the sheet in half crosswise, so the text and pictures appear on the outside.



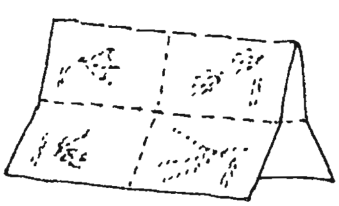
2. Fold up ends separately to form a "W" shape.



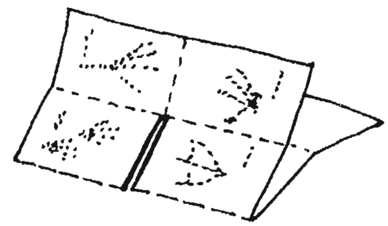
3. Next, fold it in half again to form a small rectangle. Then unfold this last fold, and fold it again back the opposite way, making good, hard creases on each side.



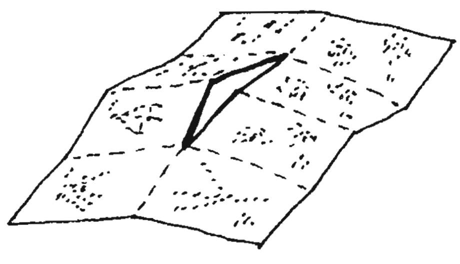
4. Unfold back to back to step #1, where the sheet is only folded in half.



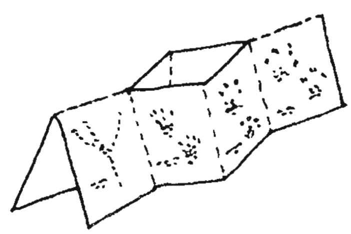
5. Place flat on the table with folded edge closest to you and cut along the middle fold through both sides to the center as seen in the diagram.



6. Unfold the sheet entirely, with the text and pictures facing up and the short edge of the sheet closest to you.



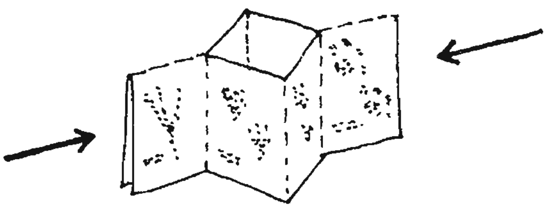
7. Refold the sheet in half, lengthwise. Stand the sheet up on the table so the pictures appear right side up, as seen in the diagram.



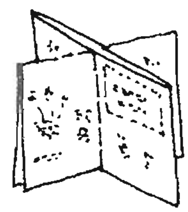
Instructions for Folding Mini Field Guide

(continued)

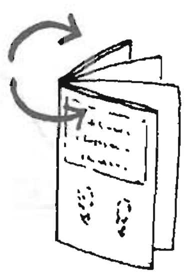
8. The part you cut with the scissors should open up and form a diamond. Grab the two outside panels and push inward until you form a four-paneled revolving door.



"revolving door"



9. Finally, fold all the pages together to form a small book. Make sure the cover page is on the front.

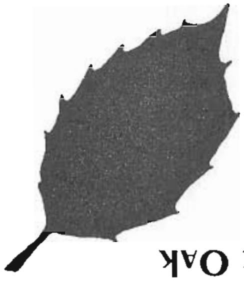


10. Make good, hard creases on all sides and YOU ARE DONE.

Mini Field Guide TO Trees of California's Creeks and Streams

Coast Live Oak

1"-2" long

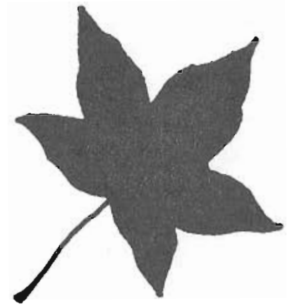


California Sycamore

5"-11" wide
light yellow-green
hairy underneath

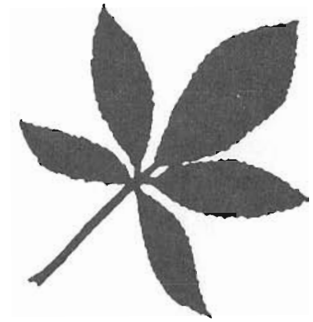
Big Leaf Maple

10"-20" long
dark green on top
smooth edges



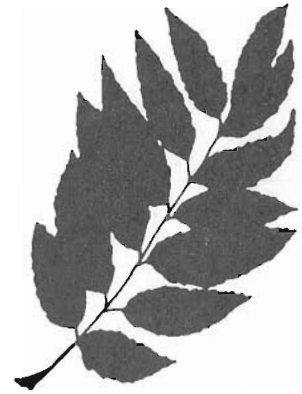
California Buckeye

5 leaflets on a stem
dark green
leaflets are 3"-7" long



California Black Walnut

9-17 leaflets on a stem
8"-15" long



Fremont Cottonwood

1.5"-3" long
yellow-green
shiny & thick

Black Cottonwood

2"-4.5" long
deep green,
thick & leathery
shiny on top,
whiter underneath

White Alder

2"-5" long
light yellow-green
wavy edges

Bay Laurel

3"-5" long
wider than
willow leaves
distinct smell

Willow

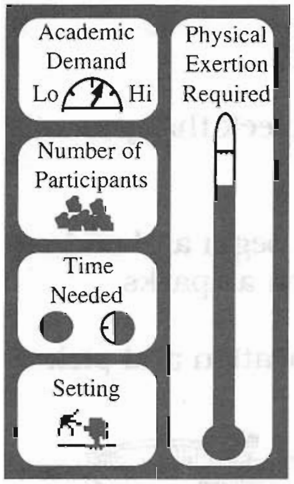
Narrow & 2"-6" long
18 different species

Red Alder

2"-6" long
deep yellow-green
color paler underneath

Activity #3

Creek Walk



Question: What can we learn by walking and observing along a creek, and how can this knowledge help protect the habitat?

Summary: The youth group completes a walk along the creek to assess the health of the creek with respect to pollutants, erosion, vegetation, and debris. Group members also learn the process of reporting problems to the appropriate monitoring agencies.

Materials:
- Topographic map of creek to be walked
- Camera and film in waterproof, zip-lock plastic bag
- Protective footwear — rainboots or old tennis shoes
- Extra shoes, socks, and pants to change into after walk
- Clean water and soap for washing hands afterward

For each group of 4-6:
- Pencil and clipboard (or cardboard and tape)
- Creekwalk Notebook and Observation pages (included). Reproduce 4-6 Observation pages for each group.

Purpose:

To help youth:
1. Gain experience collecting data through visual observations of the stream site.
2. Gain experience and knowledge about the proper methods for reporting pollution or other problems found at the creek site.
3. Gain appreciation of creek ecology, and how things like natural vegetation, stable banks, and unpolluted water are all a part of the health of the creek system.
4. Gain experience suggesting ideas for the improvement or maintenance of creek quality and communicating those suggestions to the proper community agency.

Background

One of the best and simplest ways to monitor the health of a creek or stream is to walk along the creek. Creek walking allows one to locate sources of possible pollution such as pipe discharges from industrial facilities or businesses, storm drain discharges, dump sites along the creek, or construction sites along the creek. It also allows one to assess the quality of other aspects of creek habitat, such as vegetation, presence or absence of natural and human debris, and stability of the banks. Creek walking provides a good opportunity to document pollution sources and report them to the agencies in charge of monitoring water quality. It also allows one to determine which creeks are not polluted and to monitor their health on a regular basis, if desired.

Activities Before the Walk

(Observing, Communicating, Relating, and Applying)

1. Get a map from your local flood control agency that shows the creek that you will walk. Ask for a drainage basin map or stream inventory map.

2. Get the permission of landowners to cross any private land. To begin and end your walk, it is best to use public access points to the creek such as parks.

3. Arrange for transportation that will deliver you to the starting location and pick you up at the ending location of your creek walk.

4. Arrange for members to bring protective footwear, such as rainboots or old sneakers to wear during the creek walk. They should also bring an extra pair of pants, shoes, and socks to change into at the end of the creek walk. The dry clothes should be left with the car or van that will pick you up at the end of the walk.

5. Go over the data sheets with the group members. Use the following information to make sure group members become familiar with the things they will be assessing on the creek walk.

Vegetation

The vegetated area on either side of the stream, along with the flowing water, forms the creek habitat. Vegetation is critical to creek health because it shades and cools the water, holds the soil in place, adds nutrients to the stream in the form of leaves, provides woody debris to help form fish habitat, and provides habitat for streamside wildlife. Vegetation also acts as a filter for sediment and pollution coming into the water from the land. On their data sheets, the youngsters will be assessing the quality of the vegetation as either missing, trampled, sparse, dense, landscaped, or canopied with trees. Every 50-100 yards they will describe the vegetation using one or more of these terms.

Pools & Riffles

Pools are deeper than adjacent areas in the stream. Pools are formed when natural debris (such as sticks) piles up and slows the flow of water. The presence of pools is very important to healthy creek habitats because pools provide feeding and resting areas for young fish. Riffles are areas of the creek that flow faster than other areas, often over rocks, and are good habitats for aquatic insects and important spawning areas for fish. Every 50-100 yards, the youngsters will stop and describe the condition of the creek with regard to pools and riffles as none, few, or many, and as having mostly pools or mostly riffles.

Pollution
The following indicators of pollution can often be found in creeks or streams: (1) foam on the surface of the water; (2) an oily sheen on the surface of the water; (3) an unusual smell; (4) an unusual color; or (5) the presence of thick mats of blue-green, green, or black algae. (Algae are very tiny plants that can resemble seaweed and often indicate that excess sewage or fertilizer is entering the water.) The group members will mark on their data sheets whether or not they notice any of these indicators of pollution. If there is evidence of water pollution, the group may walk upstream to see if they can find the place where it enters the stream by finding the place where the pollutant no longer exists and looking around that area. Locating the source of water pollution is not easy, but it is often possible at least to identify the storm drain from which the pollution seems to be coming.

Discharge Pipes
At every observation, the group members should note in their Creek Walk Notebooks any discharge pipes in the area, as well as if there is anything flowing through them, and whether the water coming out is clean.

Debris
Every 50-100 yards, the group members should describe any debris in the creek. There are two kinds of debris to make note of: woody debris, such as fallen logs and sticks (healthy signs), and human trash, such as trash, tires, and shopping carts (unhealthy signs). Woody debris helps form pools that are important as resting and feeding places for fish and helps to add necessary organic matter to the creek. Human trash is ugly, sometimes dangerous (since glass or metal can harm animals or people using the creek) and often adds pollution to the creek.

Stream Bottom
At each observation site describe the composition of the stream bottom using words such as rocky, sandy, muddy, or cemented bottom. The type of stream bottom tells a lot about stream health. Muddy stream bottoms are usually unhealthy signs, since the mud and silt smother eggs and larvae of creek organisms and hinder animals' ability to see food sources in the water. Rocky or pebbly stream bottoms are one indicator of a healthy stream habitat.

Shade
Shade is a positive sign of creek health. The shade cools the water, making it a better environment for aquatic insects and fish. Shade also helps provide camouflage for small animals in and out of the water.

Erosion of Stream Banks
Stable banks are important to the health of the creek since excessive dirt from eroded banks can cloud the water and interfere with aquatic animals' breathing and their ability to see prey. Eroded dirt and silt can also smother fish eggs in spawning areas on the stream bottom. Every 50-100 yards, the group members

should describe on their data sheets the quality of the stream banks. Are there any banks or parts of banks that have been washed away or worn down through erosion? Indicate if banks have been artificially modified by the placement of rocks, wood or cement supports or lining.

Wildlife

Every 50-100 yards, the group members should make an observation of the types of animals seen in or near the water. Make notes regarding any animal seen, including tiny insects and birds flying overhead. Diverse wildlife is a sign of a healthy creek habitat.

Other Notes

Include any interesting observations that do not fit into any of the above categories.

Activities At the Creek

1. Go over the following rules for creek walking:
    - Work cooperatively as a team.
    - Stay in designated stream site area.
    - Do not attempt to walk in or across creeks that are swift and above the knee in depth. These can be dangerous.
    - Watch for poison oak, and do not touch or brush against it!
    - Watch for dogs.
    - Disturb streamside vegetation as little as possible.
    - Don't walk on unstable banks.
    - Don't walk on spawning areas. (They will look like a round or oblong area of clean gravel about 1-3 feet long.)
    - Be careful about the water coming in contact with your skin, particularly if you think the water may be polluted.
    - Wash your hands after water contact and before eating. **Never drink any creek water.**

2. Divide the group into teams of 4-6 and pass out Creek Walk Notebooks, clipboards, and pencils. Answer any questions and briefly review the procedure for filling out the sheets.

3. At the end of the creek walk, compare Creek Walk Notebooks and Observation Pages and discuss the various teams' observations. Use questions such as the following to encourage further exploration of these topics.

   VEGETATION Are there any areas that are potential sites for revegetation projects? A well-planned revegetation project idea could be presented to a neighborhood improvement organization or other citizens' group. (See **Be A Friend of Your Local Creeks**, Activity #10).

Pools & Riffles Are there any stretches of the creek that have lots of pools and riffles that your group could write a letter about to authorities requesting that it be especially protected?

Pollution Was there evidence of water pollution that should be reported to authorities or local environmental groups? If so, it's a good idea to have photo documentation. Complaints are most useful when they are specific enough to afford a good chance of identifying the party responsible.

Good complaint:	Water with the smell of gasoline coming from 8-inch steel pipe coming out of a hillside on the west side of ABC Creek, about 100 feet south of where First Street crosses over.
Not so good complaint:	An oily sheen on the water in ABC Creek in the portion of the creek just south of where First Street crosses over.

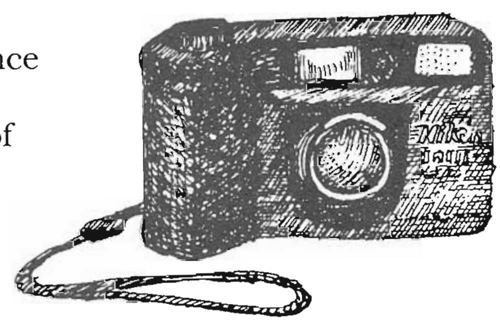
The more information you can include with your complaint, the more likely it is that an agency will send out an inspector. One good approach is to offer to meet with the inspector to point out the problem.

Debris Are there any areas of heavy trash or debris that your group could organize to clean up?

Erosion Are there any long stretches of eroded banks that should be reported to a local citizens' or environmental group? Are there any areas where erosion threatens property or where the water is cloudy or muddy due to eroded banks that should be reported? See resources below for reporting findings of your creek walk.

Tip

It is a good idea to photograph evidence of pollution or debris that you find. Before taking a photo, place a piece of paper with the date and location somewhere that will be visible in the photograph.



Optional Follow-up Activities

- Make a formal report of your findings — the good and the bad — and present it in either a written or oral form to appropriate agencies or citizen's groups in your city. The report can be done in three parts: a narrative, a stream walk map, and a summary sheet.

- Begin a community action project, such as a creek clean-up or a revegetation project to help remedy one of the problems identified on your creekwalk. See **Be A Friend of Your Local Creeks**, Activity #10, for more information.

Resources for Reporting Pollution & Debris

See the Resource section in the **Introduction**, for information on reporting water pollution that you find in a creek or stream.

Adapted in part from: *Streamwalk — A Stream Monitoring Tool for Citizens*, Environmental Protection Agency, Region 10, Seattle, WA.

Names of Group Members: Lab Notebook #3

Creek Walk Notebook

Creek Name: City or County:

Describe the beginning location of your walk:

Describe the ending location of your walk:

Every 50 to 100 yards, or when conditions change, observe the creek and its surroundings and fill out a new Creek Walk Observation page. The example below contains samples of what you might write.

Observation EXAMPLE

Vegetation: Use words like: "missing," "trampled," "dense," "landscaped," "tree canopy."

Pools & Riffles: Use words like: "none," "a few," "many," "mostly pools," "mostly riffles."

Pollution: Describe signs of pollution like "foam," "oily sheen," "bad smell," "unusual color," "algae," "muddy."

Debris: Describe both natural woody debris and human trash that you see.

Stream Bottom: Use words like: "rocky," "sandy," "muddy," "cement bottom."

Shade: Use words like: "very shady," "sunny," "potchy shade."

Erosion of Banks: Use words like: "stable," "collapsing", "supported by roots," "cemented," "lined by rock."

Wildlife: What kinds of animals do you see in the water and outside the water?

Other Notes: Use this space to note any interesting observations that don't fit into any of the above categories.

Creek Walk Observation Page

Observation # ___

Vegetation

Pools & Riffles

Pollution

Discharge Pipes

Debris

Stream Bottom

Shade

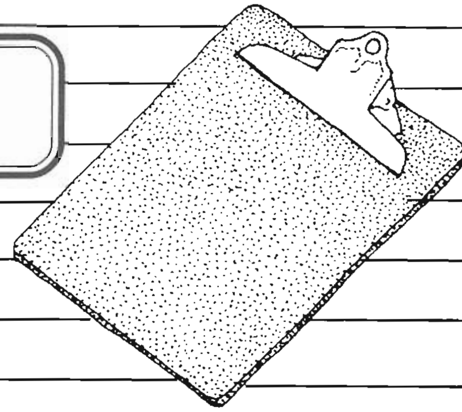
Erosion of Banks

Wildlife

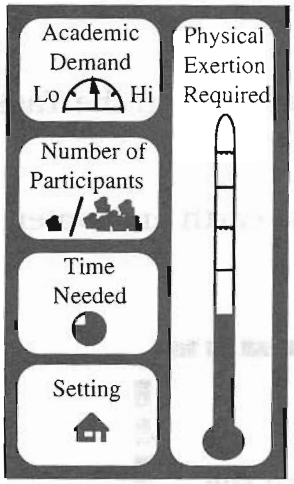
Other Notes

Creek Walk Notebook

NOTES



EROSION BLUES



QUESTION: What does erosion of stream banks look like, and what can be done to prevent it?

SUMMARY: Youth group members make model stream beds with aluminum baking trays, diatomaceous earth and water. They then observe the effects of erosion and experiment with its prevention and various effects of creekside development.

MATERIALS: **For each group of 4-6 members:**

- Large oval aluminum turkey roasting tray, approx. 12" x 17" x 3-1/2" (available from grocery store)
- Enough diatomaceous earth to fill the tray half full (available from pool supply store or nursery)
- Monopoly houses or similar items representing houses
- Spray bottle filled with water
- A handful of fresh clippings of grass
- Aluminum foil

PURPOSE:

To help youth:

1. Recognize what erosion looks like.
2. Understand that erosion of banks causes sedimentation which harms the health of creeks and streams.
3. Understand that erosion can be prevented by keeping banks properly vegetated.
4. Gain the experience of working with others toward a common goal.
5. Observe how rivers are formed.

BACKGROUND

Erosion is the washing away of soil. It occurs whenever running water carries soil away, and is a factor in the health of creeks and streams. Erosion is often caused by the loss of vegetation along stream banks. When streamside vegetation is removed or destroyed, the stage is set for erosion to occur. Erosion causes two main problems: the loss of creekside property and sedimentation. Creekside property loss is clearly evident when lawns, agricultural land, or homes near creeks are threatened due to stream banks washing away, but sedimentation is not so easily observed. When stream banks erode, the soil gets washed into the water and is called "silt." Too much silt in the water can harm water organisms by clogging their gills which makes breathing difficult. Silt also obscures vision, making it difficult for creek creatures to see their food sources. Too much silt can also irritate the gills of fish, cover over gravel stream bottoms where fish feed and spawn, suffocate fish eggs, and fill-in pools where juvenile fish live. Children usually don't realize that when they climb, slide, or ride bikes on stream banks they are contributing to erosion by destroying the streamside vegetation that is critical to holding the soil of the stream banks in place. Revegetation projects help to prevent erosion, and educating streamside property owners and others about not misusing banks helps to avoid further damage.

ACTIVITIES: (Observing, Communicating, and Relating)

1. Pass out a set of materials and a Task Card to each group of 4-6 people, explaining that they will be making model creeks.

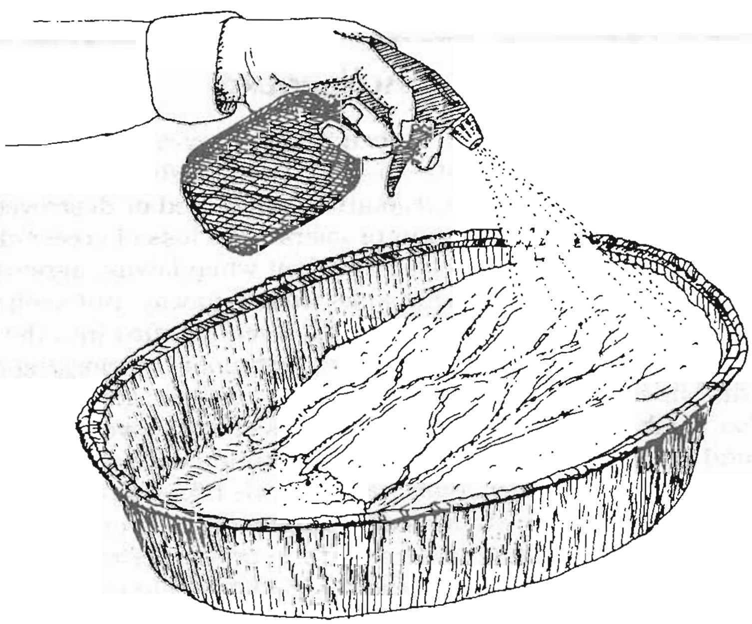
2. Circulate among the groups to help everyone complete the steps listed on the Task Cards.

   - Fill the baking pans half full with equal parts of diatomaceous earth and water. Mix well with your hands. It will feel like plaster of Paris.

> **WARNING**
>
> Pour the diatomaceous earth slowly and carefully from the bag into the aluminum trays to avoid creating dust.
> *Do not inhale the dust.*

   - Prop up one end of the tray about 6" using books or other objects. Then push, scoop, and jiggle the diatomaceous earth toward the lower end to create a sloped surface. Part of the tray will be bare. Leave some lumps in place. Let set a few minutes, then set the tray level.

   - With the water bottles set on "spray" or "fine spray," create "rain" by spraying water over the diatomaceous earth for 15-20 seconds. You will see small "streams" forming. Notice that the water will keep flowing for about 30-45 seconds after you've stopped spraying. You will start to see erosion.



• Scatter a few pinches of grass on the surface of the earth across a stream, and then make it rain again for another 15-20 seconds. What happens? (Erosion should still occur, since the water flows under the grass.)

• Next, sprinkle more grass clippings along the stream and press them with your fingers down into the earth to represent plants rooted in the soil along the banks. Make sure the banks are well covered with the grass. This represents healthy stream banks with lots of vegetation. Make it rain again. What happens this time? (The erosion should stop and the previously eroded areas may even fill in as the "roots" capture some of the earth that was floating in the water that had been eroded upstream.)

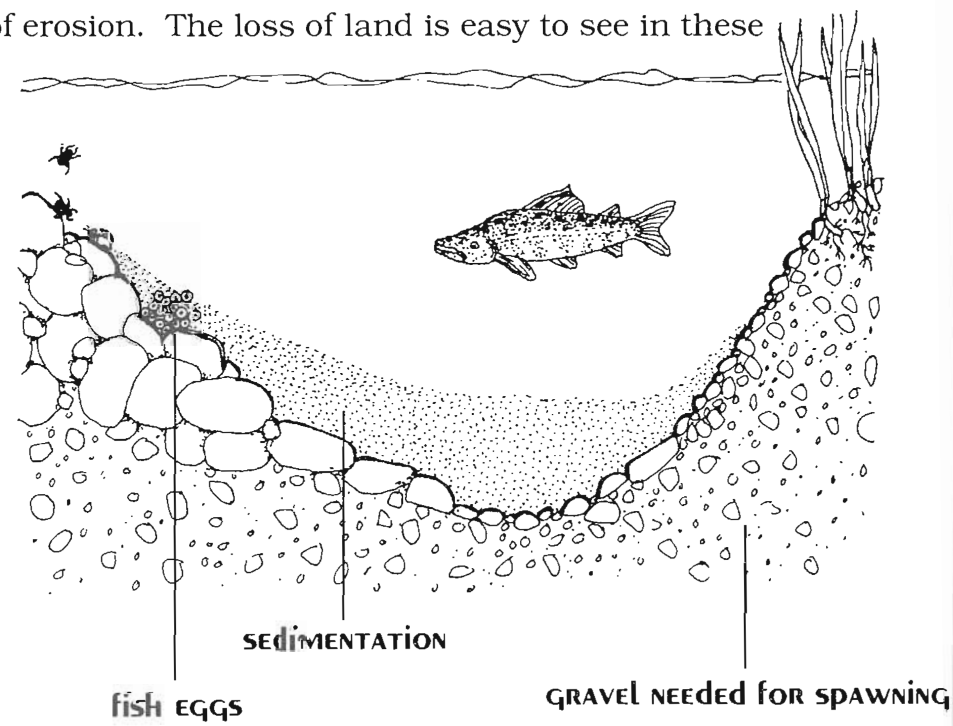
• Be a land developer and create a parking lot on the banks of the stream using a 4" x 6" square of aluminum foil. Make it rain again. Compare the amount of erosion downstream before and after the creation of the parking lot.

• Be a land developer again by building a housing tract on the stream banks using Monopoly houses. Make it rain again. What happens to the homes?

• Be a flood control engineer and transform your creek into a concrete ditch or culvert, using long thin strips of aluminum foil. Observe how this affects the speed of run-off.

3. Ask each group to demonstrate one of the Task Card steps to the rest of the group and describe what is going on. Discuss what various parts of the simulations stand for and their implications.

4. Talk about the bad effects of erosion. The loss of land is easy to see in these demonstrations, but the problems that result from too much silt in the water due to erosion are not as easily observed. Show the diagram here, and discuss how erosion causes excess silt which harms creek animals. Use information from the Background section for this discussion.



5. Finish up with a discussion of how youngsters can help prevent erosion of banks, again using the information from the Background section. If your group would like to undertake a project to help prevent stream bank erosion, see **Be A Friend of Your Local Creeks**, Activity #10.

Optional Follow-up Activity

- Shortly after a rainstorm, after the storm run-off subsides, visit a downstream site on a creek or a stream to observe the often dramatic sedimentation that results from erosion upstream. Discuss how sedimentation negatively affects diversity and aesthetic value, and what can be done to prevent it.

Task Card #4

The Erosion Blues

Question: What does an eroding stream bank look like, and what can be done to prevent that erosion?

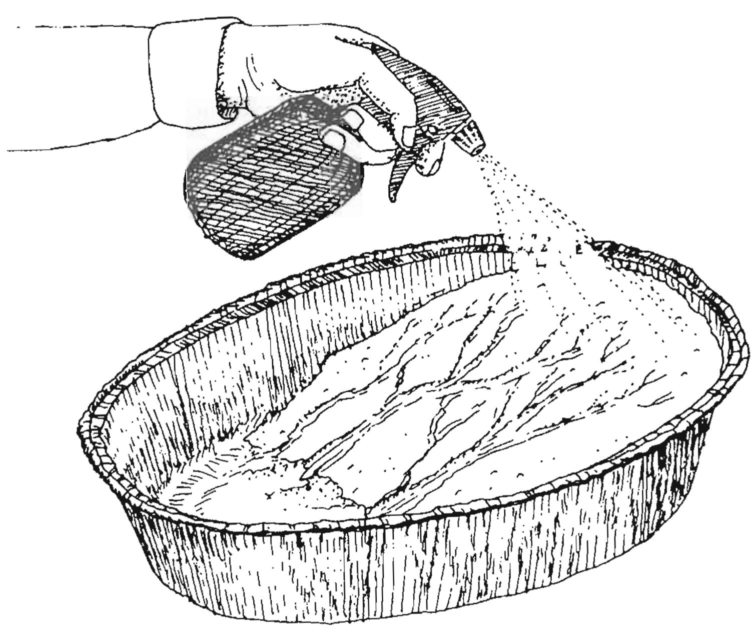
1. Fill the baking pans half full with equal parts diatomaceous earth and water. Mix well with your hands. It will feel like plaster of Paris.

WARNING

Pour the diatomaceous earth sowly and carefully from the bag into the aluminum trays to avoid creating dust.
It is not good to inhale the dust.

2. Prop up one end of the tray about 6" using books or other objects. Then push, scoop, and jiggle the diatomaceous earth toward the lower end to create a sloped surface. Part of the tray will be bare. Leave some lumps in place. Let set a few minutes, then lower tray.

3. With your water bottle set on "spray" or "fine spray," create "rain" by spraying water over the diatomaceous earth for 15-20 seconds. You should see small "streams" forming. Notice that the water will



The Erosion Blues

keep flowing for about 30-45 seconds after you've stopped spraying. You will start to see erosion occur.

4. Scatter a few pinches of grass on the surface of the earth across a stream, and then make it rain again for another 15-20 seconds. What happens?

____

5. Next, sprinkle more grass clippings along the stream and press them with your fingers down into the earth to represent plants rooted in the soil along the banks. Make sure the banks are well covered with the grass. This represents healthy streambanks with lots of vegetation. Make it rain again. What happens this time?

____

6. Be a land developer and create a parking lot on the banks of the stream, using a 4" x 6" square of aluminum foil. Make it rain again. Compare the amount of erosion downstream before and after the creation of the parking lot.

____

7. Be a land developer again by building a housing tract on the streambanks using monopoly houses. Make it rain again. What happens to the homes?

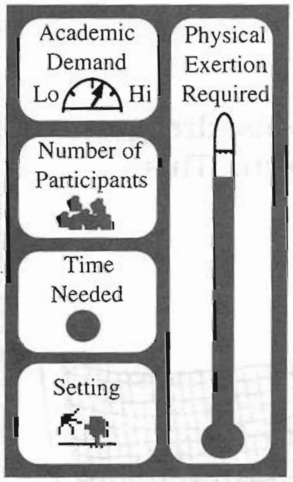
____

8. Be a flood control engineer and transform your creek into a concrete ditch or culvert, using long, thin strips of aluminum foil. Observe how this affects the speed of run-off.

____

Who Can Stand The Water?

Biological Indicators of Water Quality

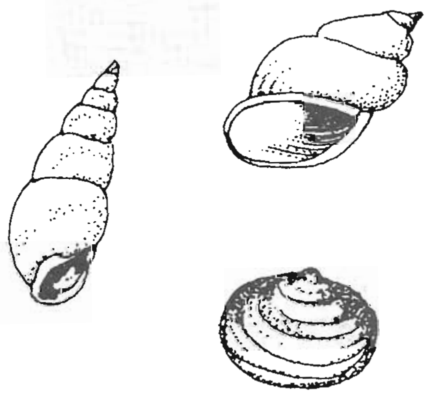


Question: How can we tell how clean creek water is, just by looking at the animals that live in the water?

Summary: Group members collect, identify, and count aquatic animals in a section of a creek and then estimate the quality of the water by observing the number and types of animals found.

Materials: **Enough for each group of 4-6 people:**

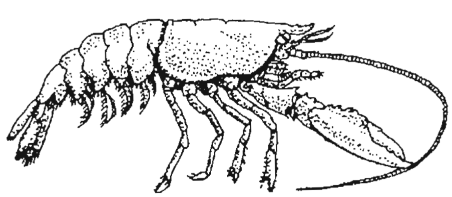
- Collection equipment (see box below). For best results, each group of 4-6 people should have at least two of these three collection devices— more, if possible.
- Used and cleaned containers that are white on the inside, such as yogurt, cottage cheese, or sour cream containers.
- *Macroinvertebrate Identification Guide* (included).
- Lab Notebook Pages #5a and #5b (included).
- Protective footwear, such as rainboots or old tennis shoes, and dry shoes, socks, and pants to change into after activity.
- Field guide such as *Pond Life: A Golden Guide* (see Resources list).



Purpose:

To help youth:

1. Become familiar with some of the small animals (macroinvertebrates) that live in creeks and streams.
2. Understand that macroinvertebrates vary significantly in their ability to tolerate polluted water.
3. Understand that the quality of the water in a creek or stream can be estimated by identifying the macroinvertebrates present.



Collection Equipment

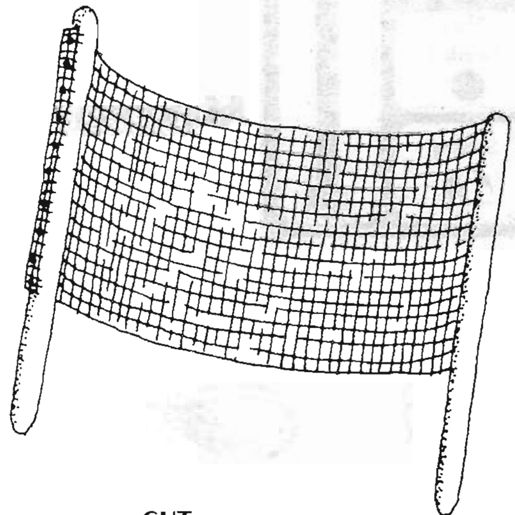
(These materials can also be used for
Activity #8, Adaptations of Creek Creatures)

For best results with this activity, construct enough handscreens, dredges and dipnets, so that each group of 4-6 people will have their own. This activity can be carried out using only dipnets, if necessary.

Hand screen

Materials:
- nylon screening (at least 2'x4' in size)
- two wooden dowels (approx 3' long)

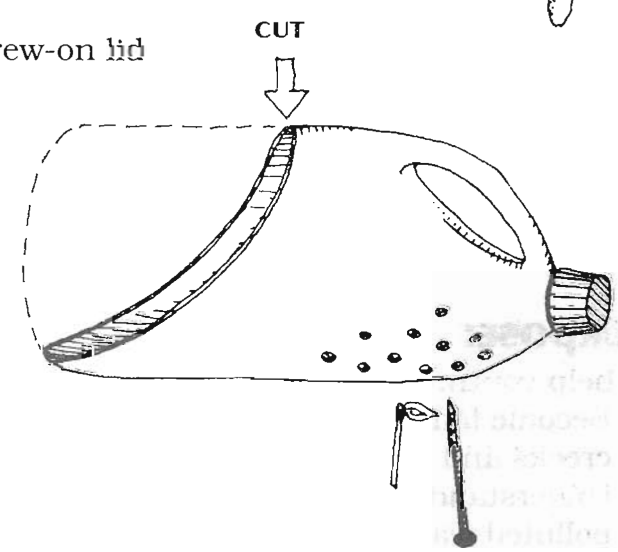
To make: Attach edges of screening to dowels as shown, using a staple gun or waterproof epoxy glue.



Plastic bottle dredge

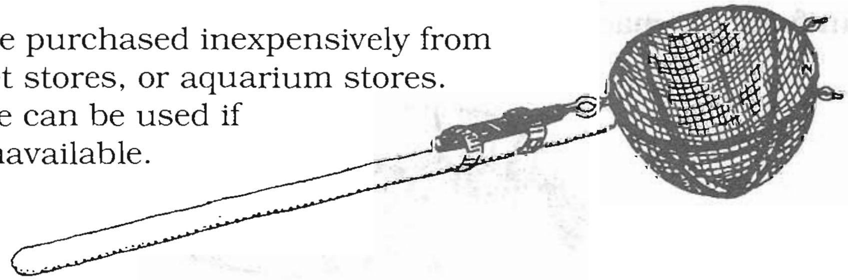
Materials:
- plastic bottle w/ handle and screw-on lid
- scissors or sharp knife
- large nail
- matches

To make: With a knife or scissors, cut and remove section of bottle as shown. Then heat nail with a match to poke approximately ten drain holes.



Dipnets

Dipnets can be purchased inexpensively from drugstores, pet stores, or aquarium stores. A kitchen sieve can be used if dipnets are unavailable.



Background

The presence or absence of a variety of macroinvertebrates is one of the best ways to assess water quality in creeks and streams. Macroinvertebrates are those animals lacking a backbone (hence, "invertebrate") that are visible to the naked eye (hence, "macro"). In California creeks, macroinvertebrates include insects, clams, mussels, snails, and worms. The most commonly found macroinvertebrates in most creeks and streams tend to be insects in their young, larval stages. These larvae spend about a year in the water before they transform into winged adults.

Macroinvertebrate populations change rapidly in response to changes in water quality. Some organisms are intolerant of pollution and cannot survive in any but the cleanest of creeks, while others are tougher and can survive well in quite polluted water. (See lists below of pollution-intolerant, moderately-tolerant, and pollution-tolerant species). The key to determining water quality based on the macroinvertebrates present is not the number of organisms but the *number of types* of organisms present. In clean water there should be a great variety of different kinds of organisms found, but only a few individuals of each kind. Polluted water does not have much variety of species; the number of organisms found may be high but there will be only a few types of species present. Lots of different species, and fewer numbers of each, is a sign of health.

The vast majority of stream-dwelling macroinvertebrates live in the riffle areas. Riffles are the parts of streams where the water runs swiftly over an uneven bottom composed of rocks or gravel. The riffle areas provide shelter for the organisms under the rocks, and the constant flow of water provides a continuous and plentiful supply of oxygen and food in the form of plant and animal matter.

This activity is designed to be performed fairly easily in the riffle portion of a creek or stream. It consists of collecting and identifying macroinvertebrates, assigning them to a category based on their species, and then performing simple calculations (based on the number of types of species found) to arrive at a number signifying water quality. Because this activity has been simplified for use by children, only the extremes of water quality can be determined. Subtle differences in water quality, as well as determining the sources of pollution, are outside the scope of this activity. Activities #3 and #10, **Creek Walk** and **Be a Friend of Your Local Creeks**, address the issues of identifying and reporting sources of pollution.)

Activities: (Observing, Communicating, Comparing, Relating, and Inferring)

Preparation

1. Locate a creek or stream that can be used for study. A riffle area of the creek (fast flowing water over a rocky or pebbly bottom) is the best area for conducting this activity. Obtain permission from landowners or park officials to collect and return macroinvertebrates.

2. At a meeting prior to the field trip, construct the collection equipment you will need to complete the activity at the creek or stream.

At the Creek

1. Select a safe spot where the water is shallow enough to wade. It should be no deeper than the youngsters knees). Make sure everyone wears protective foot wear, such as rainboots or old tennis shoes, and wades carefully, watching out for

slippery rocks and deep holes. Everyone should wash hands with soap and clean water after this activity.

4. Divide into groups of 4-6 people and assign equipment to each group. It is best if each group has <u>at least</u> two collection devices (i.e., one dredge and one dipnet) and at least one or two white-on-the-inside containers. Go over the collection procedures for the type of equipment your group is using (see Task Card #5). Pass out Task Cards, Macroinvertebrate Identification Guides, and Lab Notebook #5a to each group and explain the procedure for identifying and listing the organisms found. Remind everyone to handle all the aquatic animals carefully and keep them in water in their containers in a shaded place until they are returned to the area where they were found.

5. Assist each group in finding a riffle area of approximately 3 x 3-feet to carry out the activity. Remind group members to collect <u>only one</u> of each type of organism. The object is to find the greatest variety of organisms possible, not the greatest number of organisms.

6. As the groups begin to collect organisms, circulate among them helping with identification, assigning the organisms to a category, and filling out the Lab Notebook page, #5a.

7. When the groups have finished, and before the organisms are returned to the places where they were found, gather everyone together to compare and discuss results. Were any Class 1 organisms found? These animals are sometimes referred to as clean water indicators, since they are only present in unpolluted water. Were a great number of Class 3 organisms found? This is a sign of pollution. Review the meaning of the term "macroinvertebrates," using the Background information. Using the information from each group's Lab Notebook #5a page, work as a group to fill out Lab Notebook page #5b. Performing the calculations on this page will give you a ratings number for stream quality assessment. Discuss how and why the presence of a good variety of organisms is a sign of a healthy creek habitat.

Optional Follow-up Activities

- Repeat this activity in another creek or another location on the same creek and compare water quality.

- Write an article for your local paper or report your findings to a group that monitors water quality in your area, such as the California Dept. of Fish & Game or an Urban Creeks Council affiliate. (See Resources in the **Introduction**.)

Adapted in part from *Watersheds*, The Pennsylvania Alliance for Environmental Education (PAEE), 4999 Jonestown Road, Suite 203 Harrisburg, PA 17109, (717) 545-8861; and *Stream Quality Monitoring: A Citizen Action Program*, Ohio Scenic Rivers Program, 1889 Fountain Square Ct, Columbus, OH 43224, (614) 265-6791.

Task Card #5

Who Can Stand The Water?

Biological Indicators of Water Quality

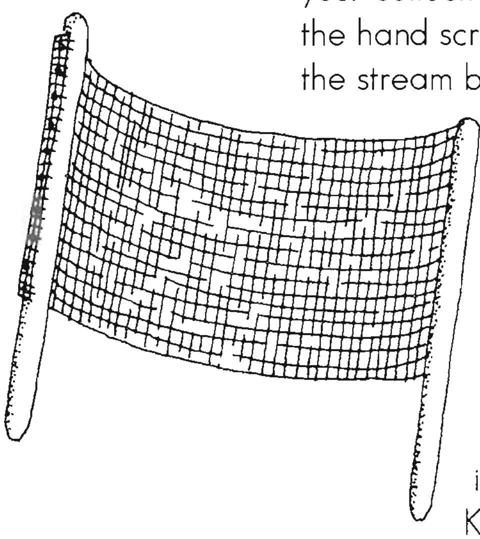
Question: Howcan we tell how clean the creek water is just by looking at the animals that live in the water?

Activity:

1. With your group, find an area of the creek approximately 3-by-3 feet in size, with a rocky or pebbly bottom. Use this area as your collection site.
2. Stay inside the boundaries of your collection site, and gather **one of each type** of the small animals you find, using the following methods.

<u>If you are using a hand screen:</u>

• Position the hand screen at the downstream boundary of your collection site. Two people should hold the handles of the hand screen and place the net firmly on the bottom of the stream bed, so that water flows through the screen. One or two other people should go 3-feet upstream and pick up and rub all the rocks, so that any organisms will fall off the rocks and be carried by the current into the net The people upstream should also disturb the bottom of the stream with their feet, dislodging any animals in the creek bottom. Carefully haul up the screen and deposit the organisms into the collection containers filled with water. Keep one of each type of animal in the container and return all the others back to the areas where they were found. Repeat once or twice.



<u>If you are using a dredge or dipnet:</u>

• Search the surface, creek bottom, and undersides of the rocks in your collection area, capturing all visible aquatic animals and placing one of each in the collection containers.

Who Can Stand The Water?

Biological Indicators of Water Quality

3. Place **one of each type** of the animals your group found into the white containers for better observation, add more water if necessary, and keep the containers in a cool place.

4. Use the *Macroinvertebrate Identification Guide* to identify the animals you found and list them on the Lab Notebook page #5a. Also, write whether each of the animals you found is Class 1, Class 2, or Class 3 by looking at the lists at the bottom of the Lab Notebook page. If there is an animal that you can't find in the *Macroinvertebrate Identification Guide,* ask your leader for help looking it up in another field guide.

5. Meet with your leader and the entire group for final discussion. Then, carefully return all the animals to the places they were found.

Who Can Stand The Water?

Biological Indicators of Water Quality

Write the names of all the types of animals your group found. Use the ***Macroinvertebrate Identification Guide*** to figure out what each animal is called.

Then use the lists below to write next to each animal's name which class it belongs to, Class 1, Class 2, or Class 3.

Name	Class
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________
______________________	______________________

Class 1 – *Pollution sensitive*

Caddisfly larva
Mayfly larva
Riffle beetle larva
Stonefly nymph
Hellgrammite

Class 2 – *Moderately pollution tolerant*

Aquatio beetles ("water penny")
Riffles bettle
Crayfish
Aquatic sowbug
Cranefly
Blackfly
Horsefly larva
Damsefly nymph
Flatworm
Gill snail
Fingernail clam

Class 3 – *Pollution tolerant*

Air-breathing snail
Limpet
Mothfly larva
Leech
Midge
Rat-tailed maggot
Mosquito larva

Who Can Stand The Water?

Biological Indicators of Water Quality

Fill out this page with the large group all together at the conclusion of the activity. Have each group use the information from their Lab Notebook pages #5a to help fill it out.

List each type of animal found today by any of the groups. Put each under the proper category.

Class 1 *Pollution sensitive (They need clean water!)*

_________________________ _________________________

_________________________ _________________________

_________________________ _________________________

Total number of types found ____ x 3 = ________

Class 2 *Moderately pollution tolerant (Can live with some pollution)*

_________________________ _________________________

_________________________ _________________________

_________________________ _________________________

Total number of types found ____ x 2 = ________

Class 3 *Pollution Tolerant (Don't mind living in polluted water)*

_________________________ _________________________

_________________________ _________________________

_________________________ _________________________

Total number of types found ____ x 1 = ________

Stream Quality Assessment
Excellent = 23 and above
Good = 17-22
Fair = 11-16
Poor = 10 or below

GRAND TOTAL = ________
(Add together the three totals above)

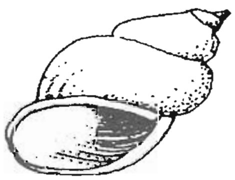
Macroinvertebrate Identification Guide

Riffle Beetle

Body beetle-like; with legs

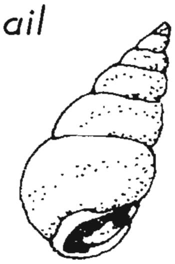
Aquatic Beetle
"Water Penny"

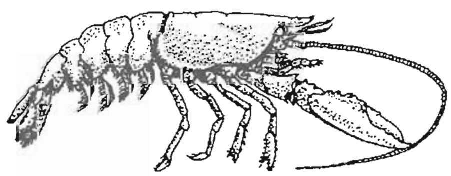
Round body about the diameter of a pencil eraser



Air Breathing Snail

Gill Snail





Crayfish

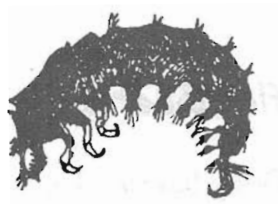
Aquatic Sowbug

Fingernail Clam

Macroinvertebrate Identification Guide

Cranefly Larva

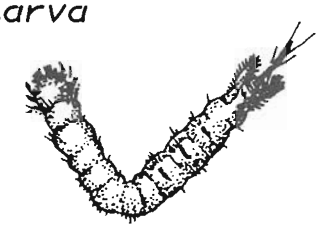
Body black or brown; more than 1/3 inch long; caterpiller-like



Caddisfly Larva

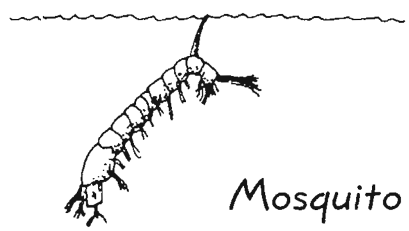
One or two hooks or claws at or near end of abdomen

Mothfly Larva

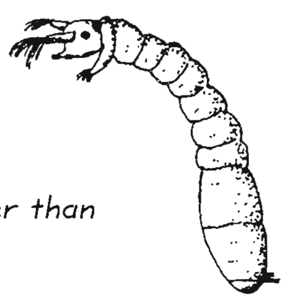


Horsefly Larva

Riffle Beetle Larva



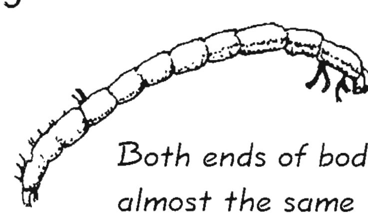
Mosquito Larva



Blackfly Larva

One end of body wider than other end

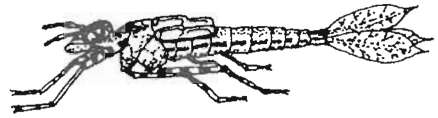
Midge Larva



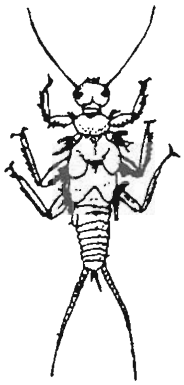
Both ends of body almost the same width

Macroinvertebrate Identification Guide

Hellgrammite



Damselfly Nymph

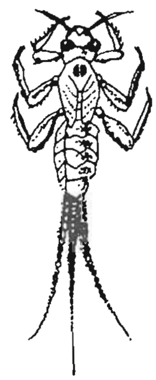


Stonefly Nymphs

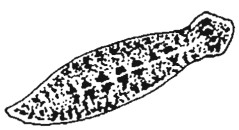
Two tails and two hooks at the end of each leg

Mayfly Nymphs

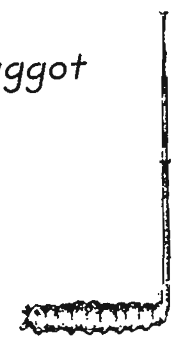
Three tails (occasionally two) and one hook at the end of each leg

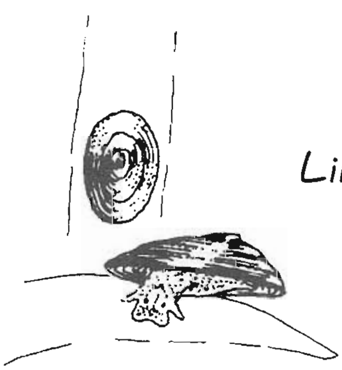


Rat-tailed Maggot

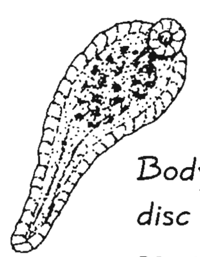


Flatworm





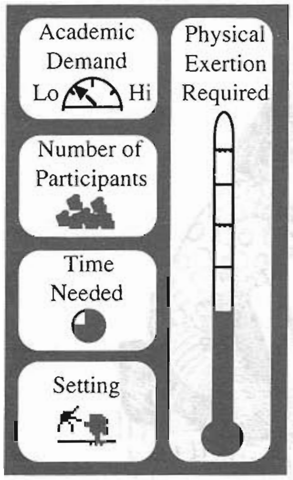
Limpet



Leech

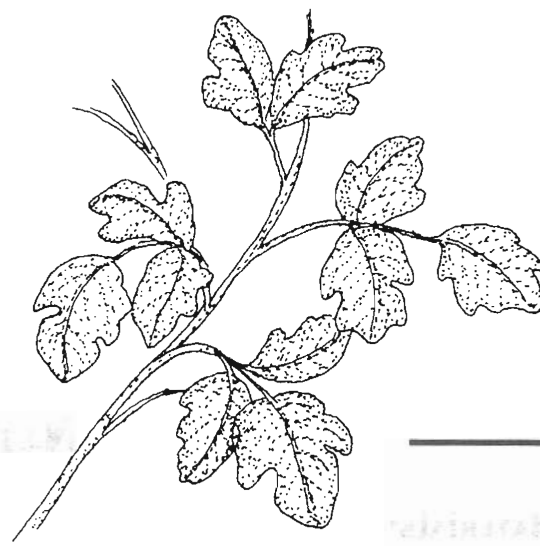
Body with large suction disc at each end; body segmented

Creekside Art



Question: What art activities can be inspired by your group's visit to a creek?

Summary: Youth group members use the inspiration and materials of a creek habitat to create art, such as watercolors, rubbings of natural objects, poetry, and murals. Choose among the following art projects, some that should be done creekside and others which can be carried out following a visit to a creek or stream.



Purpose:

To help youth:

1. Translate their perceptions of nature into art
2. Gain enjoyable experience with watercolors, rubbings, mural-making, and poetry.

Background

People often use art to express feelings evoked by natural settings. Woods, meadows, mountaintops, oceans, creeks, and other natural settings have long inspired artists and will certainly be inspirations to the children in your youth group.

Activities: (Observing and Communicating)

Creekside Watercolors

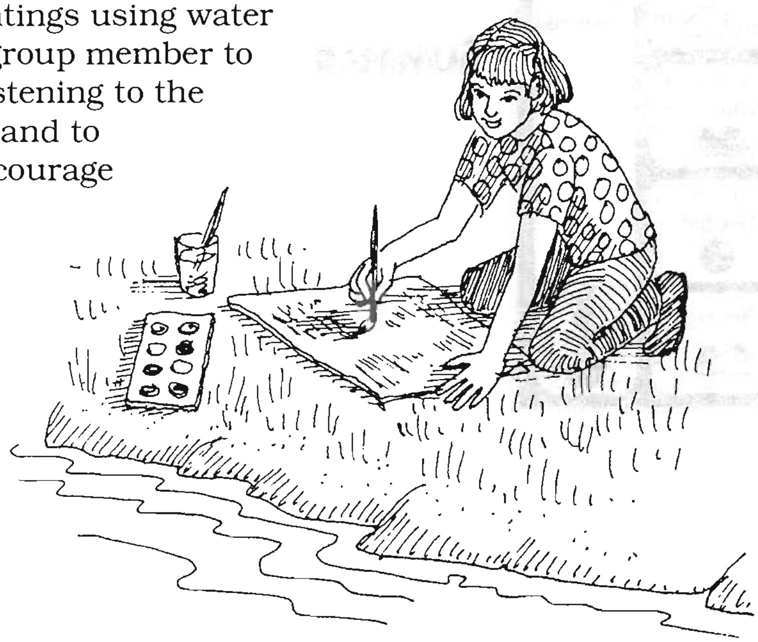
Materials:

- Many small paper or plastic cups (recycle used cups or yogurt, sour cream, or cottage cheese containers)
- Pencil and clipboard (or cardboard and masking tape) (1 per person)
- Funnel
- Two empty, 1-gallon water bottles
- Watercolor paints or paintsets
- Paintbrushes
- Paper
- Large bucket

Creekside Watercolors
(continued)

Activity:

Create watercolor impression paintings using water from the creek. Encourage each group member to sit alone quietly near the creek, listening to the sounds of the water and animals, and to paint whatever they feel like. Encourage them to experiment with mixing colors and wetting their paper before painting. When finished, use the funnel to transfer paint-filled water from their cups into the empty water bottles. Take this paint-filled water home and dispose of it down the drain, not in the creek!



Nature Rubbings

Materials:

- Various sizes of paper, including large, blank newsprint
- Large crayons
- Masking tape

Activity:

Use various sizes of paper and the sides of crayons to make rubbings of the natural things you find along the creek. Make rubbings of leaves, trees, bark, stones, or any interesting texture that you can find. Simply hold or tape the paper on top of the object, then rub evenly with the side of a crayon. Be careful not to harm plants (no picking), and be sure not to rub poison oak (pictured on previous page). Work alone or with a friend. Take a break in the middle of your art session to discuss technique and share your results. Experiment with different sizes: try tiny and giant rubbings. As possible follow-up activities, try identifying some of your plant rubbings in a field guide or making a detective game out of trying to identify the source of other people's rubbings.

Creek Creature Mural

Materials:

- Paper
- Colored pens, paints, crayons
- Scissors

Activity:

After returning to the meeting site following a creekside activity where organisms were collected, such as **Who Can Stand the Water** (Activity #5) or **Adaptations of Creek Creatures** (Activity #8), ask group members to recall and recreate through drawings some of the animals they found. Challenge them to either strive for detail and accuracy in portraying the organism or to use artistic license to create a fanciful version of a creek animal they remember. After the group members have drawn, painted, or colored, and cut out one or more creek animals, encourage them to create a stream mural using all the drawings. If the group members are happy with the finished project, consider displaying it as a community action project to increase awareness about the value of creeks (see **Be a Friend of Your Local Creeks,** Activity #10).

Making Observations & Memories Into Poetry

Materials:

- Paper and pens
- If writing at the creek site, provide clipboards (or cardboard and masking tape)

Activity:

Create poetry inspired by the sounds and sights of the creek. Your group can write during the creek visit or at the following meeting, or both. If you're writing poetry back at the meeting place, encourage the members to recall the mood, sounds, and sights of the creek habitat, perhaps by playing a tape of water sounds or the sounds of an aquatic habitat. Such tapes can be purchased at bookstores, music stores, or nature stores, perhaps borrowed from libraries, or you can record your own. If you're writing at the creek site, suggest that each person choose a spot to sit alone and quietly observe the surroundings for several minutes before beginning to write. Encourage the group members to experiment with free verse as well as some of the more structured forms of poetry:

FREE VERSE Explain to the group members that they will be writing poems in nature, but don't necessarily have to write poems about nature. Suggest that they sit quietly for several minutes, and then begin to write, trying to let the thoughts just flow from their heads and onto the paper without thinking about them too much. The poem can be about anything at all, and it doesn't even have to make literal sense.

HAIKU Originated by the Japanese, haiku is usually on the topic of nature and consists of three unrhymed lines of five, seven, and five syllables each.

For example:

The fish swam by me
Nothing left in the shimmer
My heart beat faster

CINQUAIN Cinquain is derived from the French and Spanish words for five. Cinquain poems are always five lines long and have the following structure: (1) The first line is the title in two syllables (or two words); (2) The second line is a description of the title in four syllables (or words); (3) The third line is a description of the action in six syllables (or words); (4) The fourth line is a description of a feeling in eight syllables (or words); and (5) The fifth line is another word for the title in two syllables (or words).

For example:

Osprey
Fishing eagle
Moves above dark water
With graceful strength it finds its meal
Seeker

DIAMANTE Diamante is a poem shaped in the form of a diamond. It can be used to show that words are related through shades of meaning from one extreme to an opposite extreme, following a pattern of parts of speech like this:

noun
adjective adjective
participle participle participle
noun noun noun noun
participle participle participle
adjective adjective
noun

For example:

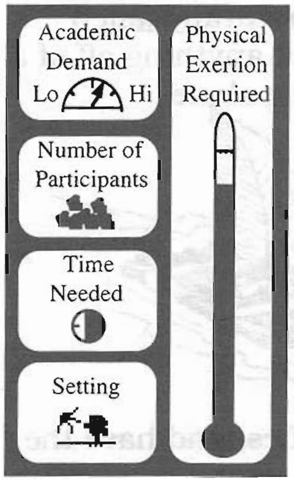
Stream
small, clear
Rippling, moving, growing
Life, plants, animals, people
Rushing, sustaining, cleansing
Connected, universal
Water

You might consider conducting a community action project (see **Be a Friend of Your Local Creeks** - Activity #10) that uses the group's creek-inspired poetry. The poetry can be used as part of a display, or perhaps your group could give a reading of poetry that helps promote community awareness about the value of creeks.

HINT

Combine one or more of these on-site art activities with another of the activities in this guide, such as **Creekwalk** (Activity #3), **Who Can Stand the Water?** (Activity #5), or **Adaptations of Creek Creatures** (Activity #8). Art activities are often best done near the end of the creek visit when the youngsters are receptive to a more thoughtful activity and have been affected by the atmosphere of the creek site, but are not yet ready to leave.

CREEKSIDE RACES

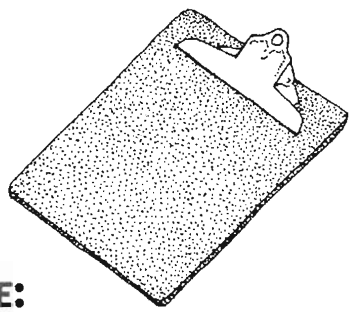


QUESTION: What is a fun way to learn about stream velocity, riffles, pools, and bouyancy?

SUMMARY: Youth group members create boats from masking tape, twine, and naturally fallen materials found at a creek site. They experiment with various types of float design; experience the effects of eddies, pools, and riffles; and measure the velocity of the water's flow.

MATERIALS:

- Masking tape (1 roll)
- Scissors
- Twine (1 roll)
- Tape measure
- Stop watch (at least one; several if possible)
- Calculator or pencil and paper for calculating
- Lab Notebook pages 7a and 7b. Photocopy 1-3 copies, depending on size of your group.
- Clipboard for the leader
- An extra pair of shoes and pants for each person to change into afterward.



PURPOSE:

To help youth:

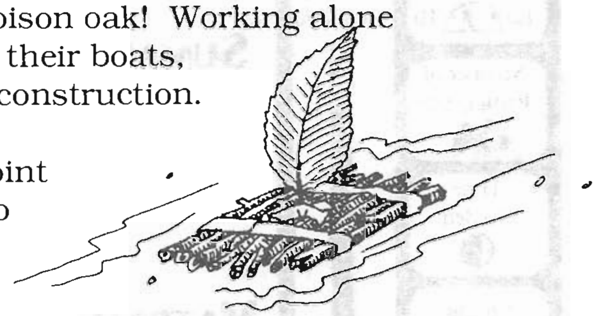
1. Experiment with the effects of various boat designs.
2. Learn to measure the velocity of a creek's flow.
3. Experience the effects of eddies, flows, pools, and riffles.

BACKGROUND

Knowing the speed or velocity of a creek's flow is helpful to biologists when studying a creek habitat. The velocity of the water will determine the types of organisms found, the amount of sediment in the stream, the transportation of nutrients, and the amount of oxygen entering the water by aeration. Knowing the velocity of the creek is also helpful in determining the time it takes for pollutants to travel between two locations. A simple method of determining stream flow is by releasing floats and measuring the time it takes for them to travel a certain distance. For a 10 foot distance the formula to use is: 10 feet divided by the number of seconds = velocity in feet per second. For example, if a boat travels 10 feet in 30 seconds, use the formula, 10 divided by 30 = .333 feet per second.

Activities: (Observing, Communicating, Comparing, and Relating)

1. At the creekside have everyone collect sticks, leaves, or other naturally fallen materials to make a boat. Emphasize that they should not pick anything off of a living plant. Remind them to watch out for poison oak! Working alone or with another person, have them construct their boats, using twine and masking tape to help in the construction.



2. Stage a few races by starting at a common point and having spotters stand at the finish line to see which boats cross first. After the race, discuss which factors affected the speed of the boats: shape, size, course in stream, obstructions. Introduce the terms eddies, flows, pools, and riffles, and have the group members search the stream for examples of each.

   Eddies: Portions of the stream where water flows circularly.
   Flows: Portions of the stream where the water flows straight.
   Pools: Deep, slow-moving parts of the stream created by a build-up of rocks, sticks, or other natural debris.
   Riffles: Shallow, fast-moving parts of stream, often with rock or gravel on the botttom.

3. Discuss again which design elements affected the speed of the boats. Allow time for the group members to experiment with new shapes and constructions, based on what they've observed from the first few races.

4. Challenge the group members to use their boats to determine the speed of the water's flow. First have them measure off a 10-foot stretch of the creek that appears to have a consistent flow. Then ask them to time how long it takes a boat to travel that distance. Show them the equation at the top of Lab Notebook page #7a: 10 feet divided by the number of seconds = speed in feet per second. Ask youngsters to put the information from the first time trial into this equation.

   For example, if the boat travels 10 feet in 30 seconds, use the formula, 10 divided by 30 = .333 feet per second. Help the group understand the formula by doing the calculations (with the calculator or by hand) for their boat's times. Ask them to enter their names and their boat's time on the Lab Notebook page.

5. Ask if anyone can figure out why knowing the velocity (speed) of the water's flow might be important to stream biologists. Use the information in the Background section to help explain this concept and clarify the idea for group members.

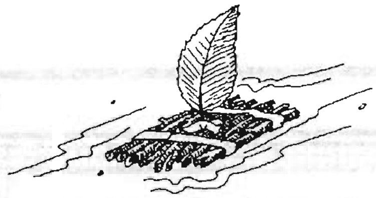
Why biologists would want to know the velocity (speed) of a stream

- Velocity affects the type of organisms that will be found in the stream.
- Velocity affects the amount of sediment that will be found in the stream (faster water is generally clearer, and has less sediment).
- Velocity affects the amount of oxygen that is in the water, which in turn affects the organisms that can live in the stream. (When fast-moving water tumbles over rock, the splashing creates **aeration**, which mixes oxygen into water.
- Velocity determines the time it takes for pollution to travel downstream.

6. Explain that everyone should now make several more time trials for their boat. Explain that just timing the boat once does not give an accurate idea of how fast it can really travel. To get a more accurate estimate, have the groups do five time trials for each boat and then average the times. To expedite this process, have several boats go at once and call out times as they cross the finish line. Have the youngsters enter the times on Lab Notebook page 7b. At the end, have them figure their averages using the calculator or paper and pencil.

Tip

The group's understanding of the formula for determining stream velocity will vary, depending on the age and math experience of group members. The result of the calculation will often be a fraction of a second, expressed in decimal form, and children may not completely understand this concept, nor will they completely grasp the concept of "feet per second." Nevertheless, there is still educational and play value, even for very young children, in collecting the data (timing their boats trips), helping to perform the calculations, and getting a result.



Creekside Races

10 feet ÷ number of seconds = speed (in feet per second)

Name of Boat	Name of Owner(s)	Time
______	______	10 ft. ÷ ___ seconds = ____ ft. per sec.
______	______	10 ft. ÷ ___ seconds = ____ ft. per sec.
______	______	10 ft. ÷ ___ seconds = ____ ft. per sec.
______	______	10 ft. ÷ ___ seconds = ____ ft. per sec.
______	______	10 ft. ÷ ___ seconds = ____ ft. per sec.
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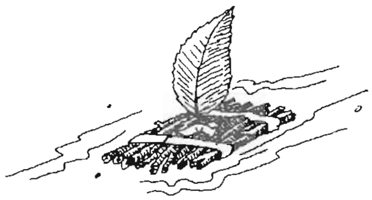


Creekside Races
(continued)

Name of Boat

____

Name of Owner(s)

____

Trial 1 __________
Trial 2 __________
Trial 3 __________
Trial 4 __________
Trial 5 __________
Total __________
Average __________
(total ÷ 5)

Name of Boat

____

Name of Owner(s)

____

Trial 1 __________
Trial 2 __________
Trial 3 __________
Trial 4 __________
Trial 5 __________
Total __________
Average __________
(total ÷ 5)

Name of Boat

____

Name of Owner(s)

____

Trial 1 __________
Trial 2 __________
Trial 3 __________
Trial 4 __________
Trial 5 __________
Total __________
Average __________
(total ÷ 5)

Name of Boat

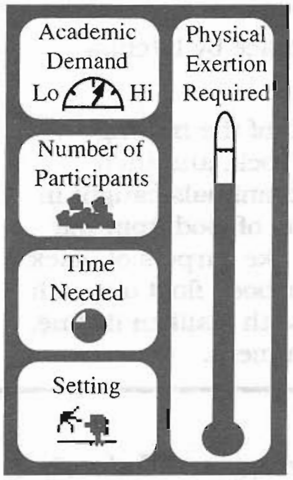
____

Name of Owner(s)

____

Trial 1 __________
Trial 2 __________
Trial 3 __________
Trial 4 __________
Trial 5 __________
Total __________
Average __________
(total ÷ 5)

ADAPTATIONS OF CREEK CREATURES



QUESTION: Which characteristics of creek organisms help them to survive in the creek environment?

SUMMARY: Youth group members collect aquatic organisms at a creek, observe them carefully using hand lenses, and then devise several classification systems for the organisms they have found. Later, the group leader leads a discussion of the adaptive characteristics of some common creek dwellers.

MATERIALS:

- Hand lenses for magnified viewing
- *Guide to Creek Creatures and Their Adaptations* (included)
- Dipnets. (Purchase these at a drug store or aquarium store, or see Activity #5 for instructions on how to make one.)
  For best results, each group of 2-4 people should have at least one dipnet.
- Used and cleaned yogurt, cottage cheese, sour cream, or other containers that are white on the inside (one for each group).
- Protective footwear, such as rainboots or old tennis shoes, and dry shoes, socks, and pants to change into after activity.
- Field guide such as *Pond Life: A Golden Guide*, Golden Press, New York (optional, but extremely useful).

PURPOSE:

To help youth:

1. Understand what is meant by "adaptations": characteristics that aid an animal's survival in its natural habitat.
2. Practice classifying organisms according to their common features.
3. Become familiar with some of the adaptive characteristics of common creek invertebrates.

BACKGROUND

Characteristics that enhance an animal's ability to survive in its natural habitat are called "adaptations." For example, ducks' webbed feet are an adaptation that allows them to survive better in water because the webbing assists them in moving swiftly to capture food. Similarly, giraffes' long necks are an adaptation that allows them to survive better in areas of tall trees and sparse vegetation; and monkeys' grasping tails aid survival in their life among the trees.

All animals have adapations, even the small insects, molluscs, and amphibians that live amidst the rocks in a creek. Creek creatures are outfitted in a variety of ways to enable them to survive in the difficult environment of fast-moving water. Many have flat, streamlined bodies that allow them to escape the current by squeezing beneath and between rocks on the stream bed. Others have grasping claws or suction cups on their bodies to help keep them in

Background
(continued)

place against the swiftly flowing current. For example, tadpoles keep their place by latching onto rocks with their suction-like mouths.

Creek creatures also often have adaptions that help them collect food out of the moving water. The net-building caddisfly larva attaches a funnel-shaped net to the rock, and then periodically creeps out from its crevice to harvest the feast of tiny plants and animals caught in the mesh. Black fly larvae have feather brushes on their head that comb bits of food from the passing water. Black fly larvae line up on rocks in dense colonies that look like carpets of black moss. With their forelegs clamped tightly to the rock's surface, they let their body float out with the water's flow. Should the larva lose a grip, it simply hauls itself back in with a silken lifeline, another adaptation that aids survival in the running water of a creek environment.

Activities: (Observing, Communicating, Comparing, Categorizing, and Inferring)

<u>Before the field trip</u>

1. Construct or purchase simple collection equipment, such as dipnets and dredges. (See Activity #5 for instructions.) Gather used yogurt, cottage cheese, sour cream or other containers that are white on the inside to use to hold the animals found.

<u>At the creek site</u>

2. Select a safe spot where the water is shallow enough to wade (no deeper than the youngsters' knees). Make sure everyone wears protective footwear (rainboots or old tennis shoes) and wades carefully, watching out for slippery rocks and deep holes. Everyone should wash their hands with soap and clean water after this activity.

3. Explain that they will be collecting organisms and then inventing a system for classifying these organisms based on their characteristics. To provide practice classifying by characteristics, briefly play the following game at the creek site.

Classification Game

- Think of a pair of characteristics (such as brown hair/not brown hair; short pants/long pants; wearing red/not wearing red) that you could use to classify the members of your group. Do not tell the characteristic you are thinking of, but instead begin to sort and divide the group according to these characteristics.

- After you have assigned a few people to each group, have the kids try to figure out which characteristic you are sorting them by. If they don't guess, continue sorting group members into one of the two categories, until someone figures out the sorting characteristic.

Classification Game
(continued)

- Repeat several times, using different characteristics. Let a few of the group members lead the game by thinking of characteristics and sorting the group while everyone else tries to guess.

4. As a follow-up to the game, explain that they will be using their dipnets and dredges to collect organisms from the creek, and will then be putting them in the white containers and later sorting them according to common characteristics.

5. In groups of 4-6 people, collect aquatic organisms from the surface of the water, under the water, and the bottom of the stream bed. Look on the undersides of rocks, being careful to replace rocks in the exact same spot. Sweeping the dipnets through the water over the tops of aquatic plants is a good method of collecting, too. Place organisms in water in the containers and keep them in a cool, shady place. Be sure to handle the organisms carefully. Collect for about 15-20 minutes stopping before enthusiasm starts to wane.

6. Look at the animals found through the hand lenses. Carefully inspect their mouths, legs, and other features. Then divide the organisms into different groups, based on their chacracteristics. Try several different ways of classifying the organisms according to their characteristics.

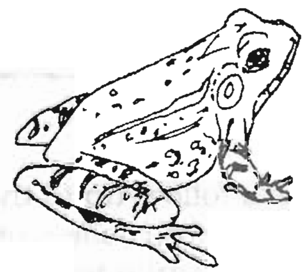
7. Get back together with the entire youth group. Have each group show the organisms they found and ask the other groups to figure out the system of classification that the presenting group used.

8. Lead a discussion on adaptations of commonly found creek organisms. Capitalize on the features of the organisms that the groups used in devising their systems of classification. Point out that many of these feature are "adaptive" and explain what this means, using information from the Background section above. Stress that all animals' characteristics are there for a reason: they help the animal survive. In creek environments, animals' adaptations often include body features that help them stay in place in the swift-moving water, gather food from the moving water, and breathe underwater (gills). Use the information below in the *Guide to Creek Creatures and Their Adaptations* to help aid your discussion. Consult a field guide for more information if you'd like.

GUIDE TO CREEK CREATURES AND THEIR ADAPTATIONS

FROGS

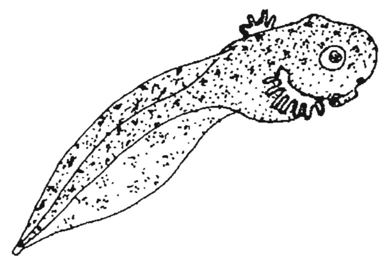
Frogs live in the damp grass and vegetation near freshwater. They eat insects, slugs, worms, and snails. The males croak loudly, by inflating their throats, to attract females during mating season.
Adaptations include:



- Eyes on top of their heads (to see prey while their bodies are hidden underwater).
- Strong legs (for moving quickly through the water and jumping on land).
- Multicolored bodies (for camouflage).

TADPOLES

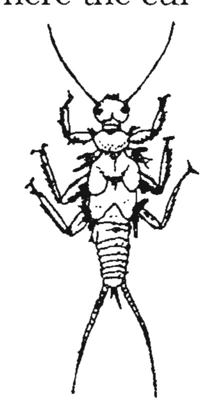
Tadpoles, for the first eight weeks of life, breathe underwater through gills located behind their head. They are vegetarian, feeding on algae. At eight weeks, their hind legs are fully developed and their lungs become functional, so they must visit the water surface for air. At this time, their diet becomes more varied, and they start feeding on smaller tadpoles and corpses of other animals.
Adaptations include:



- Suction cups near the mouth (to keep them anchored in place).
- Gills (for breathing underwater).
- Flattened tails for swimming.
- Rasping lips to scrape algae off rocks.

STONEFLY NYMPHS

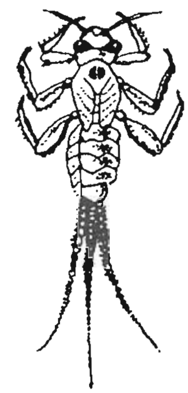
Stonefly nymphs are found only in extremely clean and cold water. Their bodies are flat so as to fit between and underneath rocks in the stream bed, where the current is weak. Flat bodies also allow nymphs to fit into the "boundary layer" on top of underwater rocks. As water flows over a rock, a protective boundary layer, less than an inch thick, forms on the rock's surface, and the current flows very slowly in this layer.
Adaptations include:



- Gills on their abdomens (for breathing underwater).
- Two claws on each foot (for grasping onto rocks in moving water).

Mayfly nymphs

Mayfly nymphs are found only in extremely clean and cold water. They swim actively among water plants, feeding on algae and other plant material. They are almost exclusively vegetarian, either scraping algae or chewing dead leaves for their food. They remain in the water for about one year before transforming into winged adults. Adaptations include:

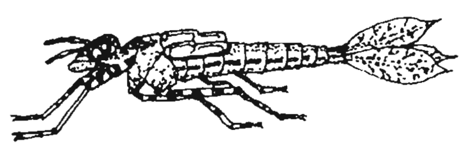


- Flat bodies (to fit between and underneath rocks on the stream bed, where the current is weak). Flat bodies also allow the nymphs to fit in the "boundary layer" on top of underwater rocks. As water flows over a rock, a protective boundary layer, less than an inch thick, forms on the rock's surface, and the current flows very slowly there.
- Gills on their sides at the base of their legs or backs (for breathing underwater).
- Long "tails" that can feel enemies approaching.

Dragonfly and Damselfly nymphs

Dragonfly and damselfly nymphs feed on other live animals and consume everything from tiny waterfleas to small fish. They moult many times throughout their lifespan and remain in the water for one to three years before transforming into winged adults. Adaptations include:

- Extended lower lip of their mouth with hooks on the end (for seizing prey). During their nymph stages they are the dominant insect carnivores of the ponds, preying upon any animal smaller than themselves.
- Large, hinged legs (for springing upon prey).
- Variable colored bodies (for camouflage).

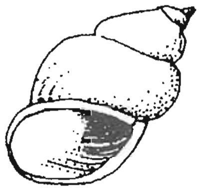


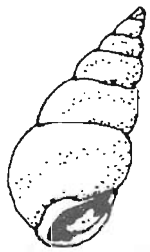
Snails

Snails creep slowly over stones and plants, scraping off algae and other plant matter with their sharp tongues. Some species breathe underwater through gills, others breathe above water by taking air into a lung-like structure, while still others can breathe both ways. Adaptations include:

- Shells (for protective hiding places).
- Variable colored shells (for camouflage).
- Teeth on their tongues (for scraping algae off rocks and pieces of plants off stems).
- Large muscular foot (for locomotion); the foot can also be retracted into the shell to "close the door" of the shell when danger is near.) If a snail is placed on an aquarium wall or a piece of glass, the wave-like contractions of the foot muscles, can be seen.

Air Breathing Snail

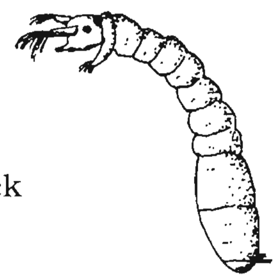




Gilled Snail

Blackfly Larvae

Blackflies lay their eggs in the cool rapids of streams because the newly hatched larvae need high levels of dissolved oxygen and fast-moving water to survive. The larvae do not swim, but attach themselves to the rocky bottom of a stream with a small sucking disk at the end of the abdomen. Masses of larvae attach to rocks in swiftly moving water and look like moss. They are a good food source for trout and other fish that live in cool streams. In the late spring, black fly larvae transform into flying adults. The female adults need a blood meal to nourish them as they prepare to lay eggs, and this is when black flies become such vicious biters. Adaptations include:

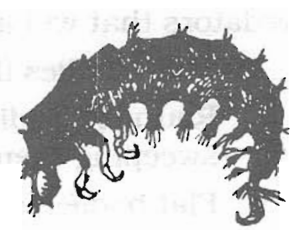


- Sucking disk at hind end of its body (to hold fast to rocks in fast-moving water).
- Two fan-shaped brushes near its mouth (to strain food from the water).
- A silken thread attached to their bodies that they anchor to rocks; (in case they get swept away in the current, they can creep back up the thread to their rock).

Caddisfly Larvae

Caddisfly larva live underwater inside protective cases they build. Their heads are tough, since they are the body part that protrudes from the cases. They also have short antennae and strong biting mouths. Caddisflies live underwater for about one year before transforming into a winged adult. Adaptations include:

- Hard-shelled head capsules (for protection).
- "Cases" made out of silk, sand, grains, pebbles, or bits of animal matter (that they construct and crawl into for prot tion). Caddisfly larvae stay in their cases, coming out just feed.



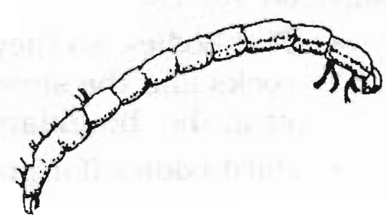
Water Striders

Water striders are long-legged, slender, predatory insects which move quickly across the water's surface to hunt every other kind of insect that lands there. They have two small legs in front to grasp their prey. They also suck blood from the bodies of dead birds and small mammals floating on the surface. Adaptations include:

- Long legs (to help them skim rapidly over the surface to catch their prey).
- Lightweight bodies (to help them walk upon the surface of the water).
- Velvet-like covering on their bodies (that traps air and surrounds and protects them during their occasional plunges down into the water).

Midge Larvae

Some midge larvae are easy to recognize because they float at or near the surface with their body in the shape of a U. They move rapidly across the surface of the water by repeatedly bending their bodies into U shapes. Other midge larvae live in muddy creek bottoms in tubes they make out of mud, sand, or plant debris, held together by silk. There are about 2,000 species of midges in the world. The larvae feed on small particles of plant matter they catch in bristles near their mouths. They transform into small flies that resemble mosquitos in size, but these flies do not bite. Adaptations include:



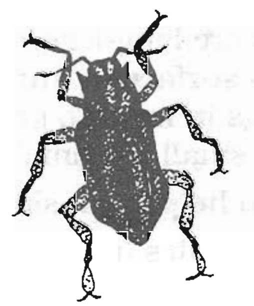
- A pair of small "prolegs" just below the head (for feeding).
- Hardened head (for protection).

Beetles

Most beetles are easily distinguished by the set of hard wings that meet in a straight line down their backs. Underneath lies a set of softer wings that is used for flight. Water-dwelling beetles generally come to the surface to breathe, and feed on other creatures of the creek, such as insects and tadpoles. Some beetles are fierce predators that will attack fish much larger than themselves.

- Hard bodies (for protection).
- Rounded bodies (so the water can rush off their bodies without sweeping them away in the current).
- Flat bodies (so they can squeeze between and underneath rocks for protection from predators and the current).
- Bodies that are light brown or dark brown in color (for camouflage).
- Paddle-like feet (to aid in swimming).

Riffle Beetle Larva

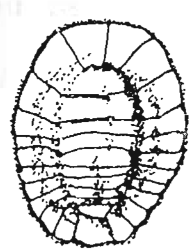


Riffle Beetle

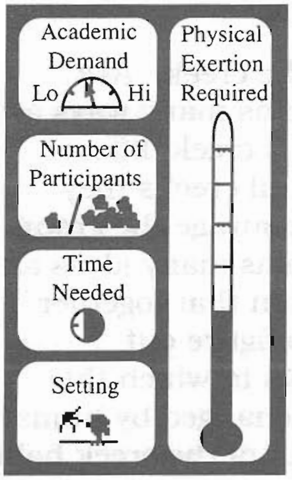
Water Penny

Water pennies are round, copper-colored beetles that look like pennies and live on the undersides of rocks. They are often hard to see, since their legs are not visible until you turn them over. They breathe through a set of gills located on the underside of their bodies, Unlike many beetles, they are vegetarian, feeding mainly on the algae on stones.

- Flat bodies (so they can fit between the bottom of the rocks and the stream bottom, where the current is weak, or in the "boundary layer" on top of underwater rocks).
- Hard bodies (for protection).



CREEK OF DREAMS



QUESTION: What do urban creeks, or other creeks that have been significantly altered from their natural state, need to become healthy creek habitats?

SUMMARY: Youth group members visit a creek that has been signficantly altered from its natural state to assess its level of disturbance and determine whether it is capable of sustaining wildlife. The kids imagine the creeks' past, make wishes for its future, and determine what it needs to become once again a healthy creek habitat. Note: This activity works best if it is done after kids have visited a relatively natural creek site.

MATERIALS: (for each group of 3-5 people)
- Task Card #9 (included)
- Pencil
- Clipboard (or cardboard and tape to make one)

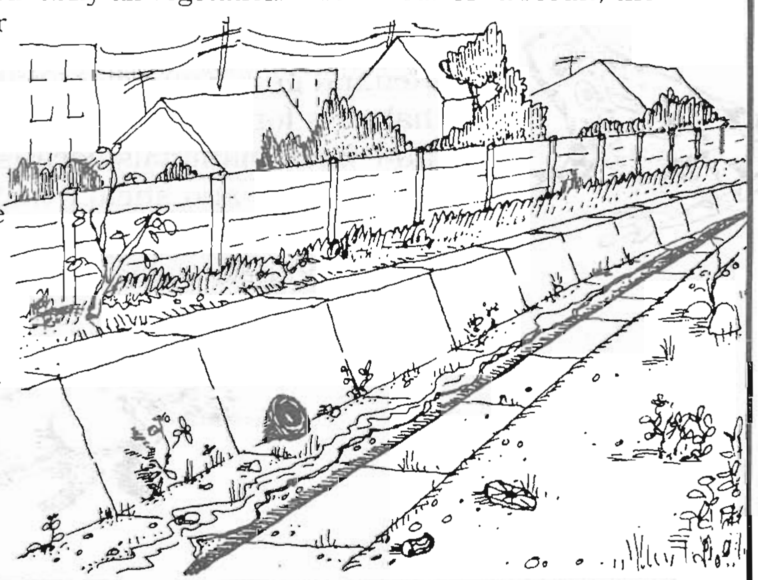
PURPOSE:

To help youth:

1. Recognize the components of a healthy creek habitat: native vegetation, running water, rock or gravel bottoms, and stable banks.
2. Realize that many cement-lined drainage ditches in their community used to be healthy creeks that were "channelized" because of concerns about flooding.
3. Understand that healthy creek habitats can support wildlife because they offer the necessary food, water, and shelter, whereas seriously altered creek habitats can't.

BACKGROUND

The cementing and burying of creeks in the name of flood control began in large scale with the federal Flood Control Act of 1938. When a creek is channelized or buried, its banks and creek bottom are lined with concrete, and virtually all vegetation is removed. As a result, the creek habitat is destroyed, and is no longer capable of providing the food, water, and shelter necessary to sustain creek wildlife. The federal funding available for these "channel improvement" projects was so attractive that from the 1940s to the early 1970s those funds were used to channelize over 34,240 miles of creeks and streams throughout the United States. It is estimated that funds from states, counties, and towns were used to channelize another 200,000 miles of creeks and streams. Besides being channelized or buried, creeks in many areas have been destroyed or damaged by water pollution, garbage dumping, vegetation removal, and erosion of the banks.



ACTIVITIES: (Observing, Communicating, Comparing, and Relating)

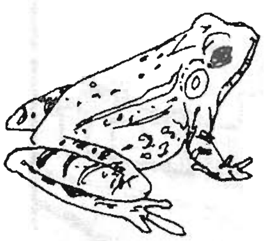
At the Creek

1. Assemble the group in a place where they have a good view of the creek. Ask them to think of as many ways as possible that this creek differs from more natural creeks they have seen. (Encourage the group to come up with as many ideas as possible.) Explain that together you are going to figure out whether the ways in which this creek has been changed by humans affects the health of the creek habitat and its ability to support wildlife.

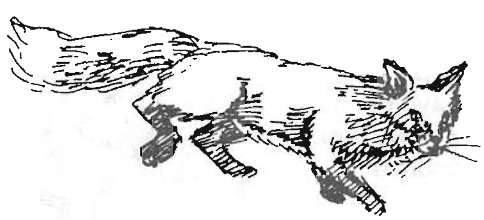
2. Pass out Task Cards, pencils, and clipboards to each group of 4-6 people. Explain that they should fill out the survey questions according to their observations of the creek. Go over the Task Card briefly, answering any questions.

3. Allow about 20 minutes for the groups to conduct their survey and fill out their Task Cards, assisting where needed.

4. Reconvene the entire group and go over the Task Cards, assessing together whether the creek offers adequate wildlife habitat.



Remind group members that creeks are usually good habitats for a variety of animals such as birds, frogs, and small mammals because they offer the basic food, water, and shelter that all animals need to survive. Go over the findings of each group, asking questions and discussing some of the points in italics.



Creek of Dreams

Leader's Key

Creek bottom What is the bottom made of? Cement? Dirt? Gravel? Rocks?

Why do rock and gravel bottoms generally make the best creek habitat? Gravel bottoms are required for most fish species to lay eggs, since water running over gravel bottoms usually has more oxygen in it, and dirt bottoms will cover up and smother the eggs. Rock bottoms provide shelter for small water animals, such as fish, insects, and snails to hide from predators.

Running water Is there water in the creek? Is it flowing or does it appear stagnant? What does it look like? Muddy? Clear? Any odor or color?

All animals need clean water to survive. Does the water look healthy for animals to drink?

Creek banks What is on the banks? Cement? Barren soil in contact with water? One type of plant or a variety? Trees, bushes, ferns, grass?

Can animals easily get down the banks to the water? Can animals find shelter near the creek? Shelter for birds and larger animals is usually provided in the trees or thick bank vegetation, which they use to hide, rest, and build nests. Why else is vegetation important to a healthy creek habitat? Plants, shrubs, and trees on the banks, in addition to providing shelter for animals, also provide nutrients by dropping leaves into the water. Vegetation also shades and cools the water, making it a habitat for fish. Plants also keep the banks from eroding; erosion of the banks makes the water murky which harms animals that live or feed in the creek.

Other vegetation Are plants growing in the stream? ____________

Is algae or moss growing on rocks in the stream? ________

Are dead or decayed plants on the creek bottom? ______

Are there fallen leaves, twigs, or branches? ____________

What do these things tell us about the quality of the creek habitat, especially its ability to support wildlife? Plant growth in the stream is a sign that the water is very low or dried up for much of the year. An excess of algae or moss is often a sign of water pollution. Dead and decayed plants on the creek bottom and fallen leaves are good signs, since these things provide nutrients and shelter for small animals, which in turn provide food for larger animals that visit the creek to feed.

Canopy of trees Are there any nearby trees that overhang the creek? One, a few, or many? ______________________

Why is a canopy of trees a sign of a healthy creek habitat? Trees provide shelter for animals, nests for birds, and dens and burrows for small rodents. Trees shade and cool the water, making it a healthier habitat for young fish and many insects. The leaves and twigs that trees drop add nutrients to the stream which feed smaller animals who in turn feed larger animals.

Pools & Riffles Does the water flow in a steady stream? Or are there areas that flow faster (riffles), and some that flow slower (pools).____________________________

Why are riffles and pools a sign of a healthy creek habitat? Riffles — fast-flowing, shallow areas of the creek, usually with gravel bottoms — are important because they are often the places where fish lay eggs. Riffles also are home to a large number of aquatic insects, since the oxygen and nutrient level is high. Pools — deeper, slow-moving areas of the creek — are important because they are places where young fish can feed and have shelter until they grow big enough to move throughout the creek. A creek with both riffles and pools is likely to support a wide variety of creek life, because some animals feed and live better in pools, while others feed and live better in riffles.

Pollution Walk a little way up and down the stream. Do you see any places where water enters the creek? If so, what does it look like?

____

Water drains into urban creeks from streets throughout the city. Any pollutants poured on the streets, sidewalks, or gutters will be washed downhill into the nearby creeks when it rains or when other water is present.

Describe the way the water looks, particularly any color or odor you notice. ______________________________________

Some types of pollution are invisible and have no odor, while others leave signs such as a color or smell. Observing the types of insects and other small animals living in the creek can be a good indication of whether there is pollution or not. A wide variety of insects and small animals is a good sign, while an abundance of just one or a few kinds of animals is usually a bad sign. (See Who Can Stand the Water?, Activity #5).

Shelter List all the shelters you notice, even very small things that would shelter small animals. ______________________________

Healthy creek habitats support so many types of animals because they provide the food, water, and shelter that all animals need. In a natural creek environment, imagine where the following animals would find shelter: deer, frog, racoon, bird, mouse, waterstrider, young trout. Discuss as a group whether this creek offers food, water, and shelter for the above animals.

Shade Describe anything you see near the creek that would create shadows at different times of day. ____________________________

Shadows provide shelter, since animals cannot be seen as easily by their predators if they are hiding in a shaded place, either under the water, or on the banks. Also shade cools the water temperature making it a better habitat for a wide variety of aquatic life.

Evidence of Animal Life List all the animals you see or hear in or near the creek. Include birds, insects, and anything else. Describe them if you don't know their names.

________________ ________________ ________________

________________ ________________ ________________

The presence of animals is a sign of a healthy creek. If there are many birds, for example, it means that the creek habitat is providing the necessary food, water, and shelter for their survival. A variety of animal life near a creek is a healthy sign; likewise, an absence of animal life, or the presence of just a few species, is a sign that the creek habitat has been damaged in some way and cannot support wildlife.

Are there insects on the rocks or near the banks? A few? A lot? Many different types? ______________________________

Observing the types and numbers of insects living in or near the creek can be a good indication of whether there is pollution or not. A wide variety of insects and small animals is a good sign, while an abundance of just a few kinds of animals is usually a bad sign. (See **Who Can Stand the Water?**, Activity #5).

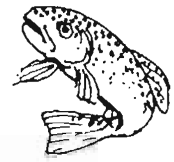
Describe any other evidence of animals you see, such as tracks in the mud, trampled bushes, nests, burrows, etc. ________________

____

5. Ask the youngsters to close their eyes and imagine that they could be transported back in time 200 years to this very spot.

   (Help set the scene by talking about how 200 years ago, only a few European settlers had arrived in California, and small groups of Native Americans were the only people living near the creek. There were no cars, no freeways, no roads, no cities, no pollution, and little noise aside from the sounds of nature. Although none of the elements of modern life existed then, this creek existed, and flowed through this very spot. Elaborate on this as much as you wish to help evoke images.)

   Still with their eyes closed, ask the youngsters to imagine the sights, smells, and sounds of this very place 200 years ago. After a few minutes of silence, have them open their eyes and talk about some of the details (plants, trees, rocks, insects, birds, mammals, sounds) they imagined. Remind them that in the earth's time, 200 years is very short time, and that this creek probably existed thousands of years ago.



6. Next ask them each to make a wish for this creek's future. If you have not done so in a previous activity in this book, this would be a good time to talk about the various organizations throughout California that work to restore creek habitats to more natural states. These restoration projects often work on revegetation, stabilizing creek banks, investigating water pollution problems, and cleaning up debris.

7. Review the requirements needed for a healthy creek environment. As the youngsters name things, encourage discussion of why each item is important to the overall health of a creek. For example, vegetation is important because it provides shelter for animals, adds nutrients to the stream, cools the water, and helps stabilize the creek banks.

Optional Follow-up Activities

- Carry out the survey in this activity at a relatively natural creek or stream site, and compare the results.

- Make plans to organize or participate in a community action project that would begin to restore this creek to a healthier state. (See **Be A Friend of Your Local Creeks,** Activity #10 for more information.)

- Survey older residents of the area about their memories of the creek. Use this information, along with old maps and photos you may be able to find in a library, to create a display about the history of the creek that you can show somewhere in your community. (See **Be A Friend of Your Local Creeks**, Activity #10, for more ideas.)

Task Card # 9

Creek of Dreams

Creek bottom What is the bottom made of? Cement? Dirt? Gravel? Rocks?

____

Running water Is there water in the creek? Is it flowing or does it appear stagnant? What does it look like? Muddy? Clear? Any odor or color?

____

Creek banks What is on the banks? Cement? Barren soil in contact with water? One type of plant or a variety? Trees, bushes, ferns, grass?

____

Other vegetation

Are plants growing in the stream?______________

Is algae or moss growing on rocks in the stream? ________

Are dead or decayed plants on the creek bottom? ______

Are there fallen leaves, twigs, or branches? __________

Canopy of trees Are there any nearby trees that overhang the creek? One? A few? Many? ______________________

Pools & Riffles Does the water flow in a steady stream? Are there areas that flow faster (riffles) and some that flow slower (pools)?

____

Pollution Walk a little way up and down the stream. Do you see any places where water enters the creek? If so, what does it look like?

____

Describe the way the water looks, particularly any color or odor you notice.

____

Creek of Dreams

Shelter List all the shelters you notice, even very small places that would shelter small animals.

____

Describe anything you see near the creek that would create shadows at different times of the day.

____

Evidence of Animal Life List all the animals you see or hear in or near the creek. Be sure to include birds and insects. Describe them on the back of this sheet if you don't know their names.

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

Are there insects on the rocks or near the banks? A few? Lots? Many different types?

____

Describe other evidence of animals you see, such as tracks in the mud, trampled bushes, nests, burrows, etc.

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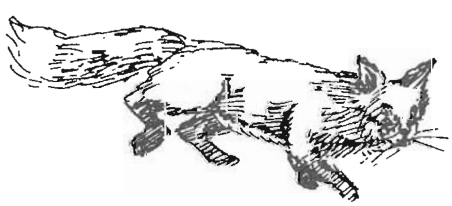
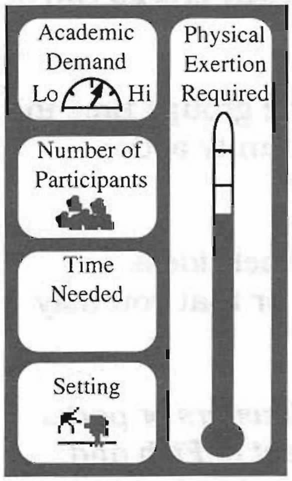


Be A Friend of Your Local Creeks



Question: What can your group do to help protect and restore creeks and streams in your community?

Summary: Youth group members identify potential projects they can undertake to help protect or restore creeks and streams. They then choose, plan, and carry out a community action project.

Materials: Task card #10. (Photocopy one for each group of 3-5 people.)

Purpose:

To help youth:

1. Realize that their actions can help protect and restore local creeks and streams.
2. Improve their ability to work as a group to plan and carry out a project aimed at a valued goal.

Background

Creeks are valuable and fragile ecosystems. One of their main values is that they provide habitat for a great variety of plants and wildlife. Particularly within urban areas, creeks and streams often provide a last remaining natural area that wildlife can use for food, water, and shelter. Creeks are also a valuable source of water and recreation for human beings. Creeks are fragile in that their health is easily destroyed through human actions, such as pollution, garbage dumping, urban run-off, and devegetation of the banks. Projects to protect and restore the health of creeks are being carried out by a number of citizens groups throughout California. Young people are often very concerned about the quality of the environment and the protection of wildlife. By participating in community service or public education projects, youth groups can contribute significantly and tangibly to the protection or restoration of valuable creekside habitat.

Activities: (Observing, Communicating, Relating, and Applying)

1. Start by asking if anyone knows of any nearby creeks. Discuss the appearance and health of the creeks in your area.

2. By way of review, discuss ways that creek habitats can be damaged or destroyed (through pollution, garbage dumping, erosion, devegetation of stream banks, or cementing of the creek bed). Stress that some young people's activities, such as

riding bikes along creek banks and sliding down creek banks, can particularly aggravate the problem of erosion. Also, ways in which littering near creeks can set the stage for further garbage dumping there.

3. Pass out Task Cards to each group of 3-5 members and allow the groups time to read the cards and come up with suggestions for possible community action projects.

4. Reconvene the entire group and discuss their ideas. Accept all their ideas as valid. Below are some ideas that may surface in the discussion or that you may want to contribute for the group members to consider:

   - Organize your own creek clean-up. *Gain permission from landowners or parks officials before doing this. A clean-up permit from the Department of Fish and Game will only be necessary if the stream flow will be altered by the clean-up project; most projects will not require a permit. Solicit community volunteers or get another youth group involved to help with the project. Gather materials you will need such as gloves and garbage bags. Discuss safety considerations. Arrange for someone to haul away the garbage collected. Make plans to celebrate your good work after the clean-up.*

   - Educate the community about the value of natural creeks by creating a mural, window painting, or a poster that illustrates the importance of creek habitats. Display these items somewhere in your community, such as in the windows of a local business or the display case in a public building.

   - Develop a presentation for groups of children or adults about the value of creek and stream habitats, using a skit, song, slide show, video, public service announcement, or photo essay.

   - Develop a presentation about the things that threaten the health of creeks: erosion, pollution, building construction, or roads built too close to the creeks.

   - Carry out any of the activities in this book with another group of youngsters, stressing the importance of protecting creeks.

   - Educate the community about urban run-off pollution by stenciling storm drains with warnings, such as "No Dumping — Drains into a Creek." Gain permission first from city or county officials.

   - Write up the results of a creek walk (see Activity #3) and submit them to city or county officials and the local newspaper.

   - Educate streamside property owners about guidelines for protecting the health of creeks and streams. In some communities youth groups have prepared information sheets and distributed them to people who live along creeks. For example, the sheet might list various kinds of problems — such as pollution, dumping, and erosion — and the telephone numbers of the agencies who should respond. A good guide to follow is *Stream Care: A Guide for Streamside Property Owners*, available at no charge from the Santa Cruz County Planning Department. (See Resources in the **Introduction**.)

- Identify sites where garbage is frequently dumped and try to prevent future garbage dumping by carrying out the following measures:
  (a) Ask the city to post a "No Dumping" sign where the worst dumping occurs.
  (b) Try to identify the dumper by checking to see if any mail with a name and address was dumped. Report this information to the police.
  (c) Ask nearby residents to try to document who is doing the dumping by taking a picture while it is happening or by writing down the license number of the car or truck. With this evidence the police are often willing to issue a citation to the dumper.
  (d) Work with a local Urban Creeks Council group to help come up with solutions to prevent dumping at a particular site. (See Resources in the **Introduction**.)

- Organize a Friends of ______ Creek group for a creek near you. To get some ideas on how do this, contact the California Urban Creeks Council or a local urban creeks council affiliate group. (See Resources in the **Introduction**.)

- Put on a "Creek Week" celebration by working with the local affiliate of the Urban Creeks Council or another civic group. For instance, a Creek Week was organized in Sacramento and culminated with 600 volunteers performing clean-ups of 16 creeks during the course of one Saturday morning. There were prizes for the best junk-and-gunk found during the day. A grand prize went to a group of volunteers who found a rocket combustion chamber in the creek bed.

- Participate in any long-term stream monitoring projects that are being conducted in your community. To find out what projects are being undertaken, contact an Urban Creeks Council office, Sierra Club or other environmental group in your community.

- Educate mountain bike riders about the fact that riding on creek banks causes erosion and hurts creek habitats and inhabitants. Do this by posting signs near creeks (get permission first), creating and posting flyers in bike stores, or setting up a demonstration booth at an environmental event or mountain bikers event.

- "Adopt" a stream, creek, or watershed in your community by visiting it regularly, helping to monitor and maintain its health. (See Resources in the **Introduction**.)

- Grow seedlings to be reintroduced in a habitat restoration project. (See Resources in the **Introduction**.)

- Participate in a creek habitat restoration project (such as revegetation, irrigation, weeding or clean-up) that is managed by an environmental, state, or local organization. Contact The Nature Conservancy of California or the nearest Urban Creeks Council for information on local projects that may be underway. (See Resources in the **Introduction**.)

- Conduct your own stream bank revegetation project. Contact owners of the land or park officials to gain permission. Work with a botanist or the local chapter of the Native Plant Society to determine what, when and how to plant.

Task Card # 10

Be A Friend of Your Local Creeks

Question: What can your group do to help protect and restore creeks and streams in your community?

Activity:

1. Keep in mind that the things that most threaten the health of creeks and streams and the wildlife that depend on them are
   a. dumping of garbage
   b. erosion of stream banks
   c. polluted water running off streets and into creeks when it rains
   d. water pollution from businesses and individuals who illegally dump pollutants down storm drains
   e. removal of streamside trees and plants
   f. constructing buildings or roads too close to creeks

2. In the next 5-10 minutes, come up with some ways that your group can help solve any of the above problems or educate others about the problems of creeks and streams.

3. Choose one person from your group to tell the larger group about your best ideas. Today, your youth group will decide upon one or two projects that you will actually carry out that will help creeks in your community.