

California State Parks  
**JUNIOR RANGER**  
**PROGRAM HANDBOOK**



# California State Parks

## Junior Ranger Program Handbook



State of California



The Resources Agency

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# Acknowledgements

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The Junior Ranger Advisory Committee (Jim Fife, Val Nixon, Donna Pozzi, Stephanie Price, Rich Silver, and Kathryn Yee), who met in 1990 and 1991 to compile the first handbook (from which the current handbook was developed); the late Stacey French met with us many times and provided helpful resource materials, fun activities and interpretation ideas, and an Animal Life program; Wendy Harrison contributed a Plant Life program, activities, ideas on how to work with children, and effective methods of interpretation; Joy Meads volunteered to proofread and edit the entire handbook; Val Nixon carefully edited the first draft of the handbook and contributed valuable suggestions and information, particularly for the Geology section; Rita Nunes sent helpful information from Indian Grinding Rock State Historic Park and advised us on the California Indians section; Stephanie Price took the time to create a sample history and water program and sent fun activities to go with them; Laurel Rayburn provided the background information and program for the Energy section; Charles Smith, Native Californian Concow/Maidu, gave ideas for the California Indians section and edited it for accuracy; Tom Tanner provided valuable information on Native Californians, both by interview and by the loan of excellent books on the subject; Kathy Yee drove from San Francisco to Sacramento to edit an early draft of the handbook, and sent a box full of helpful reference books; Cara O'Brien and Joanie Cahill created the Junior Ranger Adventure Guide.

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## Third Edition

The latest edition of this handbook is the product of the hard work of a number of additional individuals. Heather McCummins contributed many, many hours of time in formatting the handbook, bringing consistency to its look and “voice,” and



researching and writing information needed to bring the handbook up to date. She was supervised in this work by Jenan Saunders, Donna Pozzi, and John Werminski. Additional people who assisted with the review of the handbook and recommended changes include: Carol Cullens of the Interpretive Publications Section; Alex Peabody, Aquatic Safety Specialist, and Jim Fitzpatrick of the Public Safety Division; Kathy Lindahl, Paulette Hennum, Leo Carpenter, and Cuauhtemoc of the Archaeology, History & Museums Division; and Janet Didion, Cynthia Roye, and Syd Brown of the Natural Resources Division. We would also like to thank graphic designers Gail Dudding, Laurena Cabañero, and Jane Howard for their work on the graphics used in many of the handbook's activities and the handbook cover.

# Introduction to the Handbook

## About the Handbook



Freeman Tilden said it best in his 1957 classic, *Interpreting Our Heritage*: “Interpretation addressed to children (say, up to the age of twelve) should not be a dilution of the presentation to adults, but should follow a fundamentally different approach. To be at its best it will require a separate program.”

How can you plan interpretive programs for those young people who will someday inherit the state parks legacy? Experienced interpreters say the first step is to approach life as a child: allow yourself to crawl about the ground on your knees, roll in the cleanliness of tide-washed sand, or examine at length the busy activity of an ant colony as the little creatures scurry back and forth. If you can find joy in these things, you are ready to attempt the second part of the interpretive process: sitting down and designing a Junior Ranger program that will provide both meaning and enjoyment for your young guests and a true sense of satisfaction for you. This handbook is a place to start.

A Junior Ranger program can be a staff-led interpretive program, the Adventure Guide, a park-specific self-guided workbook, or web-based activities. Comments from parents and program participants favor the one-on-one interaction children receive during staff-led activities, but self-guided activities are a viable option and can be just as beneficial. Consider what your park has to offer and be creative when you are planning a Junior Ranger program.

This guide has been developed as a reference tool for preparing and leading Junior Ranger programs. Almost all of the subject sections presented in the handbook include the following:

### Interesting Facts

These are bits of trivia you can use in your talk to help get the Junior Rangers interested in the subject.

## **The Sample Program**

This outlines one (or more) of the many possible ways a program might be organized. Since this handbook will be distributed to a wide variety of state parks, the sample programs generally do not include specific references to plant and animal species, types of rocks, California Indian groups, etc. (although in some sections park-specific sample programs have been included). The sample programs are provided to give you ideas and a place to start, but you can personalize them and adapt them to the specifics of your unit.

## **Activities**

Games, activities, and crafts have been included in many of the subject sections to help reinforce the program content and to involve the Junior Rangers in the program. Some of these activities and crafts can easily be incorporated into a self-guided workbook and serve as a way to get entire families involved. (Note: Additional activities are included in the “Directed Activities” section).

## **Subject Information**

This is a compilation of useful information that you may want to include in your program, modifying or embellishing it according to your park environment. As the information is very general, your program will be more effective if you find out more about your park’s special features, plant and animal life, and history.

Concepts researched for use in this handbook were sometimes complex and difficult to “translate” into a language kids could understand. We hope to have spared you this “translation” problem by presenting the information simply, without cumbersome scientific words or concepts that may be difficult for 7- to 12-year-olds to understand.

## **Application/Conclusion**

Each sample program will end with an explicit or implicit stewardship application. It is important that the Junior Rangers think about how they can apply what they have learned, both while they are in the park and when they go back home. Junior Rangers should leave the program, or complete an activity, with the following concepts in mind:

- Understanding the relationship between each subject area and humans (interaction, exploitation);
- Understanding good stewardship in each subject area.

Example: If the Junior Rangers are learning about animal life, they should understand how they can help protect animals and endangered species while in the park, how actions back at home (such as construction in the neighborhood) can affect animals, and how actions around the world can affect biodiversity (for example, the effect of losing the rainforests).

## **Suggested Resources**

At the end of most sections, a list of books and other materials is included to help you prepare your program. (Note: There is also a more extensive list at the end of the handbook).

## **Other Sections**

### **Working with Children**

This section includes suggestions on how to get (and keep) the attention of a group of 7- to 12-year-olds, how to deal with troublesome children, and how to include children with special needs in your program.

### **Self-Guided Activities**

Self-guided activities can bring families together, allow for flexibility when visiting parks, and encourage exploration and learning. A “Junior Ranger Adventure Guide,” in both English and Spanish language versions, is available as a self-guided option for program participants. Parks are encouraged to develop their own park-specific self-guided workbooks. In Appendix A you will find “paper programs” designed for Junior Rangers to do on their own. These worksheets can be adapted to be park-specific and incorporated into a park workbook, or copied and given to Junior Rangers who ask for them to complete. The child should complete several paper activities before being eligible for a stamp in his or her logbook. See the introduction to “Self-Guided Activities” for more information.

## **Using the Handbook**

This handbook is not intended to be a reference book that sits on your shelf, gathering dust; rather, it is designed to be a “working handbook.” The three-ring binder format was selected so that you would be able to add your own sample programs, articles, games, reference materials, program notes, etc. to this book, and so that there would be space for periodic updates.

As you develop successful programs, activities, and games, please send them to the Interpretation and Education Division in Sacramento. Your ideas can then be shared with other interpreters and included in future updates. Your contributions and comments are welcome.

Because they are difficult to mass produce, tabs have not been included; however, you may find it easier to use the handbook if you add them.

We hope you find the handbook helpful. Good luck in preparing your Junior Ranger program!

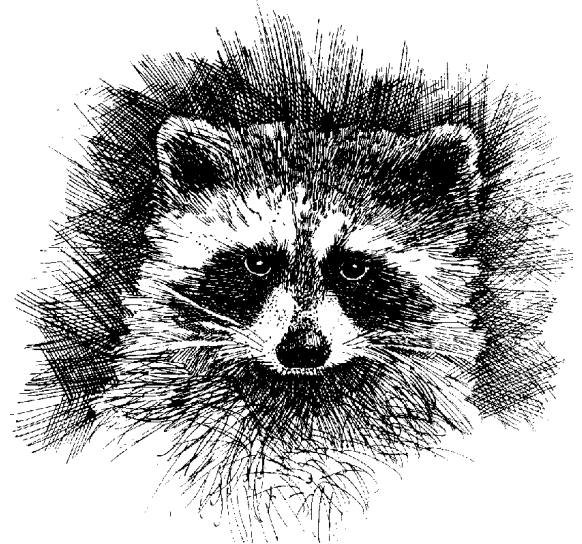
## History of the Junior Ranger Program

Although the California Department of Parks and Recreation is a leader in the Junior Ranger Program movement in the United States, this type of program really had its beginnings in the late 1930s in the National Park Service. It was at Yosemite National Park in 1938 that park staff devised a new program that would come to be called the Junior Naturalist Program.

The goals of this new program were quite simple and sound very similar to those of the present day State Park System interpreter: “to make possible a children's program of interpretation to fit their specialized needs.”

The program soon expanded within the National Park Service to Sequoia National Park, Rocky Mountain National Park, and the national historic sites of our nation's capital in and around Washington, D.C. The program became so important that it was included as a topic of discussion during the November 1940 Second Park Naturalist Conference at Grand Canyon National Park.

“Organized informality” became the theme of the first Junior Naturalist Program at Yosemite: “Through play, contests, activities, direct observation, and creative pursuits, children receive an insight and simple techniques in various fields of nature study.”



These early leaders in interpretation wanted to provide children “a purpose of direction rather than building a thorough fund of knowledge.” In other words, they wanted the program to be meaningful to young people without bearing any resemblance to the classroom regimen from which they had escaped for the summer. They wanted to show that, contrary to the 1930s stereotype of a naturalist being “a nut with a net,” a naturalist was someone with an interest in and knowledge of the great outdoors and the desire to preserve the nation's scenic and cultural treasures.

In the early 1970s, the California Department of Parks and Recreation began its own pilot Junior Ranger Program. In 1973-74, the program was adopted and, over the years, expanded throughout the state. In 1991 a Junior Ranger logbook was added to the program, allowing children to record their experiences and to receive stamps for

programs attended. The self-guided Junior Ranger Adventure Guide was created in 2002 for parks that do not have staff to lead programs but still want to offer the Junior Ranger Program. Where properly organized and enthusiastically carried out, the Junior Ranger Program has become one of the most important and successful elements of state park interpretation.

## Program Goals

The Junior Ranger program should accomplish two primary goals:

- Provide an opportunity for children to participate in a fun, hands-on activity designed especially for them;
- Develop in children an appreciation for the cultural and natural resources preserved in state parks, an awareness of the interrelationship among those resources, and a desire to help protect them.

Every Junior Ranger activity should provide a worthwhile experience that promotes further thought and action by the child, rather than just instruction. Concepts should be simple, yet meaningful. Active involvement and participation by the children should be incorporated into each Junior Ranger activity.

The Junior Ranger program must be adapted to local resources, types of visitors and visitor use, and staffing and scheduling limitations. Units unable to have daily activities due to visitor use patterns or personnel limitations are still encouraged to have a Junior Ranger program. Activities should be scheduled for the days and seasons of highest visitation. To maintain a statewide program of the highest quality, it is important to follow the guidelines established in this handbook.

## Program Guidelines

### Eligibility

The Junior Ranger Program is primarily designed for children 7 to 12 years old. Children under seven are generally too young to participate fully and to assimilate the program material. At times, their presence disrupts the program and diminishes the effectiveness of the interpreter with the older participants. You might consider developing a Junior Ranger Cub Program geared toward children under seven. By the age of thirteen, most young people have passed into another stage of development and are apt to find the concepts presented in most programs below their intellectual level. Self-guided workbooks allow children of a wider age range to participate in Junior Rangers along with older siblings and adults.

## **Study Segments and Electives**

There are twelve study segment areas: Geology, Native Californians, History, Plant Life, Animal Life, Energy, Water, Weather and Climate, Ecology, Park Careers, Recycling, and Safety and Survival/Crime Prevention. In addition to these, you may wish to develop a program on a topic of local or special interest, such as Oceanography, Archaeology, Astronomy, Architecture, Orienteering, Pioneer Crafts, etc. A page has been included in the logbook for special electives stamps.

Some state parks have developed profession-specific “Junior” programs (such as Junior Historian, Junior Engineer, Junior Curator) as a creative way for children to learn about other jobs available within state parks or about resources specific to a particular park unit. The Park Careers section of the Junior Ranger Handbook and logbook is an excellent place for these programs to be incorporated. These “Junior” programs can be created under the auspices of the larger Junior Ranger Program and utilize the Junior Ranger materials, awards, and awards structure. Staff who are developing profession-specific programs should report on, and request Junior Ranger supplies/awards for their program, through the Junior Ranger Program. Also, please send program information to the Interpretation and Education Division, attention: Junior Ranger Program Coordinator, so the program can be promoted statewide.

## **Self-Guided Activities**

Self-guided activities may be used in parks that currently do not offer Junior Ranger programs due to limited staffing or a day-use clientele or as an alternative for kids and their families who aren’t able to fit a conducted Junior Ranger program into their schedule. Some examples of self-guided activities are available in this handbook. These worksheets can be adapted to be park-specific or copied and provided to Junior Rangers who request them. The child should complete several of the self-guided worksheets before earning a stamp in their logbook. We also encourage you to develop self-guided activities that are based on the resources of your unit.



The “Junior Ranger Adventure Guide” is also a self-guided activity and is available in both English and Spanish. Upon completing the Junior Ranger Adventure Guide, a child should bring it to the kiosk or visitor center to receive a metal Junior Ranger badge. If a child wants to continue with Junior Rangers after completing the Adventure Guide, he or she can simply take the Guide to a park that conducts Junior Ranger programs. There a logbook will be issued and credit given for one activity. Copies of the Adventure Guide can be downloaded from the Department’s website or ordered from the Interpretation and Education Division.

## **Recognition Awards**

The Junior Ranger recognition awards were developed specifically for use in the Junior Ranger Program and should be used exclusively for this program. They should not be used for "Litter-Getter" or other service programs. To maintain program consistency and avoid the confusion and disappointment that arises when participants receive different awards from one park to another, the Junior Ranger awards are not to be supplemented with locally developed materials. Only official statewide awards are to be given out. In some parks, using local funding, park-specific versions of the statewide badge are available. These badges closely resemble the statewide badges and are an exception to the policy that locally-developed materials are not allowed. Please send samples of all park-specific badges to the Junior Ranger Program coordinator in the Interpretation and Education Division.

A Junior Ranger logbook will be issued to each participant at the first program he or she attends (See "Using the Junior Ranger Logbook"). Interpreters should stamp the appropriate section of the logbook when the child completes each portion of the program. When a Junior Ranger completes one program or self-guided workbook, he or she will have earned a metal Junior Ranger badge. Upon completion of five programs, a Junior Ranger poster is awarded; after ten programs, the participant receives a certificate and the Junior Ranger patch. The "Award Summary Page" of the logbook will help the Junior Ranger and the interpreter keep track of the awards a child has earned.



**Statewide Badge**



**Park-Specific Badge**



## Junior Ranger Program Materials

Junior Ranger program materials are distributed by the Interpretation and Education Division. Each year a request form is sent out to the districts, which route the form to park units, requesting orders of materials for that year. It is important to communicate with your district office to ensure you are included in their order. For questions about ordering program materials, contact the Interpretation and Education Division.

### Logbook

Also available in Spanish. See information below on how to use the logbook.



### Metal Badge

Awarded after one logbook stamp has been earned.



### Poster

Awarded after five logbook stamps have been earned.



### Certificate

Awarded after ten logbook stamps have been earned.

### Patch

Awarded with the certificate after ten logbook stamps have been earned.



### Adventure Guide

A self-guided activity book. Completion award is a metal badge. Also available in Spanish.



### Promotional Sticker

This sticker is not an award but rather can be used in a variety of ways to promote the Junior Ranger program. Stickers can be passed out at campfire programs, to school groups and other youth organizations visiting your park, or at activities that take place outside of your park, such as at fairs and other events.





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for completing that segment. In addition, there is a page for self-guided activities (which children complete on their own). Please see the section on Self-Guided Activities in this handbook for more information about their use.

At the end of the logbook, there is a place where Junior Rangers can write down the addresses of new friends they meet, record special memories of their visits to state parks, identify the plants and animals they saw in the parks, and get autographs from park staff.

Finally, there is a page on which to keep track of the stamps and awards a junior ranger has earned. Should a child earn all the awards, he or she can be encouraged to start over again!

## **Promoting and Recording/Evaluating Your Program**

There should always be some degree of promotion going on for your programs. After all, the best program in the world won't have much of an impact on children visiting our parks if they don't know about it in the first place. Promotion can be done in a number of ways at a variety of venues. The most important thing may be simply to let other staff, and volunteers, at the park know about the program and when it will be offered. This way a park aid staffing a kiosk can let an arriving family know about it, a maintenance worker talking with a parent and child at the restroom can give a "plug" for it, a ranger who is doing a walk-through can give a personal reminder to campers he or she encounters, and a docent can tell those families with children who are on his or her general tour group about the opportunity for them to take part in your program as well (the same goes for a reminder at campfire programs). But these people can only do that if you keep them informed.

In order to do this, and to have something that can be provided to visitors, why not develop a simple calendar, or other handout, with information about your program (be sure to include the important information on when and where the program will be, how long it will last, and what the topic will be)? A supply of the handouts could be kept at the park's entrance kiosk and/or at a visitor center front desk. Be sure to post it on all bulletin boards that are available in the park as well. Did you know there is even a decorative "template" you can use for your bulletin board reminders? All you have to do is request it from the Department's Distribution and Reproduction Center (DARC). The template is on standard size paper and has a decorative, kid-friendly border. This can then be handwritten on, or run through an office printer, to convey any information you want. Ask for template "INT-201A" and be sure to tell them how many copies you want. Looking for something eye catching to promote the Junior Ranger program? A promotional poster is available through the Interpretation and Education Division.

If your programs are rather sporadic and therefore don't lend themselves to being "advertised" in this way, then at least look for ways to let visitors know (again

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through word of mouth and postings throughout the park) that your programs are available and more information can be obtained from a specific source (be sure to specify how visitors can get that “more information”).

Adding a blurb to the park’s website would be ideal as well, for those families that take the time to peruse the park’s site in advance. General information about the availability of Junior Ranger programs at the park can also be added to the park’s printed materials.

Working with local news outlets is also a possibility. See the appendix for sample press releases you could use to help write one about your program.

With all the work that goes into the development, promotion, and presentation of your program, it can be easy to forget about the important follow up that should be done as well. Consider how to best have your program evaluated—whether by children in attendance, another staff person, your supervisor, or an interpreter from somewhere else in your district. And use the information obtained from those evaluations to make improvements in the future (otherwise you’re just wasting those people’s time). For a great source of advice on the subject of evaluations, and ideas for how to carry them out, see *Aiming for Excellence: An Evaluation Handbook for Interpretive Services in California State Parks* (which is available on the State Parks website, and can also be obtained from the Interpretation and Education Division).

Be sure to report the statistics for your program to the appropriate person so they can be recorded into the CAMP database for tracking purposes (this used to be done using the DPR 918 forms and then was folded into the CAMP program). Additionally, make sure your programs are a part of the maintenance tracking portion of CAMP, so there is a record of the maintenance needs for the program, most importantly materials and supplies that will need to be replenished periodically.

## **Tips for Program Success**

- The Junior Ranger Program is intended for children. Discourage adults from attending sessions.
- Have Junior Rangers recite the Junior Ranger pledge at the beginning of each session, to build group spirit and reinforce program goals.
- Fifteen is the recommended maximum number of participants per session. Where groups tend to get too large, consider posting sign-up sheets at the kiosk or visitor center. Whenever possible, schedule additional sessions rather than exceed the recommended maximum.

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- Experiment with scheduling Junior Ranger activities at different times of day until you find the best time for your unit. Avoid the heat of the day, especially in units with water recreation. Early morning (9:00, 9:30, or 10:00 A.M.) or late afternoon (4:00 P.M.) times work well in units where visitors tend to be busy or leave the unit during the day. If personnel are available, Junior Ranger sessions could be scheduled at the same time as interpretive presentations geared to adults. In units with mostly weekend visitation, try offering two Saturday sessions.
- The recommended length of time for Junior Ranger sessions is 30-45 minutes. After sixty minutes the attention span of the 7- to 12-year-old child often begins to wane; an hour is the maximum recommended time for a program.
- If possible, have participants meet at the same location each day.
- Reassure parents that you will return to the same place at a specified time with their children and that they may watch from a distance if they have special concerns about safety.
- Take advantage of all opportunities to explain and publicize the program. Within the park, make use of bulletin boards, entrance station contacts, campfire programs, park publications, and patrol activities. Newspaper, radio, and television coverage should also be considered. (See sample press releases in Appendix D.)
- Whenever possible, present awards at campfire programs. Ask the district superintendent, chief ranger, or a visiting "V.I.P." to present them. You might have the participants describe, act out, or demonstrate some portion of what they learned.
- One person in each district should be responsible for coordinating the district's Junior Ranger program. Often this will be the District Interpretive Coordinator. This person's duties should include training personnel involved in the program, publicity, scheduling, ordering Junior Ranger materials from the Interpretation and Education Division in Sacramento, monitoring the program during the season, and preparing and submitting the district's annual evaluation forms.
- Use natural objects, appropriate artifacts, drawings, photographs, and other visual aids to support or illustrate concepts. Take a knapsack of props to the site with you.
- Try to keep the administrative paperwork simple and short. For example, do not issue logbooks at the beginning of a session only to collect them for signing at the end. Take advantage of the children's enthusiasm and anticipation at the opening of the session by starting your subject matter presentation. Give only a very brief introduction to the Junior Ranger Program. Avoid losing their interest with

## *Junior Ranger Program Handbook: Introduction*

explanations of procedures, passing out and collecting papers, etc. Save these for the end of the session.

- Encourage other personnel such as lifeguards and maintenance workers to get involved with the program, presenting appropriate study segments or electives.



# Working with Children

## Introduction

An effective Junior Ranger program will:

- Get the children interested in the subject
- Teach them about the subject
- Involve them in the subject
- Encourage their stewardship in our parks and at home
- Make them want to know more!

There are many ways to lead a Junior Ranger program, but some styles will make more of an impact on kids than others. Probably the least effective style is the lecture format.

Children in the 7 to 12 age range generally won't be able to follow a long stream of adult lecturing without getting lost. Moreover, children who learn by listening alone will retain much less of the content of the program than they would if they were taking a more active role in learning (asking and answering questions or taking part in activities).

A far more effective way of leading a Junior Ranger program is an inquiry-discussion format. The interpreter who uses questions and answers to lead a discussion draws on the child's natural curiosity and enthusiasm for new ideas and experiences. The effective leader of an inquiry-discussion will be open and responsive. He or she will be most likely, in this format, to change attitudes, since this format builds on the Junior Rangers' interests, perceptions, responses, and questions.<sup>1</sup>

A cautionary note: When using the inquiry-discussion format, it is important for the leader to maintain control of the direction in which the discussion is going. To achieve this, the interpreter should direct the questions and answers toward the objectives of the session. Any material the leader needs to convey that cannot be presented in the inquiry-discussion format should be given concisely, enthusiastically, and at a level the group can understand.



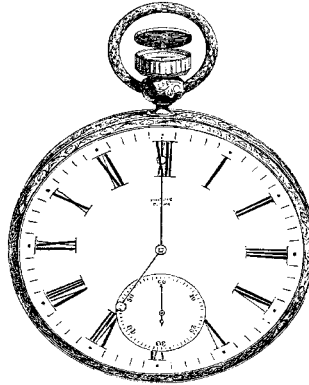
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<sup>1</sup> Information on interpretation styles is from *The Good Guide* by Alison L. Grinder and E. Sue McCoy. Scottsdale: Ironwood Press, 1985.



Tips from experienced program leaders:

- Remember to be accurate. If you don't know the answer to a question, admit it and discuss how you'll find out.
- If you enjoy what you're doing, the children probably will, too.
- Don't try to include too much in your program. It should not be more than one hour long.



## **Returning Children to Nature<sup>2</sup>**

Paul, a fourth-grade student in San Diego, commented, “I like to play indoors better, ‘cause that’s where all the electrical outlets are.” His viewpoint is swiftly becoming the prevailing opinion among today’s children, rather than the exception. Children are no longer experiencing the wonder of nature the way they once were able to.

As the lifestyles of Americans become increasingly fast-paced and structured, spending time in nature has become a low priority for families. Tree fort building and exploratory expeditions have been replaced by soccer practice, music lessons and computer games. A 2002 British study discovered the average eight-year-old was better able to identify characters from the popular Japanese card trading game Pokémon than native species in their own community—Pikachu, Metapod, and Wigglytuff were names more familiar to them than otter, beetle, and oak tree. The combined impact of overdevelopment, increasing park rules, environmental and building regulations, community covenants, and fear of litigation is also sending a disconcerting message to children that free-range play in nature is no longer acceptable. As a result of this growing isolation from nature, children are beginning to suffer from what Richard Louv, in his book *Last Child in the Woods*, has termed “nature-deficit disorder.” This non-medical condition describes the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illness.

In the last ten to fifteen years, in correlation with a decrease in children’s exposure to nature, medical studies have documented a large increase in childhood obesity and

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<sup>2</sup> Richard Louv. *Last Child in the Woods*. Chapel Hill, NC: Algonquin Books, 2005.

prescription drug treatment for Attention Deficit Hyperactivity Disorder. According to a study done by the Center for Disease Control, the “U.S. population of overweight children between ages two and five increased by almost 36 percent from 1989 to 1999. And two out of ten of America’s children are clinically obese...In the United States, children ages six to eleven spend about thirty hours a week looking at a TV or computer monitor.” This study also found that the amount of television children watched directly correlated with measures of their body fat. Analyzing mental illnesses in children, a 2003 survey, published in the journal *Psychiatric Services*, found the rate at which American children are prescribed antidepressants almost doubled in five years; the steepest increase—66 percent—was among preschool children. While these statistics are shocking, scientists are beginning to recognize that nature is vital to the health and well-being of children, reducing the propensity for childhood obesity and minimizing the symptoms of ADHD.

Junior Ranger programs that get children active in and with nature, both physically and mentally, are important. Not only can the activities have a positive effect on the health of a child, but as an interpreter you can present opportunities for children to increase their awareness of nature and its wonders through their senses. Thomas Huxley made the insightful analogy, “To a person uninstructed in natural history, his country or sea-side stroll is a walk through a gallery filled with wonderful works of art, nine-tenths of which have their faces turned to the wall.” As part of the Junior Ranger Program, we need to facilitate guided discovery among the participants, so that when they reach that “work of art,” they are able to fully experience and appreciate it, to have that sense of awe and wonder.

On a family vacation to the Grand Canyon, Jared, a ninth-grader, was impressed by the beauty and majesty of the surroundings, “But after seeing the canyon from several different vantage points, I was ready to leave. Although the canyon was magnificent, I felt that I was not part of it—and without being part of it, it seemed little more than a giant hole in the ground.” On the same trip, Jared and his family were driven by a thunderstorm into the cliff dwellings at Walnut Canyon National Monument. Jared related, “We found shelter in one of the ancient Indian caves. Lightning lit up the canyon and the sound of thunder reverberated in the cave. As we stood waiting for the storm to end, my family and I talked about the Indians who once lived here. We discussed how they cooked in the caves, slept in the caves, and found shelter in the caves—just as we were doing...I finally felt that I was a part of nature.” The young need only a taste, a sight, a sound—or, as in Jared’s case, a lightning strike—to reconnect with the receding world of the senses. It should be our mission, as part of the Junior Ranger Program, to provide an opportunity where children might make the one discovery that captures their attention and creates a bond with nature.

One California survey found that more than eight of ten campers became interested in the outdoors when they were children. The Junior Ranger Program is your chance to get today’s youth hooked on nature and its exciting discoveries. It may be the only chance many children have to experience nature. Many of the games and activities

found throughout this handbook are ideal for stimulating the senses and nature awareness of a child.

## Sample Program Format

### I. Introduction

#### A. Warm-up

- Introduce yourself, giving some brief personal information.
- Say something about why you like what you do.
- Stress your personal interest in Junior Rangers.

#### B. Focus

- Introduce the topic for the day.
- Get the group focused on the topic with a thought-provoking question or an attention-getter.

#### C. Objectives

- Let the Junior Rangers know what they will be doing (hiking, drawing, playing games, etc.).
- Let them know what they will have learned by the end of the program.

### II. Body

#### A. Inquiry/Discussion

- Interpreting with a question/answer (vs. lecture) format.

#### B. Guided Discovery

- Interpretation using games, activities, walks, etc: Putting the concept into action.

### III. Conclusion

#### A. Application

- Discuss how the Junior Rangers can apply what they have learned while in the unit and at home.
- Encourage good stewardship of the parks.

#### B. Administration

- Stamp log books
- Announce next Junior Ranger session, campfires, nature walks, etc.

## About Questions<sup>3</sup>

Effective interpretation using questions will lead from the simple to the complex. Keep in mind that while children of the Junior Ranger age are good at naming,

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<sup>3</sup> Information about questions has been adapted from *The Good Guide* by Alison L. Grinder and E. Sue McCoy. Scottsdale: Ironwood Press, 1985.

discriminating and classifying, they may have a more difficult time in making inferences and evaluating.

There are four main types of questions:

### **Memory Questions**

There is one right answer. “How many . . .” or “Name the . . .”

### **Convergent Questions**

There is a most appropriate or best answer.

### **Divergent Questions**

Multiple answers are possible, and questions open ended. “What if . . .” or “Imagine that . . .”

### **Judgmental Questions**

These questions get people to evaluate and choose, or to formulate values, opinions, or beliefs. Answers will be personal and unique.

### **Waiting for Answers**

A 5-6 second or longer wait gives time for Junior Rangers to formulate a thoughtful reply. An unhurried attitude is important. If you get no response, consider restating the question or giving more information. Asking questions too rapidly may imply that no response is expected. Silence, while sometimes frightening for the interpreter, gives opportunity for contemplation and encourages comment.

### **Welcoming Questions**

It is important to convey to the Junior Rangers that all questions are worthy of consideration and will be treated respectfully. Stress that questions are not impolite, will not waste time, and that there are no dumb questions.

Instead of asking questions the kids cannot answer, try giving them some information and then asking them to compare the information to another concept. Always make a positive comment that encourages participation, such as:

“Thank you for sharing that idea;” or  
“That’s a really good insight.”

Validate the children by using their ideas in discussion:

“What Brandon was saying about rainforests affects us here in the U.S. as well.”

## Directing Questions

If you do not get the answer you are hoping for, do not keep pursuing it until you get the right one. Rephrase the question, provide more information, or even give the answer yourself.

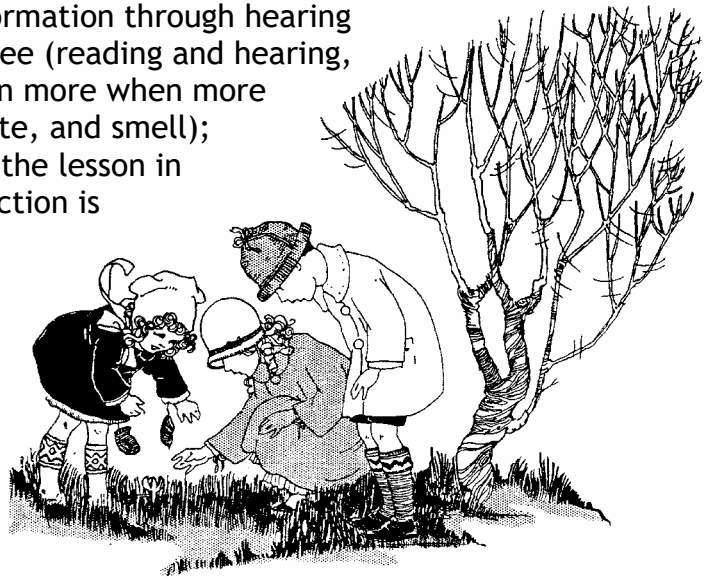
Acknowledge participants who give an unexpected answer by saying something like, “That’s a good thought” and redirecting the question or asking for more responses. If the answer is misleading, say something like, “I’m glad you said \_\_\_\_\_, because I bet a lot of people think that, but that’s not exactly it,” and then gently correct the child.

If the same people keep answering the questions, direct the next question to another person or ask for someone who has not answered yet.

## Guided Discovery

One of the most effective ways to interpret to children is to include an activity that reinforces your message. Studies on memory have shown that children retain the least information when they receive the information through hearing only; they retain more when they hear and see (reading and hearing, visual aids, watching a skit); they retain even more when more senses are involved (the senses of touch, taste, and smell); and they remember most when they act out the lesson in some way. Discovering something through action is the most fun way to learn.

In addition to the Directed Activities section of the Handbook, you will find games and activities that reinforce the interpretation material in most subject sections. In addition to these, try to include role playing, nature walks and “hands-on” activities whenever you can.



## Maintaining Order

Wendy Harrison (at Calaveras Big Trees State Park at the time of this writing) said, “The best defense against discipline problems is to have an interesting program and a sense of humor!” Since the length of a Junior Ranger segment is relatively short (30 minutes to 1 hour), disruptive behavior will not usually be a big problem. You will, however, occasionally have a child in your group who will draw attention away from

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the program and toward himself. If you have this problem, experienced Junior Ranger leaders (Wendy Harrison, Stephanie Price, Stacey French, and others) have offered the following suggestions:

If some of the children talk while you are speaking, include them in the discussion by asking them a question. This lets them know you've noticed their talking, and gets them refocused on the topic. If you know them by name, you might say, "Why do you think plants have flowers, Cindy?" or simply, "A mortar and pestle were used to pound acorns. Right, Peter?"

Have back-up activities planned so that if you have a particularly energetic group you will be able to adapt your program to make it more active.

Before you begin your program, set up parameters for when talking will be allowed and when it will not. Tell the Junior Rangers that when you hold up your hand, that means "be silent." This signal is useful, for example, when a Junior Ranger is answering a question and other children are talking, or when the group is on a nature walk and you have spotted a deer.

Another approach is to use the energy of a disruptive child in a positive way. For example, on a hike you could have the child be the leader for awhile and then take turns so all the Junior Rangers have a chance to play "follow the leader." Another way you could solve the problem quickly would be to have the child participate in an impromptu role-play in front of the group. Giving a disruptive child something to do will usually give him the attention he wants while channeling his/her energy in a more positive direction.

If the problem continues, identify the behavior that is disrupting the group, and warn the offender that if the behavior continues, he or she will have to be removed from the group. That threat will usually be enough to curtail the behavior, but you may occasionally need to separate the child from the group until he or she is ready to participate in what the group is doing.

If you are firm about limiting the size of the group to fifteen, you will not only ensure that each participant has a chance to be involved, ask questions, and see and hear everything that is going on, but you will also reduce discipline problems by keeping the group at a manageable size.

The challenge of maintaining order in your group is knowing when a child's energy has crossed the line from exuberance to disturbance. Having just "escaped" from school for the summer, a child will not want to attend a program in which he or she is required to sit still, be quiet, and listen. However, if a child's energy swings too much to the other direction, to the point where he or she is disturbing the other children, the worst thing you can do is to ignore the behavior. If you allow behavior that is clearly disruptive and rude, the rest of the group will either resent the fact that you do not control the disruptive child or join in the disruptive behavior. In either case,

your program will have lost its effectiveness. Don't be afraid to use the authority you have as the leader if the quality of your program will be compromised by disruptive behavior.

Despite the occasional disruptive child, most Junior Ranger Program leaders find that children are too interested in the program and too eager to participate in the exciting discoveries you have planned for them to have any time to make trouble. If you plan your session so that the group is active and busy, you won't have many problems in this area.

## How to Focus Kids' Attention

- Stay a child yourself.
- Remember that adults talk at 100-120 words a minute and think at 170—at that speed, it's hard for kids to stay interested.
- Children are students before they are born. They absorb information like a sponge. Their early development is in bits and pieces, but at age 8 or 9 the pieces come together.
- Be careful what you say and do around kids: often we teach children things we don't mean to.
- You will have the children for one hour. That single event could be something they remember all their lives.
- Include hands-on involvement whenever you can (feeling seaweed, grinding acorns, etc.).
- Ask questions to make children think and teach them to reason.
- Begin your program by talking about something they know. For example, compare interactions between people with interactions between animals. What do people need to survive? What do animals need to survive?
- Follow kids' energy and interest; find the teachable moment.
- Make discoveries; encourage them to look and find.
- Be enthusiastic; make nature study fun!
- Give kids recognition—it helps with problem children.

- Repetition of concepts is important; pick a few to stress. It's important to tie together what you find; bring each thing you see into the theme.
- Drama is important. When attention starts to wander, change your tone or the loudness of your voice; pull a surprise out of your pocket; act out what you're describing or grab a kid to help.
- When it comes to discipline, take it easy. Be able to laugh with and at the children and yourselves, but don't be afraid to tell children to stop doing any behavior which can harm them or the environment. You need to know that some children are trying for negative attention; help them discover something to make them look good in front of the others.

## Ten Ways to Bore the Dickens Out of Children

1. Insist that they ignore the red-tailed hawk and pay attention to your lesson on decomposition.
2. Give them scientific names for everything and have children memorize them.
3. Talk incessantly and don't give children a chance to say anything.
4. Make them write a test on every topic you cover.
5. Make children understand how hopelessly we have polluted the environment.
6. Let thirty children run wild with no direction.
7. Tell them not to run today. Keep nagging about poor behavior.
8. Allow no jokes and no laughing.
9. Ask them not to touch anything.
10. Act bored yourself. Yawn a lot.



*From Manure, Meadows, and Milkshakes. Jorgensen, Black and Hallesy. Los Altos, CA: Hidden Villa Environmental Education, 1986.*



## Including Children with Disabilities in the Junior Ranger Program <sup>4</sup>

An awareness of the needs of children with disabilities will help you plan your program to include children who have visual, mobility, hearing, or mental impairments. Focus on what these children can do rather than what they can't, and how you can adapt your program to meet their special needs.

### **Mobility Impairments**

#### Characteristics

Children with mobility challenges may require the use of wheelchairs, crutches, or canes; they may walk with difficulty, lack coordination, or may not have full use of their arms or hands. Children in wheelchairs will be concerned about steps, slippery surfaces, maneuvering through narrow spaces, going up and down steep paths, and moving over rough surfaces. Children who have difficulty walking may walk with aids such as crutches, canes, walkers, braces, or artificial limbs. Reduced agility, speed of movement, difficulty in balance, reduced endurance, or a combination of these may contribute to impaired mobility. These children will be concerned about steps or steep slopes, uneven walking surfaces, slippery surfaces, walks filled with debris, areas that collect standing water, sand, etc. Having to stand or walk for extended periods of time also presents a problem for many of these children.

#### Guidelines

The program should be held in a physically accessible location. There should be an accessible path of travel from camping or parking areas to program areas. Interpreters should be aware of pace in a conducted walk which includes wheelchair-using children. The interpreter should physically locate himself/herself next to the disabled child (or children) in the group to assure visual/auditory access to the interpretive message. Park staff should be familiar with how to provide safe assistance if needed to children who may be using wheelchairs.

#### Tips

- Review your program site and tour route. Make modifications in your walk to accommodate children who are unable to climb stairs or walk long distances, or who may need wider doors to allow for wheelchair passage, etc.
- Rough terrain may aggravate painful conditions, especially for some wheelchair-users. Rough terrain may also present tripping hazards to some children who use braces and artificial limbs. Review your site and trail with this in mind, then adjust your approach, the distance that you expect to travel, and your speed of travel.

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<sup>4</sup> Adapted from *All Visitors Welcome: Accessibility in State Park Interpretive Programs and Facilities*. California State Parks, Interpretation and Education Division, 2003.

- Allow your disabled children, who are aware of their own abilities, capabilities, and possible limitations, to make their own decisions about what they can or cannot do.
- Don't rule out games and activities without looking at all the possible approaches and alternatives.
- When offering assistance, ask the child exactly how you can help. Don't insist if your offer is declined—sometimes it isn't really necessary.
- Don't lean or automatically hold on to a child's wheelchair. It is part of the person's body and should be treated as such.
- Don't be sensitive about using words like “walking” or “running” with kids using wheelchairs. They use the same words.

## **Visual Impairments**

### Characteristics

There are many kinds of visual impairments, each with a wide range of ability, disability and limitation. A child described as legally blind may be able to read large print and ambulate without mobility aids in many or all situations, while another child might not have these skills. Children who were once able to see but have lost their sight may retain visual memory (concept of space, color, etc.), whereas those who have been blind from birth may have a different frame of reference for these same elements. Because of all the possible variations, it is difficult to generalize visual impairment into one problem with one solution.

### Tips

- Plan activities that include several senses (i.e., touch, taste, sound, smell).
- Review the route of an interpretive trail and plan to describe points of interest with descriptive adjectives.
- If you are demonstrating a skill, allow the visually impaired child to hold your hands as you work. Explain clearly and in concrete terms what you are doing as you do it.
- If you distribute printed materials, describe what is on the materials for those who are unable to read it at the time you distribute it.
- Give clear verbal directions when moving from one area to another. “We are going to turn right and go down a flight of ten stairs to the living room area” is more helpful than “follow me to the living room area.”
- When approaching visually impaired children, introduce yourself and identify yourself as a California State Parks employee.
- It is appropriate to lightly touch the arm of a person who is blind after you speak so that person knows you are addressing him/her.
- Offer assistance if it seems necessary, but don't insist if your offer is declined. If your offer is accepted, ask the child to explain how you should help.
- Look at and speak directly to the blind or visually impaired child, not through a third person. Don't shout—use a normal tone and speed of voice.
- Don't avoid using the words “look,” “see,” or “blind.” Visually impaired kids use the same words.

- When guiding a child who is blind, offer your arm. Grabbing a blind child's arm to lead him/her is dangerous as well as frightening and even insulting. The blind child will walk about a half step behind you, following your motions. Be sure to identify steps, curbs, or obstacles which may be encountered.

## **Hearing Impairments**

### Characteristics

Hearing impairments range from mild hearing loss, which may be compensated by some kind of amplification, to total hearing loss.

### Tips

- Face the light or sun as you are speaking. Light from the side or from behind you will cast shadows on your face, making speech reading difficult.
- Stand where everyone can see you and provide a clear view of your entire face and upper body. This is particularly helpful to hearing-impaired children who rely on body gestures and facial expressions as an aid to understanding what is being spoken. Keep your hands and visual aids that you may be holding away from your mouth as you speak.
- If at all possible, have a sign language interpreter available for programs. Remember that the sign language interpreter will be a few words behind, so speak accordingly.
- Speak expressively. Hearing-impaired children may rely on facial expressions, gestures, and body movements to understand you. However, be careful not to exaggerate or over-pronounce words, which will distort lip movements.
- Repeat questions or statements made by other people in the group. Remember that deaf persons are cut off from whatever happens outside their visual area.
- Get a deaf child's attention before speaking to him or her by a light tap on the shoulder, a wave, or other visual signal.
- Maintain eye contact when speaking with a deaf person. Even a slight turn of the head may make speech reading difficult.
- If a deaf visitor is accompanied by an interpreter, speak directly to the deaf person.



## **Developmentally Disabled/Learning Impairments**

There are three general categories of mental disabilities: Developmentally Disabled, Learning Disability, and Emotional Disturbance. While common behavioral characteristics may sometimes be found among members of these groups, each disability is marked by distinctive features and should be considered separate from the others.

Some of the most severe barriers a person with a mental, learning, or emotional disability faces are attitudinal barriers. They are commonly least understood by the general public. This often results in apprehension and avoidance of persons with this type of disability. Consequently, the mentally, learning, or emotionally disabled person will frequently keep his often “invisible” disability to himself.

### Developmentally Disabled Characteristics

In children described as developmentally disabled, learning develops more slowly than normal. Reasoning and judgment capabilities may also develop at a slower pace. For most children with mental retardation, it is not that the ability to learn is missing, but the speed and ease at which things are learned is slower. Developmentally disabled people are often over-protected and discouraged from exploring the world or interacting with others. Often they are limited to participating in programs that are designed “especially for their needs.”

### Tips

- Allow participants to set their own pace. Most children with a development disability learn just like everyone else but usually at a slower pace.
- Use as much demonstration as possible with your verbal explanations. Repeat directions or information as often as necessary. Reinforce your information with tactile experiences and media aids. Don't rely solely on verbal methods.
- When talking, keep your concepts clear and concise using concrete rather than abstract examples. Try to repeat concepts using different words and phrase them in different ways to facilitate understanding.
- Be sensitive to interest or lack of interest in your program and be flexible enough to change or modify your program accordingly.
- Be aware that some children with a development disability may be taking medication which may make them sensitive to long exposure to the sun. Plan your program so shade or shelter is available.
- Be aware that some children with a development disability may have problems with coordination, balance, agility, strength, or stamina.
- Don't “talk down” to the developmentally disabled child, but keep your talk on an understandable level.
- Program content for developmentally disabled children should be at a level which will facilitate comprehension. Interpretive information should be delivered concisely in short segments, encourage participation, and be reinforced through repetition.

### Learning Disability Characteristics

Researchers estimate that 2.9 million school age children have learning disabilities.<sup>5</sup> The 1968 National Advisory Committee on Handicapped Children stated that “Children with special learning disabilities exhibit a disorder in one or more of the basic psychological processes involved in understanding or in using spoken or written language. These may be manifested in disorders of listening, thinking, talking, reading, writing, spelling, or arithmetic.” A learning disability can take many forms, but unlike mental retardation it is generally confined to one aspect of learning. Because there are no reliable clues to indicate a person may be learning disabled, any programmatic adjustment for this group will be largely dependent on sensitive and alert interpreters who can adjust presentations to meet individual needs.

### Tips

- Review your programs. As much as possible, provide demonstrations as well as verbal interpretation. Use media aids to reinforce your information.
- Don't interpret a lack of response from a learning-disabled child to be rudeness. In some cases a learning-disabled child may have a processing problem which might affect social skills which in turn may produce unconventional responses.
- You may find that some learning-disabled children may seem to be standing too close to you or staring at you as you talk. This action is not uncommon for some learning-disabled children as they attempt to block out competing noise or activity and concentrate on what you are saying.
- Difficulties in coordination are a major problem for many children with learning disabilities. Therefore, fine motor tasks such as picking up a pebble or handling a moving insect may be difficult. Balance may also be a problem and interpreters should exercise care in moving a group through an area requiring balance.

### Emotional Disturbance Characteristics

Like other mental disabilities, emotional disturbance defies easy and specific definition. It may be said that, in general, emotionally disturbed children may display an inability to concentrate, an inability to build or maintain satisfactory interpersonal relationships, inappropriate behavior or feelings under normal conditions and, frequently, a general, pervasive mood of unhappiness.

### Tips

- Accept participants as people and don't expect violent or unpleasant behavior.
- Be supportive and friendly. Remember that children with emotional impairments may be very sensitive to stress and new environments.
- Be enthusiastic about your program, while maintaining a position of authority and respect.
- Children with emotional impairments may become frustrated easily. Activities that ensure success for each participant are important.
- Choose program activities that promote cooperation between individuals to achieve common goals.

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<sup>5</sup> Statistic from National Center for Learning Disabilities. [www.nclld.org](http://www.nclld.org).

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- Encourage group members to actively participate, but do not pressure them. Choose activities that allow opportunities for spectators as well as active participation.
- Allow participants to choose the activities that they would like to do. Don't let your expectations and fears limit the opportunities you provide.
- Some participants may be taking medication which may affect their responses. They may appear to be uninterested or unable to understand your program. Relax and work with them at their own pace.

### General Tips for Interpreting to Children with Mental Disabilities

- Flexibility is essential. You may need to change or modify elements of the program on the spot for a variety of reasons.
- Program content for learning-disabled or emotionally disturbed children does not have to be at a lower comprehension level. Focus should be instead on the best method of communication to enhance comprehension for a particular individual.
- Demonstrate specific concepts rather than verbalize.
- Engage as many senses as possible in order to involve participants actively.
- Use as many touchable items as possible. Keep information concrete rather than abstract (use materials that are visible as a point of reference).
- Use repetition to reinforce important points.
- Repeat concepts using different words and rephrase the interpretive message in different ways.
- By asking the participants to rephrase concepts, the interpreter can assess the group's comprehension level and can change his/her approach if necessary.

## Needs of Special Audiences

<b>Audience</b>	<b>Characteristics</b>	<b>Special Needs</b>	<b>Interpretive Requirements</b>
<b>Visually Impaired</b>	The may range from those whose vision has been corrected by glasses to those who “see” by hearing and touch.	Address these children directly, not through another person. Provide descriptions of objects, scenes, etc. Ask what help they want if you are uncertain.	Involve these children via handling of objects.
<b>Hearing Impaired</b>	Almost 4% of our population suffers from hearing impairment. Although many of these are older people, many children have partial to total hearing impairment.	These children need to see the face of the interpreter. They need to see objects and be given visual outlines.	Include these children by keeping your hands away from your mouth when speaking. Face the visitor. Repeat important points and questions. Speak slowly.
<b>Mobility Impaired</b>	Those who must use a wheelchair, crutches, leg braces, or walkers and canes in moving.	To be allowed equal access.	Limit walks to areas that are accessible. Avoid steep slopes and rough terrain.

*Adapted from The Interpreter's Guidebook by Kathleen Regnier, Michael Gross, and Ron Zimmerman. Stevens Point, WI: UW-SP Foundation Press, 1992.*

## Interpreting to Minorities and Non-English Speakers

The United States as a whole is composed of many different ethnic groups. All of these groups desire and deserve to have their voices heard through and within park sites. Audiences bring various meanings to the resource and often feel strongly about the story. Their values, traditions, and experiences all shape how they view and relate to the site. To facilitate a connection between the visitor and the resource an interpreter must be knowledgeable about the site, the different cultural and ethnic groups represented there, and their values and traditions. Incorporation of this information into programs, or the involvement of an ethnic group in the interpretation of their own culture, will not only lead to a richer interpretation of the site, but also will attract and reach a wider audience.

Changing population and visitor demographics present additional challenges to interpreters as an increasing number of park visitors are limited or non-English speakers. Even if no language interpreter is available, non-English speakers can still be included in the Junior Ranger program. You will be amazed by how much non-English speakers can learn from an English-speaking interpreter. Through the use of visual aids, hand gestures, and hands-on activities, you can convey quite a bit of information. Logbooks and Adventure Guides in Spanish are also now available.

### Tips

- Demonstrate specific concepts rather than verbalizing them. Keep information concrete rather than abstract (use materials that are visible as a point of reference).
- Involve as many senses as possible in order to involve participants actively.
- Use standard English and avoid using slang.
- Try to interpret through your body language as well as your voice.
- Use pantomime. It is fun and often engages the group to try it themselves.
- Build a library of foreign words or phrases that pertain to your topic. Keep them on notecards and refer to them when appropriate.
- Use as many touchable items as possible.
- Use clear visual aids (photographs, drawings, charts, maps, etc.) as much as possible to illustrate your points.

## Junior Ranger Cub Program

Some parks have developed Junior Ranger Cub programs geared to children under the age of 7. During the presentation of the park's Junior Ranger programs, it was found that younger children were attending with their older siblings. This appeared to be a problem for several reasons:

- The younger children did not have the attention span for the prepared program and were becoming disruptive.



## *Junior Ranger Program Handbook: Working with Children*

- The older siblings could not focus on the program because they were attempting to contain their younger siblings.
- Younger children were not physically able to participate in hikes with the older children, resulting in very short hikes or canceling the day's program.
- Parents who brought the younger child usually either participated in the program for the child, or overshadowed their older child, who felt it was no longer "his/her" program.

To try to resolve some of these issues, a program called the Junior Ranger "Cubs" was created just for the younger children and their parents. Several guidelines were developed to try to ensure the program's success.

- The program would be for children 4 to 6 years old.
- Parents or older teens would accompany the children, not older children.
- The program would be approximately 20 minutes long, changing focus every 7 minutes or so.
- The program would be very visual and hands-on.
- Teaching goals would be simple.
- Learning goals would be focused on the local park experience.

So, what can you teach small children in 20 minutes about the park and their role in exploring, protecting, and appreciating it? Keep the program simple. Here are some examples that Gail Berry developed for the San Simeon Junior Ranger Cub Program:

### Example 1

1. Teach a simple song about nature with hand gestures. I have taught the "Bats eat Bugs" song (Appendix B: Directed Activities Handouts) and made up my own gestures.
2. We then go on a very short walk around the maintenance shop and campfire center to look for places where bats may be sleeping. You may not see any bats, but it gives the children a visual sense of where the bats are during the day. I then encourage them to bring their parents to the campfire center in the evening and watch the bats. (I know the bats are out every summer evening around the campfire center).
3. We then go back to the campfire center and I have pictures of bats to color and take home (I provide the crayons), as well as stuffed bats to play with. While the kids are coloring and playing with the stuffed bats, I ask if anyone can remember one new thing they learned about bats, or if they have any questions.

### Example 2

1. Another program I do is wild animals. I bring animal mounts and skins that the kids can touch. Each animal is introduced and we talk about size and color. I bring out the stuffed animals with similar coloring as well as brightly colored stuffed animals. We talk about real and pretend.
2. Next I hide the stuffed animals—bright colored and life-like—in the bushes and trees around the campfire center. The kids are not watching. We

then look around and try to find the animals. The kids collect the animals and bring them back. We talk about camouflage and why animals would want to blend in to their surroundings.

3. We then have animal coloring sheets. The kids can decide to color the animals in real-life color, or in bright colors. While they are coloring, we talk about safety, pets versus wild animals, and feeding wild animals.

Again, keep it simple and change focus and activity every 6 or 7 minutes.

There are some programs where I can combine “Cubs” and regular Junior Rangers. When I do a scavenger hike, the kids are given lists and we walk through the park trying to locate things like a blue tent, a pine tree, a piece of trash. These are marked off the list as we see them. This is an easy program for the cubs and parents because we are moving and continually changing focus. The older kids like the game of finding things and it really gets them into observing what is going on in the park.

Other thoughts: I usually schedule the “Cubs” the 20 minutes before the regular Junior Ranger program. Then they are “done” when the older children arrive. Always have something for the kids to take home with them, whether it is a scavenger hunt list, a plastic cup and screen bug jar, or a coloring sheet. This way they can share their experience with other family members.

## **Suggested Resources: Working with Children**

Alderson, William T. and Shirley P. Low. *Interpretation of Historic Sites*. Nashville: American Association for State and Local History, 1976. The authors travelled around the U.S. and Canada, and present in this book the best of the interpretation they saw.

Beck, Larry and Ted Cable. *Interpretation for the 21st Century*. Champaign, IL: Sagamore Publishing, 1998. The authors update and build upon the interpretive philosophies of Freeman Tilden and Enos Mills, and present fundamental principles in a modern context.

Cornell, Joseph. *Sharing Nature with Children*. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998. Written by a leading environmental educator, *Sharing Nature with Children* shares some of the environmental games Joseph Cornell uses in his children's interpretive programs.

Cornell, Joseph. *Sharing the Joy of Nature*. Ananda Publications, 1989. A complement to *Sharing Nature with Children* with additional environmental games to use in children's interpretive programs.

*Junior Ranger Program Handbook: Working with Children*

Grater, Russell K. *The Interpreter's Handbook: Methods, Skills, and Techniques*. Southwest Parks and Monuments Association, 1976. A veteran interpreter shares interpretive techniques that have proved themselves through the years.

Grinder, Alison L. and E. Sue McCoy. *The Good Guide: A Sourcebook for Interpreters, Docents and Tour Guides*. Scottsdale, AZ: Ironwood Press, 1985. Good information on interpretation, particularly the section "How People Learn." Discusses stages of learning development, and is a good reference for finding out what methods of presentation are most effective for interpreting to children at various stages of development.

Gross, Phyllis. *Teaching Science in an Outdoor Environment*. Berkeley: University of California Press, 1972.

Ham, Sam H. *Environmental Interpretation: A Practical Guide for People with Big Ideas and Small Budgets*. Golden, CO: North American Press, 1992. A "how-to" book focusing on different aspects of interpretation. "Being able to communicate well with limited resources" is the author's primary concern.

*Interpretation for Disabled Visitors in the National Park System*. National Park Service, Special Programs and Populations Branch, 1986. A detailed, informative reference. Although some of the chapters have been incorporated into this handbook, the book provides more information and diagrams, and is recommended.

Jorgensen, Eric, Trout Black, and Mary Hallesy. *Manure, Meadows, and Milkshakes: Hidden Villa Environmental Education*. Ed. Dr. Elizabeth Hone and Eric Jorgensen. 2nd. Ed. Los Altos, CA: The Trust for Hidden Villa, 1986. Fun ideas for environmental education. Includes lots of activities and games.

Knudson, Douglas, Ted Cable, and Larry Beck. *Interpretation of Cultural and Natural Resources*. State College, PA: Venture Publishing, Inc., 1995. An excellent general reference on interpretation.

Krumbein, William J. and Linda Levya. *The Interpreters' Guide*. Sacramento: Department of Parks and Recreation, 1977. This booklet addresses general interpretive techniques for campfire programs, leading hikes and tours, interpreting to children, and interpreting to the disabled. Although this guide is out of print, it is available in most park libraries.

Lewis, William J. *Interpreting for Park Visitors*. Eastern Acorn Press, 1980. This book was written by a career-seasonal employee of the National Park Service who was also a Professor of Communication at the University of Vermont. He combines an academic knowledge of the theories of communication, many years of personally communicating with park visitors, and a wide experience helping other interpreters communicate more effectively.

*Junior Ranger Program Handbook: Working with Children*

Louv, Richard. *Last Child in the Woods*. Chapel Hill, NC: Algonquin Books, 2005. An excellent book that addresses why it is important to reach today's children who have little or no contact with nature.

McDonald, Linda L. *Aiming for Excellence: an Evaluation Handbook for Interpretive Services in California State Parks*. Illustrated by James A. Maddox. Sacramento: California State Parks, Interpretation and Education, 2000. This handbook presents measures and measurement tools to help assess the quality of the department's interpretive offerings. It also contains helpful guidelines for evaluation planning, an explanation of data-gathering principles, official policy information, resource lists, and sample evaluation forms.

Porter, Erika R. *All Visitors Welcome: Accessibility in State Park Interpretive Programs and Facilities*. 3<sup>rd</sup> ed. Sacramento: Department of Parks and Recreation, 2003. This handbook has three purposes: to inform park staff about access requirements, to explain common disabilities, and to provide guidelines for making interpretive services more accessible to everyone.

Regnier, Kathleen, Michael Gross, and Ron Zimmerman. *The Interpreter's Guidebook: Techniques for Programs and Presentations*. Stevens Point, WI: UW-SP Foundation Press, 1992. An excellent, easy to read interpreter's guide. Filled with pictures and useful ideas for all kinds of interpretation.

Sharpe, Grant W. *Interpreting the Environment*. New York: John Wiley & Sons, Inc., 1976. Over twenty nationally recognized experts contributed to this fine book.

Tilden, Freeman. *Interpreting Our Heritage*. 3rd Edition. Chapel Hill: University of North Carolina Press, 1977. A classic, written by the pioneer of interpretive philosophy and the recognized father of modern park interpretation. Although it was first published in 1957, this book is still relevant today, since it is not about the methodology of interpretation, but rather the guiding principles and underlying philosophy of the interpreter's art and craft.

Van Matre, Steve. *Earth Education: A New Beginning*. Warrenville, IL: The Institute for Earth Education, 1990. This book proposes a new direction for environmental education called the "earth education path," which aims to accomplish what environmental education set out to do, but didn't: to help people improve upon their cognitive and affective relationship with the earth's natural communities and life support systems, and begin crafting lifestyles that will lessen their impact upon those places and processes on behalf of all the planet's inhabitants.

Ward, Carolyn J. and Alan E. Wilkinson. *Basic Interpretation Learning System: Making Connections: the Essence of Interpretation*. Sacramento: Department of Parks and Recreation, 2003. An important resource for all state park interpreters.

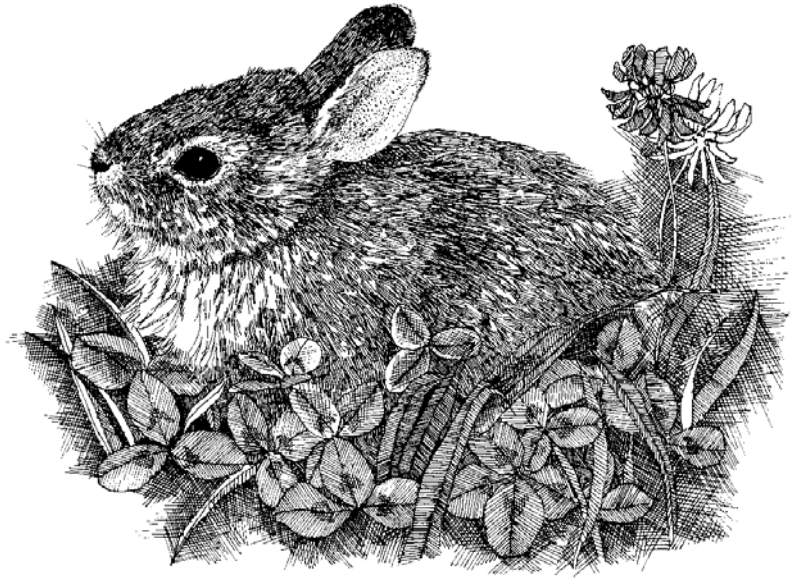
## **Other Sources of Information**

North American Association of Environmental Education. [www.naaee.org](http://www.naaee.org).

**INSERT *ANIMAL LIFE* TAB HERE**



# Animal Life



*“The wild things of this earth are not ours to do with as we please. They have been given to us in trust, and we must account for them to the generations which will come after us and audit our accounts.”*

*—William T. Hornaday*

## Introduction

Kids are naturally fascinated by animals, and California's state parks provide an opportunity for kids to see animals in their natural habitats. In this section, we've included a general sample program which can be adapted to the specifics of your park. We've also added an example of how you can make a program specific with an Animal Life program developed by Stacey French for Turlock Lake S.R.A. Both programs encourage the Junior Rangers to see distinctions between the different types of animals, to discover what animals do to survive, and to find out what different animal characteristics reveal about that animal.

A program on animals can be broad or very specific. An interpreter could give a general program on animals or one on owls, insects, predators, etc. Know the animals in your unit and use them to make your program relevant to your park. If they are available, mounts and furs are very useful hands-on tools in this program.

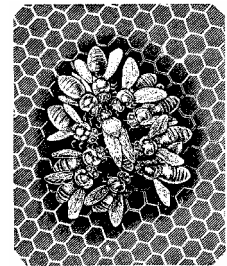
The Animal Life program encourages the Junior Ranger to develop an awareness of people's impact on wildlife (endangered species, extinction, shrinking habitats, loss of



migratory corridors, deforestation, interference in predator/prey relationships) and to discover that people are animals, too!

## Interesting Animal Facts

- 80,000 bees must fly the equivalent of three times around the world to gather enough nectar to fill just one bottle of honey.
- One beaver can cut down 216 trees a year.
- Flies walk on their food because they have tiny taste buds in their feet.
- Caterpillars have 4,000 muscles in their bodies. Humans have only 639.
- A dragonfly can fly 46.5 miles an hour.
- A newborn blue whale drinks the equivalent of 200 gallons of milk a day.
- A sea star turns its stomach inside out in order to eat its prey.
- The whirligig beetle has four eyes: it uses two to search above the water for enemies and two to scan below for food!



## California's State Animals



What is the State Animal?

Grizzly bear (the grizzly bear has been extinct in California since 1922)

What is the State Reptile?

Desert tortoise

What is the State Fish?

California golden trout

What is the State Bird?

California valley quail

What is the State Insect?

California dog-faced butterfly

What is the State Marine Mammal?

California gray whale

## Sample Program: Animal Life

### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

### II. Focus

Have the group be still and quiet for a moment, and try to hear and see signs of animal life. After a few moments ask, “Do you hear birds singing? See insects? Some animals may be easy to see without trying very hard, while you might not notice others unless you pay very close attention and look and listen very carefully.” Observe for a few more minutes.

### III. Objectives

Animal life is all around us. There are so many kinds of animals, all with different looks, adaptations, habits and lifestyles. In this program, we will find out about what animals do to survive and how they sometimes change over time so they can survive. We will also find out what we can do to protect animals.

### IV. Inquiry/Discussion

#### A. Classification

1. What makes animals different from plants?  
Animals can move, plants can't.  
Animals find food, plants make their own.  
Animals have a nervous system; plants don't have one.
2. We put animals that are similar into groups. Do you know the names of any of these groups?  
Mammals, reptiles, fish, amphibians, birds, insects, etc.  
Name some different kinds of animals in each group.
3. What do these animals have in common?  
Encourage the Junior Rangers to compare and contrast different animals in each group. For example:  
“A bear and a mouse are both mammals—what do they have in common?”  
“Is a fish a mammal? Why not?”  
“How do you know a bird is a bird? Because it flies? Then is a bee a bird?”
4. Activity: Animal Charades (see activity section below)

#### B. Animal Characteristics

1. Most of the differences between animals are there for a reason—they help the animal stay alive in its environment. In fact, animals may change and adapt to the environment over generations, helping them to more easily survive. How do the different kinds of animals breathe?  
Humans: Nose, lungs (good for breathing air)  
Fish: Gills (good for getting air from water for breathing)  
Frogs: Skin (good for living in and out of the water)

## *Junior Ranger Program Handbook: Animal Life*

Whales: Blow holes, lungs (good for living in the water but breathing air, whales hold their breath underwater)

2. What do animals eat?  
Plants, other animals
3. Can you tell by looking at an animal whether it eats plants or other animals?

Carnivores are “full-time” predators. They are meat eaters and have sharp, tearing teeth and claws (use examples from your park).  
Herbivores are plant eaters. They have flat, grinding teeth and often have hooves.

Omnivores are “part-time” predators. They eat plants and animals. They have both tearing and grinding teeth.

4. What kind of teeth do you have?  
Do your teeth make you a carnivore, herbivore, or omnivore?

### C. Survival

1. Who has a better sense of smell, you or a deer?

The deer—Animals' senses are often very different from ours. Some of their senses may be much sharper and stronger than ours are, while other senses may not be as strong as ours (discuss senses of animals in your unit). Animals' senses have evolved so that the senses the animals need get stronger, and the ones they don't need get weaker. (Such adaptations take place over a long period of time, over many generations, not during the lifetime of an individual animal.) Have you ever heard the expression, “he's blind as a bat?” Well, bats don't see that well. Since they live in dark places like caves and are awake during the night, they really don't have much use for vision like ours. But don't feel sorry for them: they have a skill we don't have. A bat can send out an ultrasonic (sound waves at a higher frequency than humans can hear) pulse to see what's in its path. If there's a moth in the bat's path, this pulse will bounce off the moth and echo back to the bat. So by following this pulse, the bat can still find food even though it can't see very well.



2. How can you tell who has a better sense of smell, sight, hearing, etc.?  
Example: A long nose/snout shows an animal adapted to depend on the sense of smell.
3. What are your human adaptations? What are they for?
4. Activity: Bat and Moth Game (see activity section below)  
Many animals have a defense against their predators (the animals who want to eat them). How do you think animals protect themselves from predators?

Running away using speed; fighting back with teeth, claws, horns, antlers, and stingers; repelling with bitter taste and odor; safety in numbers by herding; coming out only at night and hiding with protective coloration;

## *Junior Ranger Program Handbook: Animal Life*

and sensing the predator first using acute senses of sight, smell, and hearing

5. Activity: Silent Stalking (see activity section below)  
How do animals protect themselves from the weather?  
Fat, fur, shelter, hibernation/estivation (summer dormancy—common in desert areas), feathers, migration  
Are there animals we can do without?  
Discuss the necessity of predator and prey, scavengers, etc.
6. Activity: Support to Survive (see activity section below)  
How do we know where animals have been?  
Animal tracks, fur, feathers, nests, burrows, eggs, teeth, bones, antlers, spider webs, scat (also shows what the animal has been eating)

### V. Guided Discovery

Begin a nature walk, and look for the signs of animals. Discuss the importance of making a minimal impact on animals' habitats. Ask children what happens when people make changes in the wild. Discuss extinction (extinction is forever) and endangered species (there is still time to prevent extinction). What is being done? What still can be done? Are there any endangered species in your park? Explain the relationship between preserving wildlife and the Junior Ranger pledge not to feed animals or disrupt the park environment.

### VI. Conclusion

- A. Discuss park stewardship, emphasizing that the park is the animals' home and we are visitors. What is the park doing to protect animals? Do you think we should do more?
- B. Stamp logbooks.
- C. Announce other interpretive programs going on in your unit and the next Junior Ranger program.

## **Sample Program: Animal Life at Turlock Lake S.R.A.**

This sample program was developed by Stacey French when she was leading Junior Ranger programs at Turlock Lake S.R.A. With her enthusiasm and ability to “think like a kid,” Stacey had a talent for interpreting to children. Stacey's program outline is included as an example of how you might tailor one of the general sample programs in this handbook to the specifics of your park. Notice how Stacey uses posters, pelts, antlers, and games to make the program fun and keep the kids' interest on the subject.

### I. What is an animal?

- A. Discuss characteristics of animals  
Backbones, fur, method of movement, type of food it eats (carnivore, herbivore, and omnivore)

II. Are humans animals?

- A. Yes, humans are characterized as animals, because we differ from plants.
  - 1. Food: Animals feed on other plants or animals; plants make their own food.
  - 2. The way we move: Animals can move freely; plants are stuck in one place.
  - 3. Nervous system: Animals have one and can react because of it; plants lack it. Plants communicate messages (shock, exposure, growth instructions, etc.) internally with chemicals (auxins) rather than by nerve impulses.
  - 4. Growth: In animals, growth occurs everywhere. In some plants, it occurs only at the roots and branches. If you were a plant, you'd probably have a neck four feet long! Example: A scar, nail, or branch on a tree trunk doesn't move upward as the tree gets older. Woody plants do add girth (growth rings) as they grow older.

III. What animals are found at Turlock Lake SRA?

- A. Show pelts.
  - 1. Mammals: Deer, opossum, cottontail and jack rabbit, striped skunk, kit fox, coyote, ground squirrel
  - 2. Snakes: King snake, gopher snake
  - 3. Birds: Red-tailed hawk, quail, magpie, woodpecker, jay, swallow, heron, egret, crane, great horned owl
  - 4. Fish: Bass, bluegill, trout, catfish



IV. How do we know animals are here?

- A. Show antlers.  
Animal tracks, feathers, nests, burrows, eggs, teeth, bones, antlers, spider webs, fur

V. What can we learn from these signs?

- A. Show skull.
- B. Teeth: Sharp = carnivore; dull flat = herbivore
- C. Tracks: Shape of foot determines type of food animal eats  
Claws = carnivore; hooves = herbivore
- D. Skeleton: If it's light and hollow, this animal flies
- E. Show the difference between a "hollow" bird bone vs. a cow bone
- F. Crabs and lobster: Exoskeleton  
Show crab skeleton.

VI. How do animals protect themselves from other animals?

- A. Coloration, teeth, claws, antlers, stingers, bitter taste, speed, odor, camouflage; acute senses of smell, sight, and hearing

VII. How do animals protect themselves from the environment?

- A. Fur, feathers, and fat for warmth; shelter, migration, hibernation

B. What kind of shelter do they have?

1. Show shells and gall.

Birds: Tree nests, ground nests, cliff nests

Insects: Ant mounds, spider webs, galls

Mollusks (soft body): Snails, clams, oysters (They have a shell)

Mammals: Rodent burrows, deer beds

VIII. Activity: Squirrels and Coyotes (see activity section below)

IX. Activity for Posters

A. Each junior ranger can design a poster on one or all of the following:

What is the state . . .

Animal? Grizzly Bear (extinct in CA, on the CA flag)

Reptile? Desert tortoise (endangered)

Fish? California golden trout

Bird? California valley quail (here in this park)

Insect? California dog-faced butterfly

Marine Mammal? California gray whale

## Activities

### Animal Charades

Number of Children: 2 or more

Environment: Any

Equipment Needed: None

Purpose of Activity: To bring attention to the distinctive characteristics of different animals

Activity:

1. Each child picks out an animal, without telling anyone which one he or she has chosen.
2. One by one, each child acts out the characteristics of his or her animal.
3. The other kids try to guess which animal is being acted out.



*From Sharing Nature with Children, by Joseph Cornell. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998.*

### Bat and Moth

Number of children: 9 or more

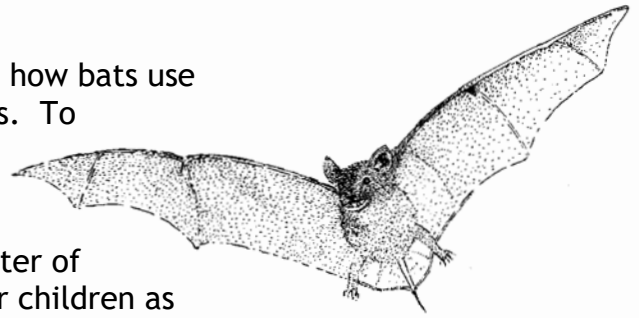
Environment: Open space

Equipment Needed: Blindfolds

Purpose of Activity: To illustrate how insect-eating bats catch prey in the dark

Activity:

1. In this game, the Junior Rangers can simulate how bats use echolocation to catch moths and other insects. To play, have the kids form a circle about 10 to 15 feet across. Choose one member of the group to play the role of a bat. Blindfold the bat, and have him or her stand in the center of the circle. Then designate three to five other children as moths and have them also come to the center. The object of the game is for the bat to try to tag as many moths as possible. Both the bat and the moths can move, but they must stay within the circle. (Once a moth is tagged, he or she should go outside the circle and sit down.)
2. Whenever the bat calls out “bat,” the moths have to respond by calling back “moth.” Tell the moths that every time they hear the bat call “bat,” it simulates the bat sending out an ultrasonic pulse to see what’s in its path. The pulse bounces off the moths and echoes back to the bat, simulated by the moths calling out “moth.”
3. The bat must listen carefully, concentrate to find out where the moths are, and try to tag them. To add more excitement, you can designate two children to be bats at the same time. Just watch to make sure the two bats don’t collide with each other. You might want to pick a short and tall child so they don’t bump heads.
4. As a variation, you can add obstacles by designating several children to play trees. When the bat calls out “bat,” the moths must call out “moth” and the trees must call out “tree.” If a bat runs into a tree as it tries to tag a moth, the bat is out.



Note: The “environment” (kids in the circle) can’t make too much noise or this won’t work.

*From Sharing Nature with Children, by Joseph Cornell. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998.*

## **Silent Stalking**

Number of children: 5 or more

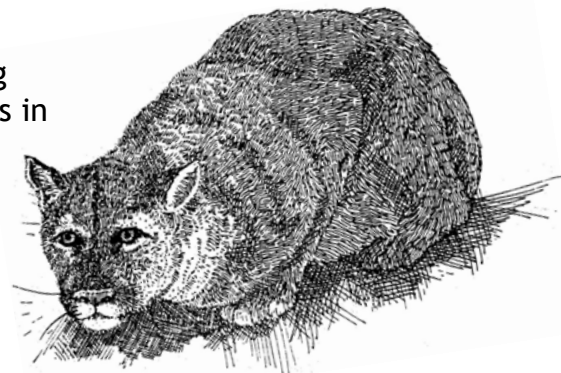
Environment: A clear area with a noisy walking surface—gravel, twigs, brush, etc.

Equipment needed: Blindfold

Purpose of Activity: To explain how a predator stalks its prey, and what it must do to keep the prey from being aware of it

Activity:

1. Choose a fairly level, open site, with a noisy walking surface. Mark off a stalking circle at least 10 meters in diameter for the group. Introduce the terms predator and prey. One member of the group is the prey; the rest are predators.
2. The prey stands in the center of the circle, and puts on the blindfold. The predators walk out to



the edge of the circle, while the prey spins around in place. After spinning 4 times, the prey yells “stop,” and all the predators freeze. The predators stalk the prey by trying to tag him before he hears them. Each predator must pause between steps to see if the prey has heard him. If the prey hears a predator, he points at him. The leader should determine if the prey is pointing at a predator in case of close calls. If a predator is caught, he is out of the game. The game ends when all predators are out, all predators have tagged the prey, or the prey has used up all the available detection attempts (two for each predator).



*From Outdoor Biology Instructional Strategies (OBIS). Lawrence Hall of Science, University of California, Berkeley. 94720. Sets I, II, III.*

### **Squirrels and Coyotes**

Number of children: 5 or more

Environment: Open space

Equipment needed: 4 “bases”

Purpose of Activity: To illustrate the importance of maintaining natural predator/prey relationships

1. Two kids are coyotes and the rest are squirrels. Set out 4 “bases” or dens. Play a game of tag, in which the coyotes chase the squirrels. The last squirrel gets a poster!
2. After the game, explain that if humans kill off the coyote, the squirrel population will grow huge and eventually die off from starvation and exposure. Tell how state parks are here to preserve land and protect animals from human interference with natural predator/prey relationships.

*From Stacey French’s animal life Junior Ranger program at Turlock Lake S.R.A..*

### **Support to Survive**

Number of children: 12 or more

Environment: Any

Equipment Needed: None

Purpose of activity: To demonstrate how survival depends on support, not just individual effort

Activity:

1. Think of the different ways animals physically support each other (kangaroo babies in pouches; monkey, opossum, and scorpion mothers carrying their babies on their backs; dolphins pushing their newborn to the surface for their first breath; ambulance crews carrying injured people in stretchers).
2. Here is a new way we can support each other and relax at the same time. Form a close circle standing shoulder to shoulder. Turn 90 degrees to the right. At the same time, everyone should sit down on the knees of the person behind them. Now, try waving your hands and walking forward in a circle.
3. Pull one person out and the circle collapses!



*From The New Games Book. Andrew Fluegelman, ed. New Games Foundation, The Headlands Press, 1976.*

## **Animal Tracks**

Number of children: 1 or more

Environment: Any

Equipment Needed: None

Purpose of activity: To identify animal tracks

Activity:

1. Have the Junior Rangers complete the Animal Tracks worksheet (Appendix B).
2. Discuss the worksheet together and then go for a walk through the park to see if they can find any similar tracks on the ground.

## **Background Information: Animal Life**

### **Predator / Prey Relationships**

Predators are animals that catch and eat other animals. Sometimes we think of predators as being incredibly strong, fast, fierce animals with super-keen senses, and we think of the prey as being the predators' helpless victims. But life isn't as easy for predators as it may appear. Many predators have to spend a long time learning how to hunt. Even after many tiring chases, a predator may still not be able to catch its swift prey. A tempting meal may stab or sting or bite the predator in self-defense, or it may outrun, out-fly, or out-swim its predator. Sometimes a predator has a hard time finding its prey because the prey uses camouflage to hide in the surroundings. Not to mention that predators may themselves be prey for another predator!

Some animals—such as hawks, snakes, alligators, frogs, and spiders—are full-time predators (carnivores). They get all their food from killing and eating other animals. Part-time predators (omnivores)—such as coyotes, skunks, raccoons, and catfish—eat both animals and plants.

Predators have different ways to hunt their prey. Some animals—such as frogs and egrets—stand absolutely still, and then snatch or pounce on their prey when it comes close enough. Coyotes and wolves, on the other hand, catch their prey by running it down. Mountain lions and bobcats try to sneak up on their prey, hiding behind rocks and trees. Then they make a quick dash and try to grab their prey.

Predation in natural communities is a step in the transfer of energy (the food web). The relationship between predator and prey is kept in balance by nature, so that neither the predator nor the prey overpopulates an area. If, for example, a predator population began to increase, these predators would consume a progressively larger

number of prey, until the prey populations begin to decline. As the prey diminishes, the predators are faced with less and less food. When there is not enough food to keep all the predators alive, some of them die or simply do not produce as many young. In time, starvation and reproduction will balance the number of predators with the number of prey. When the number of prey increases, the number of predators soon follows. This cycle, or oscillation, may continue indefinitely. The prey is never completely destroyed by the predators; the predators never completely die off.

Natural predator/prey systems keep each other “in check” by not allowing either to overpopulate. However, people sometimes ruin this equilibrium in any number of ways (hunting, construction that destroys habitats, etc.), throwing the natural system off balance.

## **Endangered Species**

An endangered species is a kind of animal or plant that is in danger of becoming extinct if nothing is done to protect it.<sup>1</sup>

Over millions and millions of years, ever since life began on earth, species have been forming and evolving, and then dying out naturally, so extinction is nothing new. However, in recent history species have been going extinct much more quickly. As of 2004, 129 species of birds, 103 species of mammals, and 56 species of reptiles and amphibians have become extinct.<sup>2</sup> These are just the ones we know about. It is possible that thousands of unknown species of animals and plants have also been lost.

Many animals are in no danger of extinction because they get along well in a world full of people. However, as people cut down tropical rainforests, 50 to 150 species may be wiped out each day.

The term “biodiversity” means all the different plants and animals that live in the same area. Tropical rainforests and California’s redwood forests have more biodiversity than anyplace else on earth. Even small patches of rainforest contain species that are found nowhere else in the world. For every species we know about, there may be 30 more that we haven’t discovered.

Biodiversity is important because each living thing contains a unique reservoir of genetic material that has evolved over eons of time, and cannot be retrieved or duplicated if lost. Scientists have investigated only a small fraction of the world’s species to determine possible benefits to humanity.

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<sup>1</sup> Information on endangered species is from *Ranger Rick* (April 1992) and “Why Save Endangered Species,” a pamphlet published by the U.S. Department of the Interior, U.S. Fish and Wildlife Services.

<sup>2</sup> Statistics from the 2004 IUCN threatened list, [www.iucnredlist.org](http://www.iucnredlist.org).

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It was “only a fungus” that gave us penicillin, and certain other plants have yielded substances used in drugs to treat heart disease, cancer, and a variety of serious illnesses. At least a quarter of all prescriptions written annually in the United States contain chemicals discovered in plants and animals. If these organisms had been destroyed before their chemistries were known, their secrets would have died with them.

As naturalist Aldo Leopold wrote, the first rule of intelligent tinkering is to save all the parts. Besides the loss of a unique species, we have to consider that all living things are part of a complex delicately balanced network called the biosphere, which is composed of ecosystems, the study of which includes the interrelationships between plants and animals and their physical environment. The removal of a single species can set off a chain reaction affecting many others. It has been estimated, for example, that a disappearing plant can take with it up to 30 other species, including insects, higher animals, and even other plants. The species that have become extinct due to natural causes have not usually left a “hole” in the ecosystem, since other species were able to adapt. Unfortunately, humans and human activity tend to accelerate the natural order to such an extent that ecosystems may be thrown off balance.

How do people endanger animals? One way is when we introduce new species of animals that are not native to a land. These new species may out-compete the native animal species. Predators of the new species which had kept their numbers in check in their original home usually are not introduced with them. Introduction of new species can thus result in over-predation of native plants or animals in the area.

Other actions which sometimes endanger animals are human settlement and agriculture. When humans turn wild land into land used for housing and farming, the change often disrupts or destroys animals' natural habitats. In addition, habitats can be harmed by pollution.

The conservation and recovery of threatened and endangered species is a tremendous and ever-increasing challenge. Through the efforts of the United States Fish and Wildlife service, California Department of Parks and Recreation, California Department of Fish and Game, National Park System, California Native Plant Society, National Wildlife Federation, the Nature Conservancy, local citizens, and other concerned groups, many jeopardized creatures now have a better chance of survival.

Most states have programs for protecting rare animals and plants. Check the website or write to the California Department of Fish and Game to find out which species are rare in your area and what is being done to conserve them.

The best thing to do to save animal species is to keep them from becoming endangered in the first place. One way to do this is to find and save the “hot spots,” or the places which are home to the greatest numbers of species. We can also try to restore habitats that have been destroyed so that the animals can live and reproduce

there. Increasingly, parklands serve as important “reservoirs” of habitats and “corridors” for animal migration. Whatever the strategy, planning ahead is more effective than waiting until a species is nearly gone, and then spending lots of time and money trying to save it. One way we can plan ahead is to start saving and recycling our resources. If that happens, species all over the world will have a much better chance of survival.

## Suggested Resources: Animal Life

Alden, Peter, Fred Heath, Richard Keen, Amy Leventer, and Wendy B. Zomlefer. *National Audubon Society Field Guide to California*. New York: Alfred A. Knopf, Inc., 1998. A compact, yet detailed statewide natural history field guide.

Armstrong, Pam, Judith Connor, Chris Parsons, Judy Rand, and Jenny Vuturo-Brady. *Sea Searcher's Handbook: Activities from the Monterey Bay Aquarium*. Monterey, CA: Monterey Bay Aquarium, in cooperation with Roberts Rinehart Publishers, 1996.

Audubon Field Guide Series. New York: Alfred Knopf, 1977. This series includes all photographs for identification of numerous topics: birds, mammals, reptiles, etc.

Benyus, Janine M. *The Field Guide to Wildlife Habitats of the Western United States*. New York: Simon & Schuster Inc., 1989. Describes plants and animals found in various wildlife habitats throughout the western United States.

Berenbaum, May R. *Bugs in the System: Insects and Their Impact on Human Affairs*. Reading, MA: Addison-Wesley Publishing Company, Inc., 1995. A fascinating, entertaining mix of entomology and history, statistics and stories.

Brown, Tom, Jr., and Brandt Morgan. *Tom Brown's Field Guide to Nature Observation and Tracking*. New York: Berkeley Books, 1983. A philosophical and practical approach to observing things in nature.

Clark, Jeanne L. *California Wildlife Viewing Guide*. Helena, MT: Falcon Press, 1996. A guide to 200 of the state's best wildlife-viewing locations.

Cruickshank, Allan D. and Helen G. Cruickshank. *1001 Questions Answered about Birds*. New York: Dover Publications, 1976. Answers over 1000 questions common to birds' natural history, behavior, anatomy, etc.

Freedman, Russell. *Animal Architects*. New York: Holliday House, 1971.

Garth, John S., and J. W. Tilden. *California Butterflies*. California Natural History Guides: 51. Berkeley: University of California Press, 1986. With wonderful

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illustrations and identification keys, this book identifies at least 235 species of butterflies.

Gray, Mary Taylor. *Watchable Birds of California*. Missoula, MT: Mountain Press Publishing Company, 1999. This book is packed with natural history facts, folklore, and observations on some 150 California birds that are “fun and interesting to observe.”

Hansen, Kevin. *Cougar: The American Lion*. In association with the Mountain Lion Foundation. Flagstaff, AZ: Northland Publishing, 1992. General natural history of cougars.

Herald, Earl. *Fishes of North America*. New York: Doubleday, 1972.

Hill, John E. and James D. Smith. *Bats, a Natural History*. Austin, TX: University of Texas Press, 1984. General natural history of bats, including the benefits of bat conservation.

Jameson, E. W. Jr. and Hans J. Peeters. *California Mammals*. Berkeley: University of California Press, 1988. A publication identifying all mammals found in California. Includes scientific names and nomenclature.

Johnson, Myrtle E. and Henry J. Snook. *Seashore Animals at the Pacific Coast*. New York: Dover Publications, 1955. Describes natural history of seashore invertebrates and fish. A good reference for general information on seashore creatures.

Klots, Alexander B. and Elsie B. Klots. *1001 Questions Answered About Insects*. New York: Dover Publications, 1977. This publication answers over 1000 questions commonly asked about all aspects of the insect world.

Love, Milton. *Probably More Than You Want to Know About the Fishes of the Pacific Coast*. 2<sup>nd</sup> Ed. Santa Barbara, CA: Really Big Press, 1996. Here’s a valuable source—a species-by-species compendium of natural history facts and interpretive lore about our coastal fish—illustrated with black-and-white drawings and some color photos.

Martin, Laura C. *The Folklore of Birds*. Old Saybrook, CT: The Globe Pequot Press, 1993. A combination of folklore, literary references, name origins, and natural history facts about nearly 100 birds.

Martin, Laura C. *Wildlife Folklore*. Old Saybrook, CT: The Globe Pequot Press, 1994. This book examines the cultural significance of more than 80 mammals, reptiles, amphibians, and invertebrates.

McGinnis, Samuel M. *Freshwater Fishes of California*. Berkeley: University of California Press, 1984. Describes all inland fishes found in California, including location, natural history, and photographs of all fish (many in color).

## *Junior Ranger Program Handbook: Animal Life*

Moyle, Peter B. *Fish: An Enthusiast's Guide*. Berkeley: University of California Press, 1993. An introductory work on the natural history of fishes.

Moyle, Peter B. *Inland Fishes of California*. Berkeley: University of California Press, 1976. An excellent reference on the identification and natural history of California's inland fishes.

Murie, Olaus. *A Field Guide to Animal Tracks*. Boston: Houghton Mifflin 1975. A standard reference (in the Peterson series).

National Geographic Society. *Field Guide to the Birds of North America*. Washington D.C.: National Geographic Society, 1987. A common field guide in use today to identify birds in the field. Uses colored drawings, location maps, and narrative for a quick and accurate identification.

National Wildlife Federation. *Ranger Rick's NatureScope*. New York: McGraw-Hill. *Ranger Rick's NatureScope* is a popular series of publications "dedicated to inspiring in children an understanding and appreciation of the natural world, while developing the skills they will need to make responsible decisions about the environment."

"Peterson Field Guide Series." The first major field guide series, Peterson's has been updated somewhat over the years, particularly the *Field Guide to Western Birds*. All identification plates are drawn (no photographs) with narrative descriptions of each plant or animal.

Powell, Jerry A., and Charles L. Hogue. *California Insects*. California Natural History Guides: 44. Berkeley: University of California Press, 1979. Although less than ideal as an identification tool, this is still a handy, state-specific insect reference.

*Project Wild K-12 Activity Guide*. Bethesda, MD: Western Regional Environmental Education Council, Inc., 1992. [www.projectwild.org](http://www.projectwild.org).

Rezendes, Paul. *Tracking and the Art of Seeing: How to Read Animal Tracks & Sign*. Charlotte, VT: Camden House Publishing, Inc., 1992. With high-quality photographs and detailed descriptions of animal signs, this publication is a valuable identification tool.

Roa, Michael. *A Guide to the Side of the Sea: A Teacher's Guide for Field Trips to Rock Intertidal Areas*. Sacramento, CA: California State Parks, 2005.

Roth, Charles E. *The Wildlife Observer's Guidebook*. Englewood Cliffs, New Jersey: Phalarope Books, Prentice-Hall, Inc., 1982. A practical manual for wildlife watching.

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Russo, Ron, and Pam Olhausen. *Pacific Intertidal Life: a Guide to Organisms of Rocky Reefs and Tide Pools of the Pacific Coast*. Berkeley, CA: Nature Study Guild Publishers, 1981. Easy to use and compact in size, this guide to seashore life is a good choice for beginners.

Shaw, Charles E. and Sheldon Campbell. *Snakes of the American West*. New York: Knopf, 1974. This book describes the natural history, location, and identification of snakes found throughout the Western United States.

Sibley, David Allen. National Audubon Society. *The Sibley Guide to Birds*. New York: Alfred A. Knopf, Inc., 2000. An up-to-date field guide to more than 800 North American birds.

Snyderman, Marty. *California Marine Life: a Guide to Common Marine Species*. Niwot, CO: Roberts Rinehart Publishers, in cooperation with Monterey Bay Aquarium, 1998. An excellent survey text of marine habitats.

Stebbins, Robert C. *A Field Guide to Western Reptiles and Amphibians*. 2<sup>nd</sup> Ed. Boston: Houghton Mifflin Company, 1985. A more specific reference than Shaw (above).

Steinhart, Peter. *California's Wild Heritage: Threatened and Endangered Animals in the Golden State*. Sacramento, CA: California Department of Fish and Game, 1990. Catalogues threatened/endangered animals of the state and tells their ecological stories.

Stienstra, Tom. *California Wildlife: A Practical Guide*. Emeryville, CA: Foghorn Outdoors, Avalon Travel Publishing, Inc., 2000. A general reference on the natural history of more than a hundred types of California wildlife. Identifies excellent observation places throughout California.

Stokes, Donald W. *A Guide to Observing Insect Lives*. Boston: Little, Brown and Company, 1983. Diverging from the focus of most field guides, this publication investigates the life cycles and behavior of common insects.

Storer, Tracy I. and Lloyd P. Tevis, Jr. *California Grizzly*. Berkeley: University of California Press, 1955. Details the natural history and extermination of the single animal most closely identified with California (appearing on the flag, park ranger patch, etc.)

Tuttle, Merlin D. *America's Neighborhood Bats*. Austin: University of Texas Press, 1988. Well-written book on some of the world's least understood animals, providing helpful information about bat behavior and biology, a key to the identification of common North American species, range maps, a glossary, color photographs, and an extensive list of sources for additional information.

## *Junior Ranger Program Handbook: Animal Life*

Wexs, John B. *Zoo Books*. A series of publications by the San Diego Zoo educational association. Each publication deals with a specific group of animals, i.e. wild dogs, snakes, cats, sharks, etc. These books are written with children in mind and are an excellent reference for animal natural history.

Zimmer, Kevin J. *The Western Birdwatcher*. Englewood Cliffs, NJ: Prentice-Hall, 1985. Zimmer details biotic zones and identifies birds expected to be found in those areas.

### **Other Sources of Information**

Animal and Plant Health Inspection Service, Department of Agriculture, Washington, D.C. 20250. Provides information about importing or exporting pets and federally regulated plant species. [www.aphis.usda.gov](http://www.aphis.usda.gov).

California Department of Fish and Game. [www.dfg.ca.gov](http://www.dfg.ca.gov).

IUCN: World Conservation Union. [www.iucn.org](http://www.iucn.org).

The National Marine Fisheries Service, Department of Commerce, Washington, D.C. 20235. Good source of information about endangered whales, seals, and other marine species. [www.nmfs.noaa.gov](http://www.nmfs.noaa.gov).

National Wildlife Federation. "The Conservation Directory."  
[www.nwf.org/conservationdirectory](http://www.nwf.org/conservationdirectory).

United States Fish and Wildlife Services. [www.fws.gov](http://www.fws.gov).





**INSERT *CALIFORNIA INDIANS* TAB HERE**



# California Indians



## Introduction

Because children find the culture so appealing, California Indian programs can be one of the most meaningful Junior Ranger subjects to interpret. Take the children back in time, and help the Junior Rangers envision California the way it was for the California Indians.<sup>1</sup>

An interpreter can emphasize many different topics related to the local Indian culture. Included here is a sample program about what the people ate and about the respectful relationship between the people and animals. However, you can present California Indians in many other ways. If you take advantage of these possibilities for variety, even a Junior

Ranger who has already completed a California Indian program can repeat the section and have a completely different experience the second time.

One effective way to interpret this subject is to include opportunities for Junior Rangers to participate in native lifestyle activities. Children will be curious about the early uses of plants, and an activity such as making acorn mush will help participants imagine what it would be like to gather and prepare their food from what can be found in the immediate environment. As Junior Rangers find out about the medicinal uses of plants, they will be able to see how, even today, we are dependent on the plant world to provide us with important resources.

California is a large state, and the environment varies widely from place to place. Since people adapted their lifestyle to the environment and used materials at hand to sustain their way of life, specific lifestyles differed from the mountains to the valleys, and from the coasts to the desert regions. Although the following information applies in a general way to most California Indians, we encourage you to find out about the people who lived (and may still live) near your park. Tailor your program so it focuses on the local tribe, its customs and stories. Also try to stress regional differences

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<sup>1</sup> All American Indian groups have names that mean “the people.” In the spirit of this tradition, California Indians will often be referred to in this section as “the people.” A good reference is Dolan H. Eargle Jr.’s *Native California Guide: Weaving the Past & Present*, (San Francisco, CA: Trees Company Press, 2000).

between tribes. Please do not assume that all the information given in this section is true for all Indian groups.

A California Indian program should be taught with sensitivity. Here are some suggestions:

- In your program, it is important to find out about the specific group or groups of Indians who traditionally lived, and still do, closest to your park. Avoid saying, for example, “Indians pounded acorns.” Say instead, “The Maidu pounded acorns.”
- Although you may be speaking mostly of the people in a historic sense, be sure you don't leave the impression that there are no California Indians left. You might say, “The Maidu once lived on or used this park site. Today, some Maidu people live in the nearby city of \_\_\_\_\_.”
- Make sure everything you say about the people is accurate and verifiable by at least one of the tribes in the local vicinity. Some of the information you have heard about California Indians may not be correct, and to repeat it may reinforce stereotypes. Note: the information in this section has been checked for accuracy by California Indian Charles Smith (Concow/Maidu).
- Use discretion in wearing Native American clothing. You might want to ask a local California Indian to speak with your group instead.
- It is better not to teach about the Native Californians' religious beliefs, except in the most general of terms.
- Have fun with this program, but make sure the information you give is historically accurate and respectful as well.

## Interesting California Indian Facts

- Christopher Columbus found out about America 500 years ago. Scientists place the first native people in California thousands of years ago! (Most California Indians, however, say they have been here from the beginning of time).
- Scientists theorize that the first Californians came from Asia, across the Bering Strait. This land bridge was 1300 miles long—that's like walking from Seattle, Washington to San Diego, California!<sup>2</sup>
- Researchers believe that some California Indians had to spend only two hours a day on survival activities (food, clothing, and shelter).
- In some areas, the nets used to snare quail were made of women's hair.



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<sup>2</sup> Although some recent studies call the Bering Strait theory into question, it is still the most widely accepted theory.

## Research Questions

A good interpreter knows his/her subject. Be able to answer the following questions for the Junior Rangers.

1. What group or groups of Indians inhabited (or inhabit) your area?
2. What area did they traditionally live in prior to European occupation of California? When did they live here?
3. How did these people relate to their environment and what was their impact on it?
4. How do we know they were here? What physical evidence remains?
5. Material culture and economy:
  - What did these people traditionally eat? How did they obtain, prepare and store their food?
  - What did they wear? How did they obtain their clothing?
  - What type of shelter did they have?
  - Were they involved in trade with other groups?
  - Did they have a seasonal migration pattern?
6. What were the other elements of their lifestyle: social structure, arts and crafts, ritual activities, games, music, etc?
7. Compare how they did things with how we do the same types of things today.
8. How did the California Indians in your area relate to the influx of explorers and pioneers?
9. Where are they today?

## Sample Program: California Indians

### I. Introduction

Introduce yourself.

Introduce the Junior Ranger Program.

### II. Objectives

Today, we're going to learn about the people who lived in California before the Gold Rush, before the Spanish missions, before Cabrillo first sailed to California and even before Columbus found out that America exists. We're going to find out what foods they ate in this area and how they prepared them. We'll also learn about the respectful relationship between the California Indians and animals, and what we can learn from that relationship.

### III. Focus the Group

A. To get the group in the mood to think about what it was like to be a California Indian prior to the encroachment of Europeans, take the group back in time:

B. Imagine California as it was hundreds of years ago, when the only people who lived here were the California Indians. Let's step into the past, and imagine

what life was like for them. First, we have to take away in our mind's eye all the things that weren't here 250 years ago. Close your eyes, and imagine your home town area without buildings and without roads. Take away, in your mental picture, all the contemporary houses, all the supermarkets and stores, all the businesses and gas stations. Imagine what your home town would look like if it were all just land. Hold that picture in your mind, as you open your eyes.

- C. If possible, show old photos of your area from local historical collections to compare with the area today.

#### IV. Inquiry/Discussion

##### A. How did the people find food?

1. Now, think about how you would survive if you lived on that land. You couldn't go to the supermarket and get food. What would you eat and drink?
2. Find out what California Indians in your area traditionally ate. Talk to the Junior Rangers about hunting, gathering, and fishing, and how the local tribe prepared their food.
3. Was food readily available in your area? Why?
4. Was there much water?
5. How did children help parents gather and prepare food? How do you help your parents?
  - Tactile experiences capture kids' interest and reinforce the lesson material. Bring in roasted and unroasted pine nuts for the kids to sample, or let them try pounding acorns with a mortar and pestle. If you're ambitious, you could try making acorn mush, soup, or bread and bringing it in for the group to sample. For the adventurous, buy meal worms from feed stores and roast them. They're nutty and crunchy!
  - If you have oak trees in your park, you may want to take the kids on an acorn hunt, or if you have pines, you might want to show them where you find pine nuts in a cone. Another option would be to find plants in your park that were also a food source, or look for insects that the people enjoyed. Point out that even today we could live on insects, plants, etc.—if we weren't so picky!
6. Activity: Cross Cultures List worksheet (Appendix B)

##### B. The People and animals

1. Where do you usually see animals?

Encourage participants to share the times they see animals—in their backyards, in the state park, in the zoo, at home (pets).
2. California Indians lived with many animals all around them. The people imitated animal motions in their dances, and each clan had a special animal that represented them.
  - a. If you had a special animal that represented your “clan” (you and your family or maybe you and your closest friends), what would it be? Which characteristics of the animal remind you of your family?

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- b. Encourage participants to share the animal that would represent them, and why.
  3. Still Hunting Activity (see activity section below)
- C. Hunting and Respect for Animal Life
  1. California Indians hunted animals. However, they killed—or selectively took—only what they needed and used all parts of the animals. The animal was used for food, its skins were used for clothing and bedding, and its bones became tools. If an Indian killed a deer, and had more than he needed, he would trade it. Someone who wanted some deer meat would trade another item such as acorns or obsidian for it. In this way, there was never a shortage of animals. Many California Indians today believe that their ancestors watched the number of animals carefully. If they noticed the salmon population getting low, for example, they would eat something else rather than endanger the salmon population.
    - a. How would you hunt without modern weapons?
  2. Activity: To learn how to hunt, California Indian children threw spears through hoops. Try throwing dowels through a small hoop.
- D. Stories and Legends
  1. California Indians did not have writing, so the people told stories to teach their children. Listen to this California Indian story, and try to guess why the people told it to their children.
    - a. Read to the group the story “The Woman Who Was Not Satisfied.” (See next page.)
    - b. What do you think the people want children to learn from this story? To teach young people to protect animal populations by not killing more animals than they needed for food.
- V. Application/Conclusion
  - A. What happened to the California Indians?

European and Mexican people invaded the land California Indians had lived on. Many people died from diseases carried by newcomers to the state. Others were killed. Some lived in the missions. The ones who escaped these fates could not live in the traditional ways anymore. Descendants of the people who did survive, however, continue to keep many of the traditions of their ancestors alive today.
  - B. Discuss which California Indians groups are active in your area today.
  - C. How should we treat people who are different from us?
  - D. Stamp logbooks.
  - E. Announce time and topics of the next Junior Ranger program and other interpretive programs.



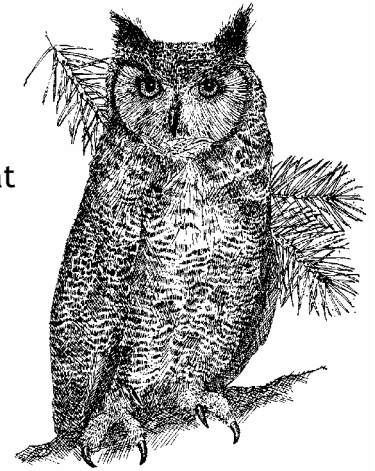
## **Story: The Woman Who Was Not Satisfied**

“One time a man and his wife had been traveling for a great distance. Sun was going down to rest when they decided to camp in a cave until Sun woke and rose for the new day.

They were very hungry, but there was no food in the cave and that which they carried was gone.

As they made their fire, they heard the song of the horned owl a little way away from them.

The wife turned to her husband, and said, ‘When Owl comes near, you can shoot him and we can eat him for supper.’



The husband then got his bow and his arrows which had the tiny obsidian points used for hunting birds. When he was ready, he sang out the same way as the owl.

Owl, thinking it was one of his cousins, returned the husband's call and came closer. The husband sang out again and when Owl answered the husband knew where Owl was, and he shot one of his arrows and, being a good hunter, he had meat for his supper.

Then he said to his wife, ‘There is enough for now.’

‘No!’ said the wife, ‘We have had no meat for a long time. We shall want meat for tomorrow as well, for we have far to go. And if you call them when Sun comes up, they will not come.’

The man heard his wife and again, taking his bow and arrows, called out for more owls. The husband began shooting his arrows as fast as the owls came. But there were more owls than arrows and still they came in great numbers.

Soon they covered everything, making Night Sky, filled with bright stars, darker than before. The husband covered his wife with a blanket and fought the owls with burning sticks from Fire. But there were too many. Then they overcame the husband and wife.

And this is the way the owls paid back the greedy husband and wife for the death of their cousins.”

*Based on a Yokuts story. Legend of the Northern California Indians, printed in the Humboldt County Office of Education N.I.C.E. program. Quoted in Whispers of Our Past.*

## Activities

### Still Hunting

Number of Children: One or more

Environment: Any secluded location

Purpose of the Activity: Learning serenity, spotting wildlife

Activity:

1. An Indian, when still hunting, would go to a place he was attracted to and sit there quietly, allowing his mind to settle into a still and watchful mood. He would be still, and watch the creatures around him return to their normal routine. Usually, an Indian went still hunting to observe and to learn.
2. When you go still hunting, let your sitting place choose you. Remain perfectly motionless, and become a part of the natural surroundings. Curious animals may come look at you and get very close if you are still, and you will have an opportunity to observe nature as it is when you aren't there.
3. After the still hunt, come back to the group and share your experiences: feelings you had, what you saw. Encourage a respectful and sensitive mood, an atmosphere in which real communication of feelings and experiences can happen.
4. Talk about what it feels like to be a part of nature.

*From Sharing Nature With Children, by Joseph B. Cornell. 2<sup>nd</sup> edition. Nevada City, CA: DAWN Publications, 1998.*

### Acorn Tops

Number of Children: One or more

Environment: Any

Materials Needed:

Wooden dowels 1/8" diameter cut into 1½ inch long segments (24 segments on a 36" dowel)

Large, well-shaped acorns, without caps (Tanoak acorns work well)

Brown molding clay (A pea-sized amount for each top)

Sharp, small knife or Exacto knife.

Purpose of the Activity: To demonstrate a toy that was made by California Indians out of natural materials.

Activity:

1. Using an Exacto knife, remove the center core out of the acorn. Enough of the shell and the meat needs to be removed from the top so that ½" of the dowel can be inserted into the acorn. The leader should pre-cut the acorns so the Junior Rangers won't hurt themselves doing it.
2. Have the Junior Rangers pick out an acorn. Instruct them to insert the dowel, and then tightly pack the clay into the hole.



3. Let the Junior Rangers practice with the tops, and then have a contest to see who can make their top spin the longest!

### **Recipe for Acorn Bread**

1. Shell dry acorns.
2. Use a blender to grind acorns into fine flour.
3. Put acorn flour into a muslin-lined colander (cheesecloth is too porous). Place the colander in the sink and run warm water through the flour until the bitterness is gone (stirring gently will speed this slow process).
4. Salt may be added, if desired.
5. Shape flour into pancake-like patties (about 1½ inches in diameter and ¼ inch thick) while flour is still moist.
6. Fry without oil on non-stick pan (at campouts, acorn bread may be cooked on hot rocks from campfires).
7. This flour may be used in place of regular flour in cookie recipes. In cookie recipes that call for 2½ cups of flour, substitute ¼ cup of acorn flour for ¼ cup of regular flour. The acorn flour can also be dried and stored in the freezer.<sup>3</sup>



To remove tannin from shelled acorns:

1. Place shelled raw acorns in boiling water, and continue to boil until the water is the color of strong tea.
2. Pour the water and nuts through a colander.
3. Place the acorns in more water and continue above process until water boils clear. This process removes tannin from the acorns.
4. Allow nuts to dry. Spread acorns to dry on cookie sheets - put in warm place (oven, if pilot light is used). When partially dry, coarse grind a few at a time in blender. Spread to dry on cookie sheets, then grind again in blender or cuisinart.
  - Use ½ cup acorn flour for ½ cup regular flour in cookies, zucchini bread, etc.

*Note: Contact your local Indian groups for recipes also.*

### **More Interpretation Ideas**

- If you have access to California Indian artifacts or replicas, ask the group to guess how they think the artifacts were used. Then ask if people in the future found some things from a Junior Ranger's closet or kitchen, what could they learn about that child from what he or she left behind? Would it be easy or difficult for people in the future to find out about the person from, say, his or her bicycle? Discuss how artifacts help us understand the California Indians' lifestyle, but also how it takes a special effort to understand the people who used the objects you see in

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<sup>3</sup> Modern version. Recipe provided by Rita Nunes.

museums. (Note: Please consult museum collections staff and/or archaeologists before using artifacts.)

- Ask the Junior Rangers to go out into the open and imagine that you had to make a house out of what you see there, using only the tools that you could find or make. How would you build your house without a hammer and nails? What kind of shape would it have? What would hold it together? Would it keep out the rain? The snow? The heat? Would it stand in a strong wind? Would it have ventilation? How would you make the door? Then tell the group how the people who lived on or near the park site built their houses. Think about how much skill they had to have to build such houses, and how they adapted to the environment. (At the same time, you can dispel the myth that all Indians lived in tepees).
- Try basket weaving, and discuss the California Indians' ability to weave baskets that could hold water without leaking.

## Suggested Program Aids

Baskets, grinding implements (mortar, pestle, etc.), projectile points, ornaments, plant materials (acorns, pine nuts, berries, rushes, etc.), musical instruments, tools (pump drill, bone, antler, chipped stone, fishing implements, etc.), equipment for games, drawings, reprints of photographs, and maps. Note: Before using original artifacts, make sure your supervisor has cleared their use with your district's collections manager. The use of reproductions is encouraged.

## Background Information: California Indians

The California known to the people who lived here over 250 years ago was very different from the California we know today. Before contact by Europeans, there were thousands of people within the present boundaries of the State of California, a diverse population that spoke 120 different languages. At that time, the people were relatively few and the animals were many. California was abundant in natural resources (the useful plants, trees, animals, fish, water and minerals that are a part of the land). The California Indians used these materials in creative and resourceful ways, and they took care of what nature had given them.

### Hunting and Fishing

Because the people had great respect for animal life, hunting was given much forethought, marked by ritual. In many tribes, men would meet in a sweathouse (a partly underground building roofed with poles, mats, earth and clay) to prepare for the hunt. In the sweathouse, bows, snares, nets and traps were sometimes made and mended. Stories of the past were told, and boys learned the skills and traditions they needed to survive. When the hunter came out of the sweathouse, he scraped sweat

from his body with a deer or elk rib tool, then washed in a nearby stream. In this way human scent was removed so that the hunter could approach his quarry more closely. Some men also rubbed herbs on their bodies to disguise their scent. The sweathouse was also a way to purify oneself spiritually before hunting, dancing, gambling, or other important ventures. Sometimes the people disguised themselves with animal skins and acted like animals so they could get close enough to shoot their prey with an arrow. Animals were caught in traps, netted, speared, and shot with bows and arrows. Great care went into the preparation of the bows and arrows and the obsidian arrow tips.

Often men hunted at night because certain animals could be found in their dens or nests. In some areas, quail were caught with snares woven from women's hair. Other kinds of small birds were caught in large drop or fan-style nets.

Fish were a very important food source—especially salmon—but the people also ate eels, clams, and crayfish. In some areas, both men and women fished together, from the shore or from boats (note: in some areas women were not allowed to fish unless attended by a male). They used hooks, nets, harpoons, traps, spears, and poison. If the fish were in a pool, some people put ground-up soaproot powder into the water. This had the effect of stupefying the fish, causing them to float to the top, where they could be easily caught. The fish were broiled over hot coals, or dried and made into meal. Dried salmon could be used for trade.

## **Houses**

California's rich variety of natural materials supplied the things the people needed to build their houses. They used earth, wood, brush, and reeds to build their homes, and also used natural materials to make their clothes and baskets. These varied from region to region depending on the available materials and climate.

Some California Indians (the Wintun, the Mono, and the Maidu, for example) built houses out of cedar bark slabs covered with animal hides and shaped like an upside down cone. The homes had a hole in the center of the roof for the smoke of the cooking fire inside to escape. Their beds were made of pine needles or fir branches covered with blankets made of rabbit fur. Other Indian tribes built their homes of planks, especially in the far north (Yurok, Tolowa, Hupa, and Karok).

In the valley, coast, and desert regions, most homes were built using tules or brush. Oblong or round in shape, this type of house was made by curving willow poles over a pit. The frame was covered with brush or tule and tied with cord. A small opening at the top of the brush hut allowed smoke to escape.

Throughout California, earth coverings were used over brush houses. The earth kept the home cool in the summer and warm in the winter. Sometimes plants would grow in the earth and camouflage the house.

In addition to dwellings, the people built sweathouses and a ceremonial house (or round house) for dancing and other social and spiritual/religious events.

## **Clothing**

Some California Indian women wore full skirts which fell to a few inches above the knee. The skirts were made out of deerskin, rushes, or shredded bark (from willow, cedar, or redwood trees). They sometimes wore their hair parted in the middle and in two braids, or with the braids tied in the back with rabbit, mink, or other fur.

Most California Indian men wore an apron belt of deer hide. Their hair was worn long, in a brush tied at the nape of the neck, or worn on the top of the head in a fine net. Children under ten years old generally wore no clothing.

Both men and women wore feather or fur capes when it was cold, and sandals and moccasins for wet or snowy days.

## **Food**

The people found everything they needed for food in the wild. Acorns were an important staple, but they also used over 500 other types of plants for food, including roots, bulbs, nuts, seeds, greens, and berries.

There were many kinds of oak trees in California, and all had edible acorns, although some were preferred over others. In the fall or summer, the people gathered acorns. They knocked the acorns out of the tree with a long stick, and then gathered them in baskets. The women prepared the acorns for eating, singing and telling stories as they did so, for it was a very social time. The first step was to split the shells off the acorn with a rock. Next, the women winnowed away the skin of the acorn by tossing the acorn kernels in the air and allowing the wind to blow the skins away. The next step was to pound the acorn kernels with a stone pestle in holes worn in a big slab of bedrock, or in a wood or stone mortar. In some areas, such as Indian Grinding Rock State Historic Park in Pine Grove, California, you can still see the places in the rock where the California Indian women once pounded acorns.

After the acorns were pounded into flour, the bitter tannic acid had to be leached from them. To do this the women took the flour to a sandy spot by a creek or river. They scooped out a shallow basin in the sand, lined the rim with pine needles, and placed the flour in the basin, right on the sand. They slowly poured warm water through the flour until all the bitterness washed away. After leaching, the dough was either cooked into mush, soup, or bread, or dried and stored. Acorn meal was cooked in baskets, pottery bowls (desert areas) or soapstone bowls (along the coast).

What the people ate varied somewhat depending on the time of year. In the spring, they gathered bulbs and plant shoots. In the summer, they gathered seeds. In the

fall, they found acorns, and in the fall and spring, mushrooms. During the winter months, the people relied on the acorns they had stored for food. They also ate dried meat, dried vegetables, and seeds. Southern California people ate the blossoms and pods of the mesquite trees and shrubs. Pine nuts from pine cones were roasted or eaten raw, boiled into a mush, or ground and made into cakes. (Pine nuts, or pignolias, are available today at health food stores and some supermarkets. It would be fun for kids to sample some before and after roasting).

Although the people in parts of Southern California grew crops, including squash and pumpkin, most California people didn't farm, but gathered the plants they found growing in their area, such as miner's lettuce, nettle, wild onions, and bracken greens.

Many tribes intentionally burned fields or meadows. After burning, the ashes from the burning enriched the soil so that the following season the young plants grew stronger and more productively.

## **Baskets**

Basket making was another important activity for women, and baskets from the California people were known for their beauty and intricacy. Possible uses for baskets were many, and the people used them for almost everything, including for carrying and storing food and other materials, as cooking utensils, trays, plates, bowls, and cups, and as works of art to be presented and cherished as gifts. Some baskets were made of twigs from willow and redbud, some were made of tule, and some were made from roots of sedge and bulrush. In some locations, different colors were achieved by dipping the material into wet ashes to make them black, or by using bark from the redbud tree to dye the material red. Grasses could also be dyed by soaking them in dark colored mud or in the juice of manzanita berries or onion skin. Shells and feathers also added color and beauty to the baskets. The colors and materials used in making baskets changed from place to place. Each tribe and each basket weaver had a unique style.

How did the people use baskets for cooking? Basket weavers were so skillful at weaving tight baskets that the baskets could hold water without leaking. To cook in the baskets, women heated round river rocks in the fire, washed the ash off them, then dropped them in a basket of uncooked acorn mush using looped sticks. To keep the rocks from burning the mush (and perhaps the basket), they stirred them around with special sticks. When the mush was cooked, the rocks were removed and the mush was ready! The women took the rocks out of the baskets and (in some locations) put them on a bed of fir boughs. The rocks would be covered by crusty, cooked acorn mush and kids would run to eat the crunchy crust off of the warm rocks.

## **Boats**

Depending on the area, California Indians made three main types of boats: the tule boat, the dugout canoe, and the plank boat. Tule boats were made by tying large bundles of tules together with strong vines. Tule boats did not last long, and had to be pulled out of the water after use so they wouldn't get soggy.

A dug-out canoe was made of pine, cedar, fir or redwood logs which were hollowed out. The people burned the wood to make it softer, and then scraped it out with bone, shell, or rock, used like an adze. The sides and bottom had to be kept a certain thickness for the boat to work. These boats might take a year or two to make. Plank boats were made in Southern California. The Chumash and the Gabrielino people split pine logs into planks using bone wedges. These planks were then shaped, fastened with fiber cords, and sealed with pitch or asphaltum to make them watertight. Each boat could hold up to 20 people.

## **Other Resources**

Obsidian is a hard volcanic glass that comes in colors of red, white and black, with black the most common color. Obsidian is found in volcanic areas, such as Lassen Peak, Mt. Shasta, and Clear Lake. But the people who didn't live near volcanos were able to get obsidian by trading with people who did have access to it. Another type of stone the people used was chert, a hard stone with a waxy look. Chert comes in blue, gray, green and red colors. Both types of rocks were used because they break with a sharp edge, and can be made into arrowheads, spears, and knife-like tools.

## **Trade**

Trading was an important part of the people's lives. Trade made it possible for them to get goods that were not available in the area where they lived. California Indians had wide ranging trade routes, which extended even into Oregon, Washington and Nevada. These routes were the roads they took to exchange materials, goods, and ideas with other tribes.

The trade routes were trails from 6 to 12 inches wide, and they were kept clear by frequent use and by the efforts of all California Indians. Often they were lined with stones on both sides. The trails had places where the people could stop and rest, like the rest stops we have on our freeways today. Some of the trade routes the people used are still used today: Highways 1, 10, 36, 76, 78, 101, 126, 127, 138, 299, and 395, among others, follow original California Indian trails.

The people traded goods for goods (acorns for obsidian, for example) or they used strings of shells or magnesite instead of paper or coins for money. These strings were made of clam shell disks, magnesite cylinders (Clear Lake area, especially), or dentalium shells, and each string was valued at a certain amount and was carefully



counted out. Dentalium shells came from the state of Washington, near Vancouver Island. These shells were shaped like small tusks or teeth. Some traders had tattoos on their arms so they could measure each shell. The shells were sometimes decorated with fishskin, snake skin, and red feathers.

Clam shells were traded by the people of the coast. The shells were broken into pieces and each piece was ground on a rough stone until it was a smooth, round disc. Holes were made in the center with a sharp pointed stone.

Magnesite comes from the Clear Lake area. It is a stone which is not very hard and could be ground into small round pieces. The stone, when polished or heated, turned shades of red, pink, or gold. These stones were highly prized (Faber). If a woman wore many strings of any of these types of shell or stone money around her neck, it was a display of her family's wealth and power (Smith).

Other items that were in demand for trade include acorns, soapstone, bear grass, bow wood, salt, deerskins, pumice stone, dried furs, jasper points and asphaltum.

## **Impact of Newcomers to California**

When other people came to California, they disrupted the Native Californians' traditional ways. The first new arrivals to California were the early Spanish explorers. Next came the Spanish missionaries, then Mexican rancheros with their herds of cattle and later, American entrepreneurs. These cattle competed for vegetation with the dwindling herds of antelope and elk. Successive waves of people poured into California hoping to profit from California's gold, agriculture and climate.

Each surge of newcomers brought increasing change and misfortune for Indian people and their cultures. Disease, killings and destruction of their way of life reduced the California Indian population dramatically during a span of less than 150 years. Some groups were completely destroyed. Ishi, an Indian of the Yahi people, became famous as the last of his tribe, but he was only one of many who saw their families and culture disappear.

## **California Indian Cultures**

As many California Indians keep the traditions of their ancestors alive, a significant portion of their culture still survives. It is sometimes difficult for others to understand California Indian culture. Have you considered how difficult it would be for someone in the future to learn about you from some items in your closet or from a few of your kitchen utensils? It would be hard for them to really know you, or to understand your habits, dreams and personality. It takes a special effort to understand the people who used the objects you see in the museums. However, such effort is worthwhile, as we see how much we can learn from the people who have lived in California for thousands of years.

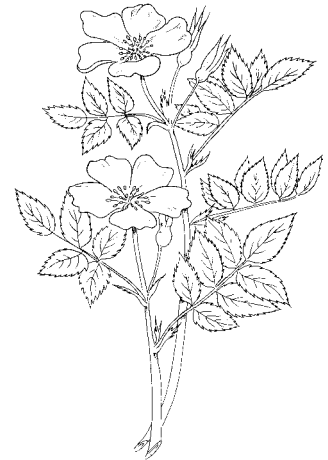
## **Native Plants and Their Uses<sup>4</sup>**

### **California Wild Rose** (*Rosa californica*)

This scraggly bush or shrub, three to six feet tall, grows in moist areas. It has toothed leaflets and thorny stems. The showy flowers are light pink to rose in color, and have five petals. The wild rose blooms from May to August.

The California wild rose was used primarily by the California Indians in a medicinal tea. Made from the leaves and roots of the plant, the tea was used for colds, muscular aches and pains, and colic. It was enjoyed by healthy California Indians also, simply for its rich, fruity flavor.

The fruit and flower of the rose were eaten. The red fruit, called the rose hip, has a delicate, apple-like flavor, and is rich in vitamins A and C. The wood of the rosebush, if straight and strong enough, was used to make arrow shafts.



### **Cattail** (*Typha latifolia*)

The cattail is a rush-like plant, three to eight feet tall, with thick, spongy stems. The leaves are very long and slender. The reddish-brown flowers, called catkins, are a dense, sausage-shaped cluster on the top of the stem. Cattail is a common plant in marshes, streams, and ponds. It blooms from June to July.

The cattail was a very useful plant to the California Indians. The leaves were used to make mats and roofing thatch. Leaf sheaths were used as caulking material for canoes and houses. Much of the plant was eaten. Bread was made from the pollen of the catkin. Young shoots were eaten raw, tasting something like cucumber. The thick roots were dried, sometimes roasted, and ground into a meal that was very starchy and equal in food value to rice or corn. Thinner roots were used as a salad or cooked as a vegetable.



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<sup>4</sup> Many of these plants are still gathered by California Indians for food and basketry materials. Contact your local Indian group for information about local plants they use.

**Wild Cucumber**  
(*Marah macrocarpus*)

Wild cucumber is also called manroot, because its underground structure sometimes resembles a crouched human or a man's head. It has a basketball-sized root sometimes weighing over one hundred pounds. The large root contrasts with the rest of the plant, which twines around other plants, but is not a parasite. The fruit of this plant is a green, prickly gourd about three inches across. When ripe, it bursts open and scatters large brown seeds and soapy pulp over several yards. Wild cucumber is common in oak woodland, streamside areas, and the chaparral. It blooms with tiny, white, star-shaped flowers in the spring.



The roots of the wild cucumber are poisonous; the California Indians put crushed pieces in pools and streams to stupefy the fish. The crushed roots mixed with sugar were also applied to sores. Oil from crushed seeds was used as a hair tonic to prevent baldness.

**Yerba Santa**  
(*Eriodictyon californicum*)

Yerba santa is a shrub that grows two to nine feet tall. Its leaves are long with wavy edges and have a varnished look. The plant also has funnel-shaped, lavender flowers. It is common in the chaparral, blooming from April to June.

Yerba santa was used to cure many ailments (the name means “holy herb” in Spanish). California Indians made a tea from the leaves and drank it to cure colds, coughs, sore throat, rheumatism, and stomach problems. They made a liniment from boiled leaves and rubbed it on the body to relieve aches and pains. This solution was also used by settlers to cure poison-oak rash. (Note: according to Edward Balls’ *Early Uses of California Plants*, California Indians were resistant to poison oak rash, with some exceptions.) Fresh leaves pounded into a poultice and wrapped around wounds and broken bones reduced the swelling and relieved pain. Fresh leaves also made wonderful thirst quenchers—as they were chewed, their bitter, spicy taste disappeared and was replaced by a sweet, spicy taste. The mouth filled with moisture and became cool.



### **Blue Elderberry**

*(Sambucus mexicana)*

Blue elderberry is a tree or large shrub (about 6 to 20 feet tall) which produces blue berries in the autumn. The leaves have tiny teeth and are divided into five to seven leaflets. The flowers are tiny and white and grow in showy clusters at the ends of the branches. The plant blooms from April to August. The flowers turn into edible, bluish berries.



The California Indians used many plants for more than one purpose. Some, such as the blue elderberry, provided food, wood, tools, medicine, dye, and even entertainment. The branches were used to make flutes, as well as bows and arrows. From the stems a black dye was made to decorate baskets. The berries were eaten, and the flowers and leaves were made into different types of medicines.

Because they used it to make flutes, the California Indians called the blue elderberry plant “the tree of music.” To make the instruments, they cut the branches in the spring, removed the pulp from the inside of the branches and then dried them. When the branches were thoroughly dry, six to eight holes were burned into them with hot sticks. Bows and arrow shafts were made from the long, thin, green branches.

Elderberries were usually cooked before eating. Sometimes they were made into a drink, and sometimes they were dried and stored for winter. The plant was used as skin medicine, too. The flowers and leaves were boiled and applied to the skin to serve as a poultice and to relieve rashes.

### **California Bay Laurel**

*(Umbellularia californica)*

This large shrub or tree can grow up to 100 feet tall. The leaves are dark green, smooth, and shiny. They have a very strong, spicy smell, especially when crushed. When held near the nose, the crushed leaves can produce headache, sinus pain, and sneezing in people who are sensitive to them. The wood of the tree is a distinctive yellow-brown color. The flowers, which are yellow-green, grow in small clusters and bloom from December to May. The nut-like fruit is dark purple and about one inch across. The bay laurel tree is common in canyons in the chaparral, in oak woodlands and along streams.



The California bay laurel was used as both food and medicine by the California Indians. The thin-shelled nuts, sometimes called pepper-nuts, were parched or roasted, then cracked and eaten. (They are too bitter to be eaten raw, but the bitter

taste disappears when the nut is roasted). Sometimes the nuts were ground into flour and made into small, bread-like cakes. Often they were stored for winter use.

Bay laurel is another plant that was used as medicine. The leaves, which are oily and pungent, were boiled into a tea, which was taken for stomach pains and headaches. Leaves were placed around the forehead also to relieve headaches. The leaves and stems were used in a hot bath to cure rheumatism. The oil of the leaves and seeds has anesthetic properties and was rubbed on the skin to relieve pain. The boughs were put on the fire, and the California Indians would breathe in the smoke to clear their nasal passages. The boughs had another interesting use—they were hung in the houses as a repellant against fleas and lice.

### **Toyon**

*(Hetermeles arbutifolia)*

Toyon is a shrub or small tree that grows six to thirty feet tall. Its dark green leaves are two to four inches long. Tiny white flowers grow in bunches at the ends of the branches and become bright red berries in the fall. These berries have earned the toyon plant two other names—Christmas berry and California holly. Hollywood was named after this plant, which once covered hillsides there.



California Indians ate the toyon berries, but cooked them first, as they are bitter when raw. The berries were either boiled, baked in a ground oven for two or three days along with meat and vegetables, or tossed in a basket filled with hot rocks.

Toyon was also used as a medicine—a tea was made from its bark and drunk to relieve stomach ache.

### **Ceanothus**

*(Ceanothus spp.)*

Ceanothus, also called wild lilac, is a shrub or small tree, two to twenty feet tall. It has small, oval-shaped, leathery leaves with blunt, sometimes notched tips. There are many species of ceanothus in California. They are common in the chaparral, especially on open slopes where there is good drainage. The tiny flowers—white, blue, or lavender—grow in clusters at the ends of branches and bloom in early spring, usually February, after the winter rains and before most of the other flowers appear.



Ceanothus flowers were used in an interesting way by the California Indians—as soap. Rubbing the flowers briskly on the skin produces a fine lather. Other parts of the plant were used, including the roots, which produced a red dye; the seeds, which were eaten; and the leaves, which were dried and smoked with tobacco. The flowers and leaves were also made into an excellent tea.

## Chia

(*Salvia columbariae*)

Chia is a herbaceous (non-woody) plant which grows four to twenty inches tall. The leaves, which are lobed, grow in a rosette pattern at the base of the stem. The deep purplish-blue flowers grow in clusters at the end of the stem. Chia blooms in the spring and is found in chaparral, sagebrush scrub, desert, grassland, and oak woodland.

The California Indians gathered chia in great quantities when the seed was ripening. The plant was cut and bundled and brought to the village. The flower heads were bent over a flat, tightly woven basket and beaten with a basketwork paddle so that the seeds fell into the basket. They were then dried or roasted and ground into flour. This flour, called “pinole,” was often mixed with the flour of other ground seeds or grains to give it a special flavor.



Chia is very high in food value and easily digested. Added to water, the seed made a refreshing drink. Less water produced a kind of gruel which could be baked into cakes or biscuits with a tasty, nutty flavor. It was said that a person could travel for twenty-four hours after eating only one teaspoonful of chia seed.

*Junior Ranger Program Handbook: California Indians*



*Map of California Indian groups is from Whispers of the First Californians by Gail Faber and Michele Lasagne, Magpie Publications, 1980. Used by permission.*

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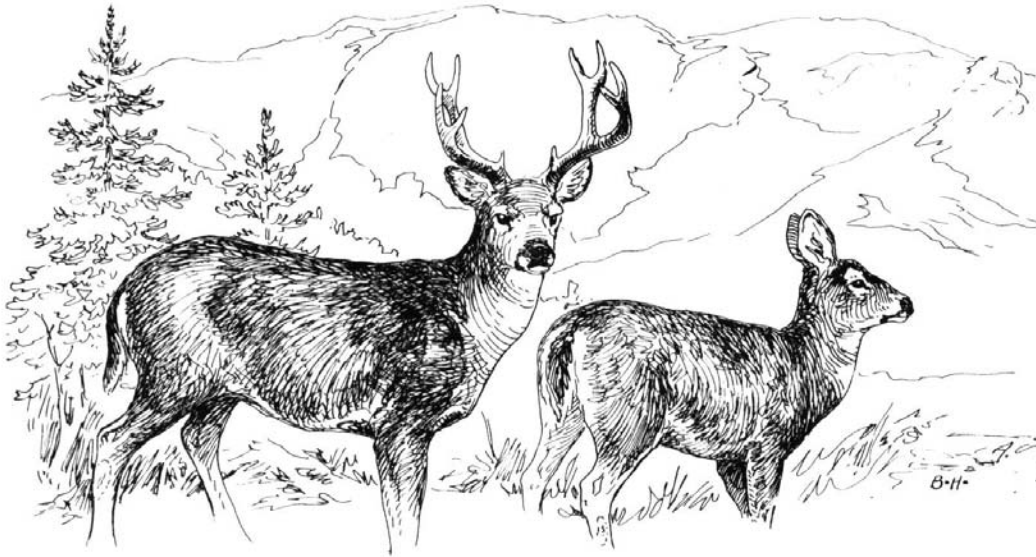
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**INSERT *ECOLOGY* TAB HERE**



# Ecology



*“When we try to pick out anything by itself, we find it hitched to everything else in the universe.”*

*—John Muir*

## Introduction

The word “ecology” is from the Greek, and means “the study of the home.” Ecology is the study of interrelationships among plants, animals, and the environment. A program on ecology can teach children respect for their environment, appreciation for all elements of nature, and a desire to preserve and protect habitats.

We sometimes forget that we are a part of an interdependent system. What happens when something goes awry with our air, soil, water or weather? How would the world be different if we lost all the rainforests or half the animal species? The ecosystem is remarkable in the way everything works together to support life. It is important for us to realize how we often upset this delicate balance.

Poet Francis Thompson said, “Thou canst not stir a flower without the troubling of a star.” Realizing how far-reaching a small change in the ecosystem can be is the first step toward becoming good stewards of our parks and our “home.”



## **Before Teaching Kids about the Environment—Read This!**

Over the course of a lifetime, an individual will build up environmental knowledge by drawing from a combination of school, the media, personal reading, family and friends, outdoor activities, and other professional and personal experiences. Yet, the National Environmental Education and Training Foundation (NEETF) found in their yearly survey on environmental awareness that Americans can correctly answer fewer than 25 percent of the basic environmental literacy questions asked.<sup>1</sup> Most people accumulate a diverse and often unrelated collection of factoids, but develop little real understanding about the environment.

According to NEETF “45 million Americans think the ocean is a source of fresh water; 120 million think spray cans still have chlorofluorocarbons (CFCs) in them even though CFCs were banned in 1978; another 120 million people think disposable diapers are the leading problem with landfills when they actually represent about one percent of the problem; and 130 million believe that hydropower is America’s top energy source, when it accounts for just ten percent of the total.”<sup>2</sup> Experts in the environmental education field attribute this environmental ignorance to printed materials and to educators and the media that oversimplify information, promote a political agenda, or perpetuate incorrect or outdated myths.

Patricia Poore, in her article “Enviro Education: Is it Science, Civics, or Propaganda?”, suggests that many of the environmental publications geared toward children are more political than scientific and often perpetuate outdated assumptions, many of which have been questioned and updated. One of the inherent problems in writing about the environment is to explain complex ideas in a way that young children will understand. Poore finds that many of these children’s publications contain oversimplification and myth, have little historical perspective, are politically oriented, and are strongly weighted toward a traditional environmentalist viewpoint, e.g. emphasizing limits to growth, conveying misinformation concerning waste management, and putting forward gloomy (if not doomsday) scenarios.<sup>3</sup>

Media sources play a major role in the public’s understanding of environmental issues or lack thereof. Studies have found that children get more environmental information, approximately 83 percent, from the media than from any other source. While the media can be good at disseminating accurate information, they generally fail to provide the depth of information necessary for the public to become environmentally literate. Kevin Coyle, former president of NEETF, believes the media

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<sup>1</sup> The National Environmental Education Advisory Council, *Setting the Standard, Measuring Results, Celebrating Successes: A Report to Congress on the Status of Environmental Education in the United States*, (Washington D.C., 2005), 9.

<sup>2</sup> Kevin Coyle, *Environmental Literacy in America*, (Washington, D.C.: National Environmental Education and Training Foundation, 2005), v.

<sup>3</sup> Condensed from the article “Enviro Education: Is it Science, Civics—or Propaganda?” by Patricia Poore. *Garbage: The Practical Journal for the Environment*. Vol V, Number 2. April/May 1993. Pg. 26-31.

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“provides a steady, even ubiquitous flow of awareness-building information but it seldom educates on complex matters or builds skill. The misapprehension it fosters can grow into persistent and incorrect myths.”

While we tend to blame publications and the media for the public’s misconceptions or lack of awareness of environmental issues and concepts, as environmental educators we must be aware of our own methods of promoting environmental stewardship. Are we actively educating the public or just disseminating information? Environmental information simply makes one aware of a topic but goes no further toward generating deeper “awareness.” True education involves a sequenced series of learning steps that result in a thorough knowledge of a subject, including developing skills, and learning how to apply them in a real world setting. As conservationist Aldo Leopold wrote in 1944, “Acts of conservation without the requisite desires and skill are futile. To create these desires and skills, and the community motive, is the task of education.” While the public can be informed about environmental topics, they also need to be equipped and trained in how they personally can use that information to make a difference in their world.

Environmental education begins close to home, encouraging children and adults to understand and make connections with their immediate surroundings. Individuals must grasp and understand the concept of causal connections within the environment in order to fully comprehend the need for environmental stewardship. This can only begin at the local level, where they often feel the most comfortable. It is at this level that people are more apt to develop the environmental awareness, knowledge and skills necessary for moving into broader issues and a more sophisticated comprehension of causes, connections and consequences. Traits of effective environmental education programs include hands-on activities, investigational approaches, and student-directed learning.

The North American Association of Environmental Educators (NAAEE) believes that to be effective, educators must take a balanced approach to instruction by incorporating differing perspectives and points of view evenhandedly and respectfully, and presenting information with intellectual honesty. In their *Excellence in Environmental Education: Guidelines for Learning (Pre K-12)*,<sup>4</sup> NAAEE proposes the following suggestions to help guide environmental program instruction:

- The child or adult is an active participant.
- Instruction should be guided by the learner’s interests and treated as a process of building knowledge and skills.
- The program provides opportunities for learners to enhance their capacity for independent thinking and effective, responsible action.
- The program should provide strong emphasis on developing communication skills.
- Educators must take a balanced approach to instruction.

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<sup>4</sup> North American Association of Environmental Education, *Excellence in Environmental Education: Guidelines for Learning (Pre K-12)*, (Washington, D.C.: North American Association for Environmental Education, 2004). [www.naaee.org](http://www.naaee.org).

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- Personal commitment begins with an awareness of what immediately surrounds them.
- Instruction provides learners with early and continuing opportunities to explore their environment.

By providing accurate and balanced information, and facilitating activities that are designed to confirm and build on this information, educators are preparing children and the public to become environmental stewards.

If environmental education is done right, the average person is more likely to take regular positive action on behalf of the environment. Individuals who understand environmental issues and how environmental quality is impacted by human decisions are better equipped to use this knowledge to make informed, well-reasoned choices that also take into account social and political considerations. According to Kevin Coyle, “We are moving beyond a time when we can rely on a cadre of environmental experts to fix our environmental problems.... A stronger public understanding of environmental science and related issues is a growing necessity, and comprehensive environmental education is the only answer that makes complete sense.”

## Interesting Ecology Facts

- It takes 100 to 500 years for an aluminum can to decompose, but we can recycle aluminum and use it again and again.
- The energy saved from recycling one glass bottle can run a 100-watt light bulb for four hours. It also causes 20 percent less air pollution and 50 percent less water pollution than when a new bottle is made from raw materials.
- The most common cause of species extinction is habitat destruction.
- In one year, a full-grown tree takes 26 pounds of CO<sub>2</sub> out of the air.
- A car gives off about a pound of CO<sub>2</sub> for every mile it is driven. In a year, all that CO<sub>2</sub> would weigh almost as much as an elephant.
- In 1963 only 500 pairs of bald eagles lived in the lower forty-eight states. Only 25 years after banning the use of certain chemicals, there are more than 5,000 pairs.



## Sample Program: Ecology

- I. Introduction  
Introduce yourself to the group.

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Introduce the Junior Ranger Program.

### II. Focus

A. Can anyone tell me what a habitat is?

An animal's home

B. What would an animal need to make a good home?

Go around the group, and ask each child to name something an animal would need to have a good home (answers might include accessible food and water, shelter, and a clean, unpolluted environment).

### III. Objectives

Today we're going to talk about ecology. "Ecology" means "the study of the home." When we think of a home we usually think of a house, but the earth is our home, too, and is also home to plants and animals. We are going to learn about how plants, animals, and humans need each other to survive, and how our health and survival depends on how well we take care of our environment. We'll be playing some games, and taking a hike down an "un-nature" trail, too.

### IV. Inquiry/Discussion

A. Where do the animals live?

1. What are some habitats (some places where animals live) here at the park?  
Oak trees, tidepools, etc . . . (examples from your unit)

B. Animals, plants and people need each other.

1. Do animals need plants to be able to survive? Why?

Yes—Some animals are plant eaters; some live in plants (bushes or trees); and plants produce the oxygen animals breathe.

2. Do plants need animals? Why?

Yes—Animals (like bees) pollinate plants, spread plant seeds, fertilize plants, and produce carbon dioxide (which plants need to produce energy).

3. Do animals need animals? Why?

Yes—Animals eat other animals, and animals help other animals (e.g. symbiosis: remove and clean off pests: shark/remora).

4. Do plants need plants? Why?

Yes—Plants need other plants for symbiosis, fertilizer (plants break down and return nutrients to the soil), succession (progression of plant communities/types).

5. So animals need plants, plants need animals, animals need other animals, and plants need other plants. What about humans? Do humans need plants and animals?

Yes—Humans eat both plants and animals, use plant and animal products, breathe oxygen made by plants, etc.

6. Do plants and animals need humans?

If you have pets or houseplants, they need you to take care of them. Pets need food, water, exercise, veterinary care, etc. Plants need water, sunlight, fertilizer, and a bigger pot when their roots get crowded. Wild

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animals are capable of living without human interference, but in some cases we have altered or destroyed their environments so much that we have to step in and help them. Humans have a responsibility to try to mitigate our damage.

7. Activities: “Knots” and “Support to Survive” (see activity section below)  
Can you see how plants, animals, and people are all connected and how we need each other to survive? A state park is home to many plants and animals, and people can affect these habitats.

- C. What can happen to plants and animals when humans visit the park?  
Sometimes, people who visit a park make noise, feed animals, leave trash, destroy plant life, or destroy animal's homes.  
Or, people like you can protect plants' and animals' homes from harm.

### V. Guided Discovery

- A. Let's see if we can spot evidence of people in the park on the “un-nature” trail.  
1. Activity: The “Un-nature” Trail

### VI. Application

- A. What was it like to see man-made objects on the trail?  
B. Why is it important to protect the park environment?  
So plants and animals have a natural, unpolluted place to live  
C. What can you do to protect the park environment?  
Take only pictures, leave only footprints.  
Do not feed the animals.  
Do not litter and help out by properly disposing of the litter you do see.  
D. How do you think protecting the park environment will make the park a nicer place for you to visit?  
E. Outside the park, what happens when people don't protect the environment?  
Our home (our habitat) gets polluted and becomes a less clean and healthy place to live. Just by looking around you can see evidence of this. Can you smell car/truck exhaust? Do you see trash? It not only looks bad, but it presents a danger for animals that might swallow it or get tangled in it. Trash, such as motor oil, animal feces, etc., can travel from your neighborhood all the way to the ocean where it causes lots of problems, including contaminating the water.  
F. Can anyone name some of the environmental problems we are having worldwide?  
The greenhouse effect, pollution, ozone hole, deforestation<sup>5</sup>  
What are some things we are doing to solve these problems?  
G. When you go back home, do you have any ideas about how you can help protect the earth, our home, from these problems?  
Recycle, save water, make less trash, don't litter, use recycled products, eat organic foods, buy California grown products, help community groups.

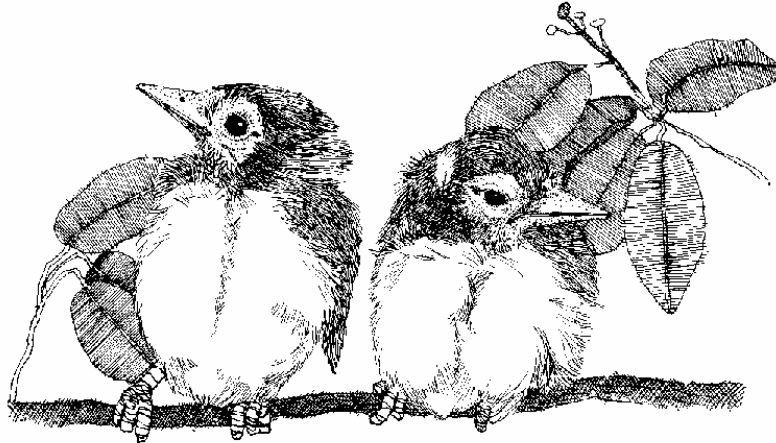
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<sup>5</sup> Information about deforestation is available in the Plant Life information section.

H. What do you think would happen if we all did these things? Would our home be a nicer place to live?

VII. Conclusion

- A. Announce when and where the next Junior Ranger session will be, and what the topic will be.
- B. Stamp log books.



## Activities

### Knots (Web of Life)

Number of Children: 6 or more

Environment: Any

Equipment needed: None

Purpose of Activity: To try and untangle the complex web of the relationships between animals and plants.

Activity:

1. Explain that every animal and plant is connected in many ways to the other plants and animals around it. The soil, the amount of water, exposure to the wind, and many other factors affect all living things as well.
2. The object of the game is to try and untangle a complex web of relationships to see the cycle involved. Give each player an animal or plant name before the knot begins. Tell them to remember their names. Stand in a circle, shoulder to shoulder. Have everyone reach across to grab two other hands (not the same person's or the person next to you). Now that you are all interconnected, try to untangle the knot without letting go of any hands. Do you end up in a circle? Two circles?
3. After the knot is untangled, ask the players their animal or plant names, and talk about the relationships between their neighbors on each side of them in the circle. Would they be eaten or eat their neighbors? How is this going to affect the food web they are part of?

*From The New Games Book, by Andrew Fluegelman. New Games Foundation, The Headlands Press Inc., 1976.*

## **The “Un-nature” Trail**

Number of Children: No more than 10

Environment: Trail

Equipment Needed: 10-15 man-made objects (clothes pins, pencils, combs, mirrors, toys, soda cans, etc.)

Purpose of Activity: To sharpen observation skills

Activity:

1. Place the man-made objects just off a 20- to 30-foot long section of trail. Use some bright objects and some well-hidden ones. Keep track of them so none are left out following the activity.
2. Have people walk the trail one at a time, silently, trying to see as many objects as possible. At the end, they whisper to you how many they have seen. If not all were spotted, tell them "there's still more," and let them start over.
3. Finish up by walking the trail as a group, pointing out and then removing each object in order. Make a point about keeping unnatural objects where they belong while hiking, then practice your new observation skills on a nature hike.

Variation:

Give each person a piece of paper and a pencil and have them write down the unnatural items. The second time through have the group pick up the items. Usually, they will find more than you originally set out.

*From Sharing Nature with Children by Joseph B. Cornell. Nevada City: Ananda Publications, 1979.*

## **Support to Survive**

Number of children: 12 or more

Environment: Any

Equipment needed: None

Purpose of activity: To demonstrate how survival depends on support, not just individual effort

Activity:

1. Think of the way systems support each other (animals require plants; plants need sunlight; humans need oxygen from plants; soil needs nutrients from decomposers, etc.). Here is a new way we can support each other and relax at the same time.
2. Form a close circle standing shoulder to shoulder. Turn 90 degrees to the right. At the same time, everyone should sit down on the knees of the person behind them. Now try waving your hands and walking forward in a circle.
3. This game shows how all systems working together support one another.

*From The New Games Book. New Games Foundation, The Headlands Press Inc., 1976.*

## **Background Information: Ecology**

When we talk about “nature,” we usually mean all of the outdoors, and all the plants, animals, and environments we find there. However, we cannot really lump all of “nature” into one big category, for every animal and plant has a particular home and a particular environment to which it has become adapted in order to live. The study of living things in relation to their environment and to each other is *ecology*.

An invisible “web of life” connects living things to their homes in many ways, including the relationships between species living in the same area and their interaction with soil, air, rain and light. In a healthy ecosystem, living organisms are in balance with nature, and do not use up their resources. When an ecosystem is thrown off balance by human interference, however, biodiversity, food chains, and even the global climate are affected. One disruption of a fragile ecology can have far-reaching repercussions.

### **Biodiversity**

The term “biodiversity” refers to all the different plants and animals that live in the same area. Tropical rainforests have more biodiversity than anyplace else on Earth. Even small patches of rainforest have native species that are found nowhere else in the world. For every species we know about, there may be 30 more that we haven't discovered.

Retaining biodiversity in ecosystems is important for many reasons, including maintaining the balance of species, the potential of these species for providing people with food and medicine, and enabling ecosystems to withstand environmental stress and adapt to change.

One potential problem if an ecosystem is disturbed is that the food web may develop a missing link. (For more information about food webs, see the Background Information section in the Energy chapter.)

### **Human Impact on the Global Climate**

Humans have been modifying their environment for thousands of years. The use of fire and the overgrazing of lands by domesticated animals have negatively affected the abundance and distribution of vegetation, increasing the size of deserts in some parts of the world. By altering ground cover, important climatological factors like evaporation rates and surface winds have changed and continue to change.



## Global Warming<sup>6</sup>

Most scientists think the world is getting warmer. According to the National Academy of Sciences, the earth's surface temperature has risen by about one degree Fahrenheit in the past century, with accelerated warming during the past two decades. Special computer programs show that temperatures could keep climbing for years to come. Scientists predict by 2100 the global surface temperature could increase an average of 1.6 to 6.3 degrees Fahrenheit.

Many scientists believe that people are causing the global warming, mostly by burning fossil fuels such as oil and coal (fossil fuels are formed underground from the remains of prehistoric animals and plants). Fossil fuels power almost everything we plug in or start up—from computers to cars. When burned, fossil fuels give off several gases, including carbon dioxide (CO<sub>2</sub>). Some of these gases also occur naturally from plant respiration and the decomposition of organic matter, but when they are combined with the emissions from human activities, the environment cannot absorb them as easily. These gases contribute to global warming because they stay around the earth and hold the sun's heat close to the surface. That's called the greenhouse effect.

Think of a car or a greenhouse. You know how hot a car gets if it is parked in the sun with the windows closed. A greenhouse works in the same way: The glass allows the sun's radiant energy in, but prevents most of the infrared radiation (heat) from escaping.

Water vapor, CO<sub>2</sub> and other gases act a little like car windows or greenhouse walls. They are part of the atmosphere, which is like a blanket of air around the earth. Sunlight passes through the atmosphere to the earth. Then the gases trap the heat so it stays close to the earth for a long time. We need some heat near the earth to keep from freezing. But we're adding a lot of extra gases to the atmosphere, and that may be making the earth a little too warm.

Some greenhouse gases that occur naturally in the atmosphere include water vapor, carbon dioxide, methane, nitrous oxide and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases:

- Carbon dioxide is released into the atmosphere when solid waste, fossil fuels, and wood and wood products are burned.
- Methane is emitted during the production and transport of the fossil fuels coal, natural gas and oil. The decomposition of organic wastes in municipal solid waste landfills and the raising of livestock also release methane gas.

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<sup>6</sup> Information on global warming, the greenhouse effect, and the ozone problem from "Global Warming" and "Ozone Depletion." United States Environmental Protection Agency. <http://yosemite.epa.gov/oar/globalwarming.nsf>. Also, from "Global Warming," National Climatic Data Center, National Oceanic and Atmospheric Administration. [www.ncdc.noaa.gov/oa/climate/globalwarming.html](http://www.ncdc.noaa.gov/oa/climate/globalwarming.html).

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- Nitrous oxide is released during agricultural and industrial activities, as well as during the burning of solid waste and fossil fuels.
- A variety of industrial processes release very powerful, heat retentive, greenhouse gases that do not occur naturally. These gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF<sub>6</sub>).

Plants and the ocean help to absorb some of the greenhouse gases and reduce their buildup, but deforestation by the timber industry, urban development and the burning of tropical rain forests by farmers are contributing to an increased concentration of the gases and the acceleration of climate change.

The problem with global warming is that a temperature rise of only a few degrees can bring about some big changes. For example, the weather would be affected. Some areas will have a dramatic increase in precipitation and runoff, whereas others will experience a decrease in runoff, either from reduced precipitation or higher temperatures. This change in water distribution would then change animal habitats and many aspects of human life, from agriculture to recreation.

Currently the sea level along California's coast is rising by three to eight inches per century. With global warming, scientists predict the sea will rise another 13 to 19 inches by 2100. The higher sea level could lead to flooding of low-lying property, loss of coastal wetlands, beach erosion, and saltwater contamination of drinking water.

Most scientists think global warming may hurt wild animals and plants. Many species may not be able to survive in a world that's drier, wetter, warmer, or significantly different from what they are used to. The ranges of many species of plants and animals are restricted and fragmented through both natural and human causes. This loss of habitat and the natural corridors allow migration could limit the ability of isolated species to adapt to climate change.

Humans could also be affected by global warming. Higher temperatures and increased frequency of heat waves may increase the number of heat-related illnesses and deaths. Hot weather tends to elevate air pollution by increasing the emission of natural hydrocarbons and concentration of ground-level ozone. Scientific studies have shown that ground-level ozone can aggravate existing respiratory illnesses such as asthma, reduce lung function, and induce respiratory inflammation. As people turn up their air conditioners, air pollutant emissions from power plants will also increase.

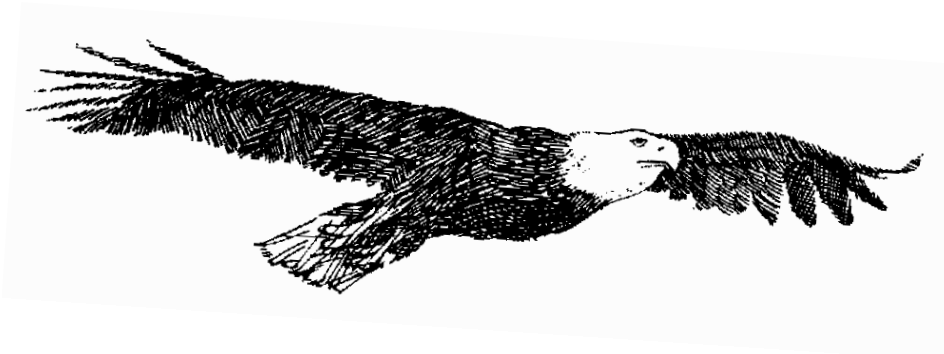
In the United States, about 6.6 tons of greenhouse gases are emitted per person every year. By reducing the amount of electricity used in homes, decreasing the production of waste, and wisely choosing modes of personal transportation, we can lower the amount of greenhouse gases being released into the atmosphere and possibly slow global warming.

## **The Ozone Problem**

Ozone is a naturally occurring greenhouse gas in our atmosphere. The earth's ozone layer, approximately 9 to 19 miles above the earth's surface, acts like sunscreen to protect all life from the sun's harmful radiation. Factors like sunspots, changing seasons, and latitude can cause fluctuations in the naturally occurring levels of ozone in the atmosphere. However, scientists have learned that human activities have damaged this shield.

It is believed that the greatest human impact on the ozone layer has been caused by groups of chemicals known as halons and chlorofluorocarbons (CFCs). People have used these gases in air conditioners, refrigerators, aerosol sprays, fire extinguishers, and in the production of certain plastics. When CFCs get into the atmosphere, they go through several chemical reactions triggered by the sun's strong ultraviolet rays to convert ozone ( $O_3$ ) into oxygen ( $O_2$ ). The depletion of ozone allows too many of the sun's harmful ultraviolet rays to reach the earth's surface. These kinds of rays cause many problems—including plant damage, eye disease, sunburn, and skin cancer. A lot of ozone has been destroyed, but contrary to popular opinion, there is no "hole" in the ozone layer—there's just much less ozone in some places than in others.

It's not too late to do something about global warming and the ozone problem, and a lot of people already have. Starting in the 1970s many nations banned the use and production of CFCs and halons, and many are looking at ways to cut down on the  $CO_2$  they add to the air. (For example, the United States has banned the manufacture of all nonessential aerosol products that use CFCs as a propellant.) Emissions of ozone depleting substances are falling and scientists predict that the natural ozone production process will heal the ozone layer in about 50 years.



## How Resources Affect Each Other

	Water	Plants	Wildlife	Humans	Soil
Soil	Affects runoff, percolation into the ground, underground storage, and purity by filtration.	Anchors plants; supplies water and minerals; affects where plants grow by topography, elevation, soil depth, acidity/alkalinity of soil.	Affects where animals live because of topography, elevation, availability of water, and types of plants that grow.	Affect productivity of soil.	
Water		Affects transpiration and where plants grow (swamp, hillside, rainfall, fog, snow, etc.).	Affects aquatic animals and where animals live (by their need for water and food).	Provides scenic value and recreation; affects where people live (flood, drought, drinking water) and what people grow.	Washes away soil; affects type of soil (swamp, desert); helps break down soil by freezing, flowing and seepage.
Plants	Make open spaces in the soil for water penetration and tap roots; shade streams and keep water cool; use water in transpiration; purify water.		Provide food, shelter and water in succulent plants for drinking; give off oxygen for breathing.	Provide forage for cattle, shelter, necessities and luxuries of life, recreation, shade, scenic value.	Help rocks break into soil by root penetration; make organic fertilizer which enriches soil and absorbs water; hold soil in place; and protect soil from rainfall.
Wildlife	Pollute water; beavers build dams which control floods and store water.	Fertilize plants; carry seeds; give off CO <sub>2</sub> that plants need; destroy plants.		Provide scenic value, recreation, hunting, livelihood (trapping); damage crops; kill livestock.	Make organic fertilizer; cause soil compaction; beavers build dams which help percolate and hold water in soil; prevent soil erosion.
Humans	Store water in dams; pollute water; divert water; use more water than is available in some areas; manage water for their benefit.	Grow new crops; eliminate natural plants; harvest trees and grass; manage plants for their own benefit.	Harvest wildlife and natural predators; upset nature's cycle of animals; manage animals for their own benefit.		Increase and decrease soil productivity; cause soil erosion; put new land in production; change the face of the earth; manage soil for their own benefit.

## Suggested Resources: Ecology

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California Institute for Biodiversity. *CalAlive!* Produces educational materials for grades 4 through 8. [www.calalive.org](http://www.calalive.org).

### *Junior Ranger Program Handbook: Ecology*

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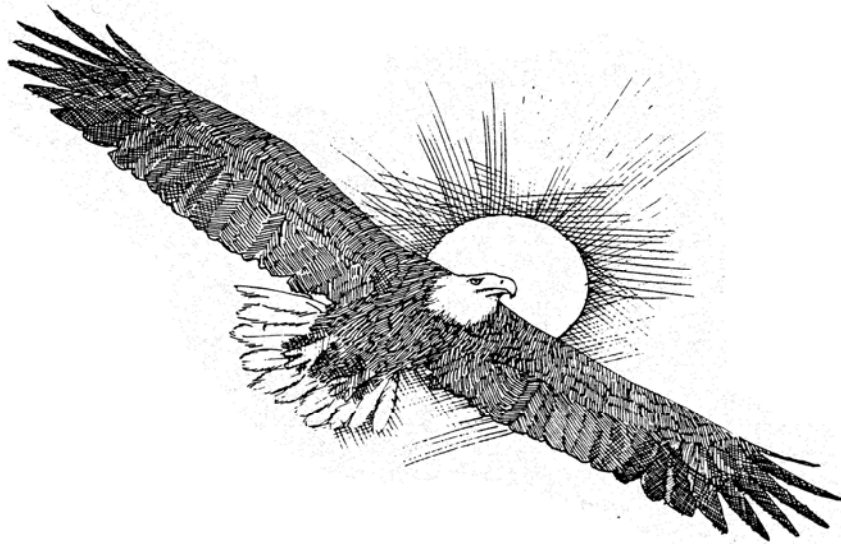




**INSERT *ENERGY* TAB HERE**



# Energy



*“The energy that sustains all living systems is solar energy, fixed in photosynthesis and held briefly in the biosphere before it is re-radiated into space as heat. It is solar energy that moves the rabbit, the deer, the whale, the child on the bicycle, and the human eye as it reads these words.”*

*—George M. Woodwell*

## Introduction

Energy is a central concept of the physical sciences. It pervades biological and geological sciences because the flow of energy underlies any system of interactions. All physical phenomena and interactions involve energy—from the building of mountains to the erupting of volcanoes, from earthquakes to weather patterns, and from mouse to man.

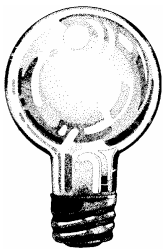
Because energy is a part of everything, there are many ways you can interpret it in a program. You could learn what a nearby power plant does, or find out what people did before they had electricity and running water. You could emphasize food chains and the transfer of energy, or you could look at all the fuel alternatives we have and their potential ramifications for the park and the environment.

Whatever the emphasis, energy is an important topic. California's use and choice of energy sources will dramatically affect our environment, our economy, and our future. If we explore our energy options and our efficiency opportunities, we will reap great benefits as a state, including slowing of the accumulation of atmospheric

CO<sub>2</sub> (which may cause or aggravate global warming), and reducing air pollution and traffic congestion.

There is a great diversity of energy sources available; new energy technology has already begun to reduce our dependency on fossil fuels. California has 50 percent of the world's geothermal plants, 82 percent of the installed wind capacity, and 99 percent of the utility-sized solar plants. Helping Junior Rangers understand the energy choices of today while preparing them to become active participants in making those choices tomorrow is an important goal of this program.<sup>1</sup>

## Interesting Energy Facts



In your lifetime, you will use:

- 26 million gallons of water
  - 1,200 barrels of petroleum
  - 13,000 pounds of paper
  - 21,000 gallons of gasoline
  - 50 tons of food<sup>2</sup>
- 
- Automobiles, motorcycles, trucks, and buses drove over 2.8 trillion miles in 2002. That's almost one-twelfth the distance to the nearest star beyond the solar system. It's like driving to the sun and back 13,440 times.
  - Recycling a pound of steel saves enough energy to light a 60-watt light bulb for 26 hours. Recycling a ton of glass saves the equivalent of nine gallons of fuel oil. Recycling aluminum cans saves 95 percent of the energy required to produce aluminum from bauxite. Recycling paper cuts energy usage in half.

## Sample Program: Energy

### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

### II. Focus

Are you a plant? Let's do an experiment to find out. Did everybody have something to drink today? Good. Now plant your feet firmly in the ground, take a deep breath, and stretch your hands up toward the sunlight. Do you feel full? No? I guess we're not plants, then.

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<sup>1</sup> *Compendium for Energy Resources*. Presented by the California Department of Education, The California Energy Extension Service in the Governor's Office of Planning and Research, and Sonoma State University. March 1992.

<sup>2</sup> G. Tyler Miller, Jr. *Living in the Environment*. Belmont, CA: Wadsworth Publishing Co, 1998.

### III. Objectives

Plants can turn sunshine into food. Today we're going to find out not only how plants can do this, but also how animals (including people) get energy. We'll also find out the amazing ways that energy is transformed from one form to another form, and which energy sources are healthiest for people and for the environment.

### IV. Inquiry/Discussion

#### A. Photosynthesis

1. Explain how plants turn the sun's energy into food.
2. Activity: Photosynthesis Relay Race (see activity section below)

#### B. Animal Energy

1. Unlike plants, people can't get energy from the sun.
2. Why does your body need energy? What does it use energy to do?  
To move, talk, exercise, think, pump blood, breathe, etc.
3. What happens by about 10:30 a.m. if you go to school without eating breakfast?  
You get hungry and run low on energy.
4. Humans get energy for their bodies by eating food—oatmeal, fruit, hamburgers, or pizza, for example.
5. Where do animals get their energy?

Animals also get energy from food sources:

Herbivores get energy from eating leaves, grass, plants, berries, nuts, and acorns (give examples from your park, showing the kinds of plants some herbivores in your park eat).

Carnivores get energy from eating other animals (give examples from your park).

#### C. Food Chains

1. If a plant gets its energy from the sun, what happens to that energy when an herbivore like a rabbit eats the plant?  
The plant gives the herbivore energy to live: first the plant gets energy from the sun, then when the rabbit eats the plant, the sun's energy is transferred from the plant to the rabbit.
2. What happens if a carnivore like a hawk eats the rabbit?  
The hawk gets energy from the rabbit, who got its energy from the plant, who got its energy from the sun.
3. Hawks don't have many predators (animals who want to eat them). What do you think happens to all the energy the hawk has stored inside it when it dies?  
Some animals (scavengers) might eat the hawk after it dies. If they don't, bacteria and other tiny living things go to work on the bird's body. These decomposers, using the hawk's stored energy, release its nutrients back into the soil. These nutrients in turn are used by plants to grow. When the sun shines on the plant, the food chain and transfer of energy starts all over again.
4. Activity: Sing "There Once Was a Daisy" (see Appendix B)

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5. Why are there fewer mountain lions than mice? Fewer mice than blades of grass?

Explain energy loss: how energy is dissipated (used) in life functions such as movement, metabolism, growth, reproduction, and maintaining body heat. Plants and animals are temporary energy “vessels”—but very “leaky” ones.

### D. Sources of Energy

1. So far, we've been talking about the energy that living things need. But people need energy for more than just moving around. We also need energy to turn on lights, to run our television, to fuel cars, and for many other things, as well. What kinds of energy do we use every day at home?  
Mostly electricity, natural gas, and gasoline.
2. We know we're using electricity when we turn on a light or drive a car. But a lot of the energy we use is hidden. For example, here's the energy involved in getting the carrots you eat for dinner:
  - a. A farmer grows carrots. He uses fertilizer which is produced from fossil fuels.
  - b. A truck takes the carrots to a processing factory. The truck uses energy from gasoline to move.
  - c. At the factory, machines wash, slice, package, and freeze the carrots. The machines use energy from electricity to work.
  - d. A refrigerated truck takes the carrots to the grocery store. Energy from gasoline is used to power the truck to keep the inside of the truck cold.
  - e. At the grocery store the carrots are kept frozen in a freezer. Energy from electricity keeps the freezer cold.
  - f. You drive to the grocery store to buy carrots. Energy from gasoline makes your car move.
  - g. You drive home with the carrots.
  - h. You cook the carrots. Energy from electricity (or gas) makes your stove hot.
  - i. You eat the carrots. This gives you energy to play!

### E. Other Sources of Energy

1. Besides electricity and gasoline, we use other kinds of energy, including solar energy, nuclear energy, wind energy, oil, coal, and other fossil fuels. Some of these energy sources are renewable, which means we won't run out of them. No matter how much energy from a renewable source we use, we will never use it all up unless the source (a forest, for example) is destroyed. Can you think of an example of a renewable energy source?  
Solar (sun) energy, wind energy, food energy, electricity, tidal energy, geothermal energy.
2. Other energy sources are non-renewable sources. This means that we can—and probably will—use these sources up. Can you think of an example of a non-renewable energy source?  
Fossil fuels like oil and coal, nuclear energy.
3. Why do you think we might run out of these kinds of energy someday?

## ***Junior Ranger Program Handbook: Energy***

There is a limited amount of these kinds of fuel, and it takes hundreds and hundreds of years for nature to make them. We're using them up faster than they can be renewed.

4. Activity: Energy Detective (see activity section below)

### **V. Application/Conclusion**

- A. From being “energy detectives,” did you discover that some kinds of energy are safer and better for the environment?
- B. How can we save energy?
  - 1. Walk or ride your bike instead of taking a car.
  - 2. Turn off lights, radio, television, etc. when leaving a room.
  - 3. Put on more clothing instead of turning up the thermostat.
- C. Announce the topic and time of the next Junior Ranger program.
- D. Stamp logbooks.

## **Activities**

### **Photosynthesis Relay Race**

Number of Children: 8 or more

Environment: Open area, approximately 40' x 40'

Equipment needed: Any objects that can be used to mark boundaries

Purpose: To learn about plants as producers, and about the elements necessary in photosynthesis

Activity:

1. Introduce plants as producers—making their own food through photosynthesis. Introduce the elements needed in photosynthesis (sun, carbon dioxide, and water).
2. Divide the group into 2 teams. Each team is divided into two groups. One group becomes “water molecules,” and the other becomes “carbon dioxide molecules.” One person (possibly the instructor) is the sun. One person from each team is the “producer.” The producer starts at the sun.
3. On “go,” each producer runs to and holds hands with one “carbon dioxide,” and brings him/her to the sun. The producer then runs and gets a “water molecule” and brings her to and connects her with the carbon dioxide that is connected to the sun. Once connected, the producer must start at the sun and alternately weave through each member, then go back and pick up another molecule. This progresses until one team has all its molecules connected, when they shout “Photosynthesis!”

### **Energy Detective**

Number of Children: One or more

Environment: Any

Equipment needed: None





## *Junior Ranger Program Handbook: Energy*

Purpose: To identify different sources of energy in order to develop an ethic to use them wisely

Activity:

1. This is a sequential clue guessing game, in which Junior Rangers try to guess which kind of energy is being described.
2. Read clues aloud. Once the Junior Rangers know the answer, have them place a finger on their noses instead of raising their hands. When enough “noses have it,” have them call the answer aloud in unison.

*Adapted from Science Alive!, Unit 1 Energy Flow.*

### **Mystery #1—Answer: Plant/Food Energy**

1. I am a renewable source of energy (you won't run out of me).
2. You can make more and more of me.
3. You have to plant me, water me, and take care of me.
4. I am solid, but often I will bend in the wind.
5. I capture sunlight energy.
6. I need air, water, sun, and soil to grow.
7. You harvest me to eat me.
8. I am the source of energy for the human body.
9. I do not pollute.
10. I am not expensive.
11. Different types grow in different countries.

### **Mystery #2—Answer: Electricity**

1. I am a renewable source of energy.
2. You can use a machine powered by water, gas, oil, wind, or the sun to make me.
3. I power your T.V., radio and lamps.
4. The machine most often used to make me is a turbine.
5. If you build a dam and let out water to roll over the round turbine, it spins so fast it produces me.
6. You can only see me at night. During the day I am invisible.
7. I look like gold or silver sparks at night.
8. I can shock you.
9. Scientists discovered a way to produce me that uses renewable solar energy called photovoltaics.
10. Photo=light, Voltaics=electricity.
11. Because you must use another source of energy to make me, I am expensive.

### **Mystery #3—Answer: Petroleum Oil**

1. I am a non-renewable source of energy.
2. There is only a little bit of me on Earth.
3. I am thick, black, and gray.
4. I am a liquid found deep underground.
5. It's hard to get me off your skin, fur, or feathers.

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6. I am expensive to buy.
7. I am as old as the dinosaurs.
8. I am actually an ancient package of captured sunlight energy.
9. You use me in cars, buses, planes, ships, and factories.
10. When you burn me, I turn into black smoke that causes air pollution, can make it hard to breathe, and can make you sick.

### **Mystery #4—Answer: Nuclear Energy**

1. I am a non-renewable source of energy.
2. There is only a little of me on Earth.
3. I am made from a rare solid rock (uranium) that produces me when it explodes.
4. Once I'm made I am poisonous and stick around for a long time (hundreds of thousands of years).
5. Scientists have yet to find a safe place for the waste I create.
6. I am the most dangerous of all the energy sources.
7. I am very expensive to make.
8. If I wind up in the wrong hands, watch out—I could destroy life and property.
9. You use me to make electricity.
10. More and more scientists believe that I cause cancer.
11. You can build bombs out of me.

### **Mystery #5—Answer: Coal**

1. I am ancient, captured sunlight energy.
2. I am a non-renewable source of energy.
3. There is more of me than oil, but still my days are limited on Earth.
4. I am black, red, or brown.
5. I am a rock.
6. I am as old as the dinosaurs. In fact, I may have dinosaurs buried inside me.
7. I am not very expensive to buy.
8. You burn me to heat your house, to make old trains run, or to make factories work.
9. When you burn me, I turn into thick, black smoke that pollutes the air. This makes it hard to breathe and can sometimes make you sick.
10. Scientists are inventing ways to use me wisely.

### **Mystery #6—Answer: Solar Energy**

1. I am a renewable energy source.
2. You can use me to make electricity.
3. You can use me to heat your water.
4. You might see big panels that collect me on the tops of houses.
5. I am free, but the cells that are needed to turn me into energy can be expensive.
6. I am more abundant on a clear day.
7. You can't use me at night unless you store me.
8. Some people have calculators that are powered by me instead of batteries.
9. There are no bad effects to people or the environment from using me.

10. I work more efficiently in the light than in the shade.

**Mystery #7—Answer: Wind Energy**

1. I am a renewable energy source.
2. On some days there is more of me than on other days.
3. I make things turn, and the motion is turned into usable energy.
4. In Holland, and in some parts of California, you can see many of the things that turn me into usable energy.
5. I am the kind of energy that makes some kinds of boats go.
6. On some days, I make the trees sway.

## **Background Information: Energy**

Energy is the capacity to do work or the ability to make things move. Energy comes in several forms—sound, light, heat, active (kinetic energy), and stored (potential energy)—and can be converted from one form to another.

Energy is an important part of our lives. It makes us live and grow, runs our lights, refrigerators, and televisions, provides hot water for our homes, and makes our cars and buses go. We need energy for everything we do!

### **Photosynthesis**

Most plants have in common the unique ability to convert the sun's radiant energy to food. No other living kind of organism on earth can transform the sun's energy to support life. This process is called photosynthesis.

Leaves are like tiny sun-powered factories. In these factories, plants make food from water, carbon dioxide, and minerals from the soil. They do this by using a substance in the leaves called chlorophyll. Combining the sun's radiant energy with carbon (from the carbon dioxide), hydrogen (from water), and minerals from the soil, plants use the sun's rays to feed themselves.

This energy is stored in the plant's structure as sugar and starch, which possess chemical energy. As a byproduct of this process, plants produce the oxygen we breathe. Plants therefore help support human and animal life as they try to support their own.

### **Food Chains and Webs**

Energy relationships between organisms are called food chains. Food chains begin with the sun, since the main source from which living things receive energy is

## *Junior Ranger Program Handbook: Energy*

sunlight. Animals can't convert the sun's energy to food, so they can get this energy only by eating plants (or other animals who have eaten plants).

There are two major food chains: grazing food chains and detritus (decomposer) food chains. Grazing chains begin when plants, the producers, convert the sun's energy to sugar and starch. Then the consumers take over: plant-eating animals (herbivores) receive the stored chemical energy when they feed, using some for immediate energy. Meat-eating animals (carnivores) get their energy when they consume the herbivores, again using some of the energy and storing some. In turn, carnivores are preyed upon by other predators. In some cases, if these carnivores do not have many predators themselves, they become the last step in the food chain. Omnivores, including humans, eat both plants and animals.

Detritus (or decomposer) food chains include insects and microscopic forms of life that break down matter. This chain completes a cycle by reclaiming the elements stored in once-living tissue and returning them to the soil, where they again nourish plants. The decomposers make it possible for the energy and nutrients stored in the body of a dead animal to support new life, rather than remaining unavailable and therefore being wasted.

Food chains are an overly simplistic way to describe the energy transfer between organisms. Most animals are part of more than one food chain and eat more than one kind of food in order to meet their food and energy requirements. These interconnected food chains form a food web. Food webs show how plants and animals are connected in many ways to ensure their survival.

### **Energy Loss**

Each time an animal eats plants or another animal, some of the sun's energy is passed along the food web. However, at each link of that web, some of this energy is lost. When an herbivore eats a plant, it is eating only a small portion of the original "sunlight" energy. When a carnivore eats the herbivore, it gets an even smaller fraction of the original energy.

A food web can also be thought of as a pyramid. For example, a marsh full of cattails can provide enough food for a group of mice. But most of those mice might be needed to provide food for only one weasel. Because of this energy loss, there are relatively few carnivores, more herbivores, and lots of plants! It takes a lot of plants to support just one carnivore.

Carnivores are large and depend on meat, so there must be fewer carnivores in an area than the number of animals they eat. In general, carnivores have a population density of approximately one per square mile, whereas omnivorous mammals average about 20 per square mile and herbivorous rodents may attain densities of up to 100,000 per square mile.

## Junior Ranger Program Handbook: Energy

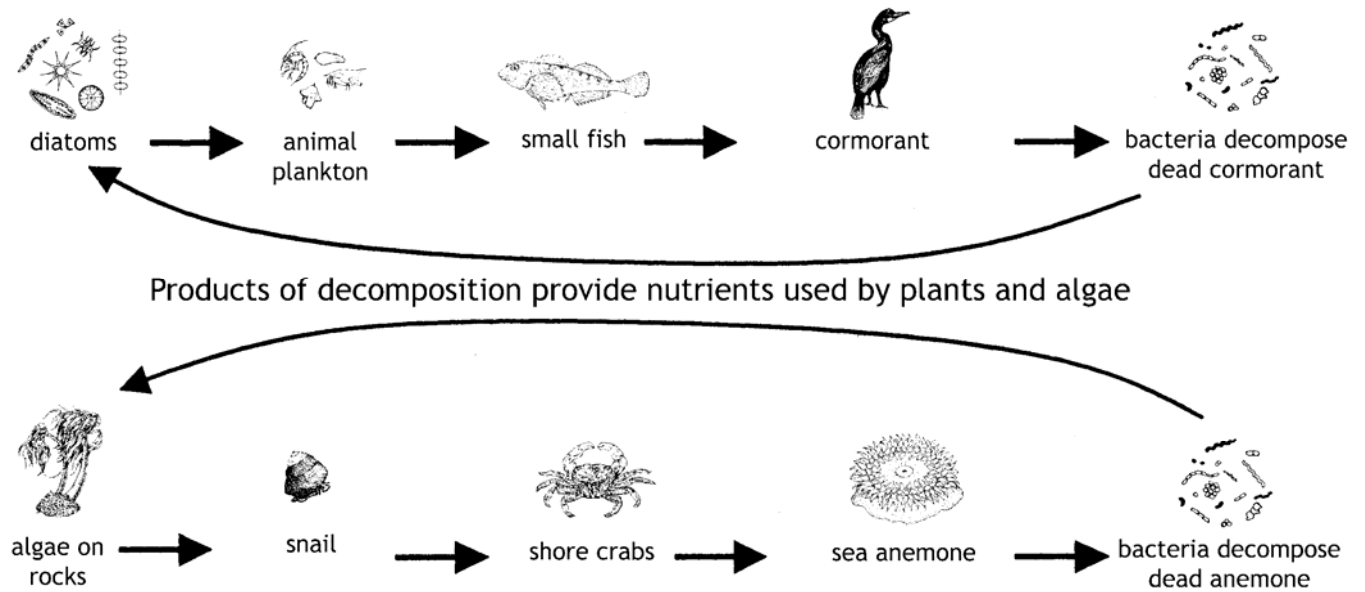
Humans are members of many food chains. For example, when we eat an ear of corn, we are part of a simple two-link chain: plant to human. When we eat a hamburger or drink milk, we are part of a three-link chain: grass to cow to human.

Since it takes so much more energy to support a carnivore, it's a good thing humans are omnivores! If humans ate only meat, the average person would consume about 1100 pounds of beef per year (or the equivalent of three calves). The three calves would eat 20 million alfalfa plants, which would require ten acres of land to grow. Each person would need ten acres of land to provide the meat needed for one year!

### Following a Food Chain . . .

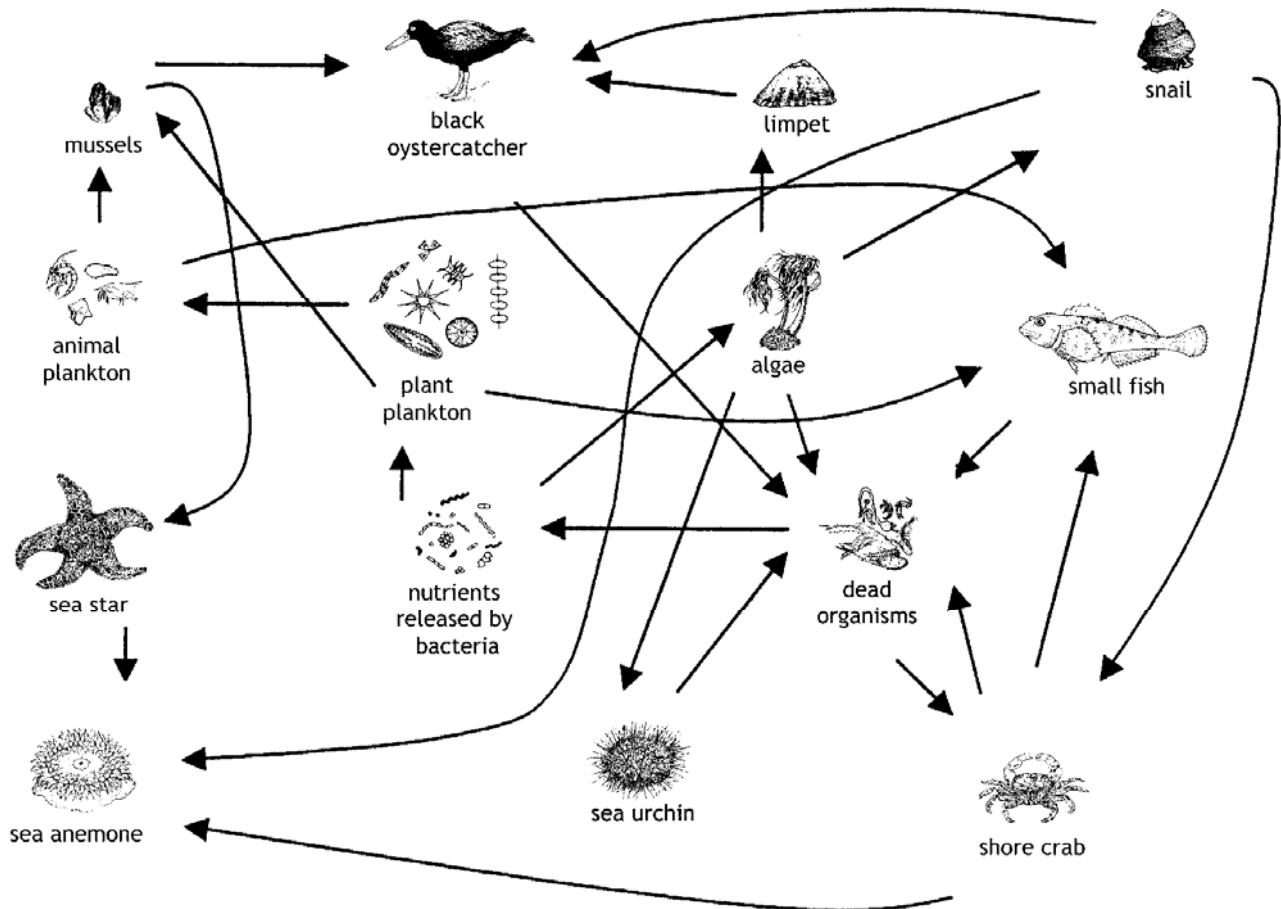
#### Intertidal Food Chains

An arrow indicates that an organism is eaten by another.  
For example, sea urchin  $\longrightarrow$  an otter  
(is eaten by)



### A Simplified Intertidal Food Web

Remember that the organisms depend on light (energy) from the sun, and minerals and water from the sea. Even in this simplified web, to make it readable, not all connections are drawn.



### Energy Sources

There are six primary sources of energy that are naturally available to us on earth: solar, chemical, nuclear, geothermal, tidal, and wind. Two of these, chemical and nuclear, are stored (potential) forms of energy. The other four (solar, geothermal, tidal, and wind energy) are kinetic forms of energy—energy that is active and always in motion. While we can use stored types of energy whenever we need them, we can only use kinetic forms when nature makes them accessible. (For example, solar energy is most readily available during sunlight hours, although some solar energy, stored as heat, can be released after dark).

### Solar Energy

Solar energy (or sunlight) falls on the earth and provides heat and light for plant and animal life. A small fraction of the sun's energy interacts with plants and fuels the

photosynthesis process, and is thus indirectly responsible for the food energy that we depend on.

Solar energy is also the source of the chemical energy that was stored hundreds of millions of years ago in the plant life of the swampy jungles on earth. We are using stored solar energy when we burn the fossil fuels: coal, petroleum, and natural gas.

The sun's energy also heats the land and the oceans and thus provides the energy for the great air and ocean currents—the winds and the waves. Scientists and engineers have found practical ways to use solar energy to heat and cool individual homes. Solar energy is the most abundant and continuous form of energy available to people, and has no adverse effects on human, animal, or plant life.

## **Fossil Fuels**

Fossil fuels are sources of chemical energy. Energy is released through a chemical reaction. Most of the electricity produced in the world comes from the chemical energy released from the burning of wood, coal and oil.

Fossil fuels are used extensively because they are relatively easy to find, collect, store, transport, and use. Once discovered, the fuels can be removed from the ground by mining or drilling, and are transported by pipes, truck, rail, etc. to any destination.

Although we currently have enough fossil fuels available, at some point we are likely to deplete the earth's supply of fossil fuels, because the earth creates these fossil fuels very slowly. It would take 300 million years for the earth to replace the fossil fuels we have used in the past century. Since we use fossil fuels so much more quickly than the supply can be replenished, we cannot continue to use these fuels at current consumption rates for much longer. For this reason, fossil fuels are non-renewable sources of energy. Natural gas is a fossil fuel which is extracted by drilling wells. Geologists investigate land formations to look for likely spots. A drill breaks up the rock, and a pipe is lowered into the ground. Generally, the gas is found at least 5000 feet below the surface. Because geologists can only guess where gas is likely to be, these exploratory drillings sometimes fail to discover any natural gas.

Natural gas is used in heaters and air conditioners, or is turned into electricity. Natural gas is relatively harmless to people and the environment. However, it is a limited resource and cannot be considered a long-term energy solution.



Petroleum is also a fossil fuel. It is found by exploratory drilling in areas where geologists think it might be. The rock is broken up and a pipe is inserted into the ground which transports the oily substance to the surface. An average oil well is 4500 feet deep.

## *Junior Ranger Program Handbook: Energy*

We use oil in our cars, buses, airplanes, ships and factories. Oil is not without its problems, however. It can harm the environment when it is produced, shipped, or burned; dumped into the water, it can kill marine life.

Coal, like oil and natural gas, is a fossil fuel formed from the remains of vegetation. Coal can be mined either on the surface or underground. In underground mining, a hole is dug to the coal bed and gradually a tunnel large enough for men and machines to enter is cleared. Coal is cut from the surrounding rock by machines, and transported to the surface on conveyors, where it is processed, loaded on trucks, and delivered to its destination. Surface mining is used when the coal is near the surface. Power shovels and bulldozers remove the earth, rock, and vegetation above the coal, then smaller machinery retrieves the coal. Strip mining digs up all overlying vegetation, so soil erosion occurs more quickly. All states now require that the mined land be restored. Dust levels in underground mines often cause the miners to have respiratory (breathing) problems.

Coal also causes problems when it is burned. Most coal contains a chemical called sulphur that creates pollution. Coal is also dirty, and leaves soot and grime. Coal is most often used today in the generation of electricity.

### **Nuclear Energy**

Nuclear energy is produced when the splitting or fusing of atomic nuclei occurs. These reactions are called fission or fusion, respectively. Although we can currently use only fission to produce usable energy, physicists will eventually have the technology to use fusion for energy as well.

The use of fission has been controversial. Proponents of nuclear energy argue that it does not pollute the air, add to the greenhouse effect by adding CO<sub>2</sub> to the atmosphere (as in the burning of coal and oil), or contribute to acid rain. It is also an important energy source for countries such as France, who do not have adequate coal, oil, or hydro-electric power to meet energy needs. Although fission was once considered inexpensive, the costs of storing or reprocessing the spent fuel and dismantling the plant when its lifetime is over have proved very expensive.

The problems of mining the uranium required for the fission reaction are similar to those of other types of mining. The miners are exposed to dust, accidents, fumes, and intense noise. Moreover, breathing radioactive gas has been linked to lung cancer. Waste materials from uranium mining are also dangerous and must be kept contained. The reactors themselves are highly radioactive, and must be kept out of contact with living material. Nuclear plant discharge (or waste) must be stored for hundreds of thousands of years before it is safe.

There is a safer, less expensive future for nuclear power, however. Plasma physicists are currently working on a fusion power plant, which would use an inexpensive fuel, deuterium, which can be found in ocean water. Deuterium is a naturally occurring

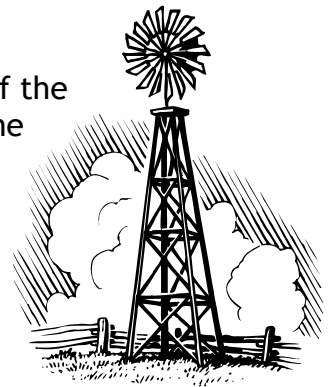


isotope of hydrogen which can be fused to produce helium. In the process, under conditions of very high temperature and pressure (such as occur on the sun), energy is released. The byproducts of this process have a relatively short-lived radioactivity and decay quickly, as opposed to the hundreds of thousands of years for fission waste products. Although this technology is being studied by many nations, including the U.S., Europe, and Russia, it has not yet been realized as a source of power.<sup>3</sup>

## **Geothermal Energy**

There is a tremendous amount of energy in the earth from the heat of molten rock and radioactive decay. Although heat energy is an active or “kinetic” form of energy, the heat of the earth is effectively stored and insulated by the solid, thin crust on which we live.

When heat from the molten interior of the earth meets underground water, steam results. When this steam pushes through the surface of the earth, it creates geysers. Geologists study these geysers to determine whether they are usable; if so, the steam is channeled to a nearby electric plant for conversion to electric power. Geothermal energy can be used directly and does not require a processing plant. It does not create major land disturbances (as with mining) or waste disposal problems (as do nuclear energy or fossil fuels). When available, it is considered a desirable source of energy.



The drawbacks to geothermal energy are the sulfur and other noxious fumes produced, and the corrosive qualities of this water, which results in high maintenance costs for machinery. In addition, geothermal energy is available to us only in those regions where magma (molten rock inside the earth) is close to the surface and the energy can leak out through cracks in the crust. Since these sources are not numerous, geothermal energy is not widely used. In California, we have a geothermal plant in the Sonoma area.

## **Tidal Energy**

Like geothermal energy, tidal energy is a form of continuous energy from the sea. To use this energy, the water is used to turn a turbine and create electricity. Tidal generation of electricity is only practical in places near an ocean where there are high tides. Tidal energy is the least used of the six energy sources.

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<sup>3</sup> Information on fusion is from theoretical physicist Dr. Philip F. Meads, Jr.

## **Wind and Water Energy**

Wind and water energy are used extensively in areas where they are available. The kinetic—or moving—energy of water and wind can be converted to electricity through the use of windmills and turbines.

Windmills are turned by the blowing wind, and this motion produces electricity. In some areas of California, you can see groups of these windmills turning as they generate electricity.

Water energy (or hydroelectric energy) works as water in a dam is released, rolling over a round turbine. The turbine spins very quickly, and this motion produces electricity. Wind and water are renewable sources of energy.

## **Electricity**

We call electricity an intermediate form of energy. It is not stored energy, like fossil fuels, and it is not in the form in which it finally appears as light, motion, or heat. Electricity can be generated by water, sun, or wind. Otherwise, electric energy depends on fossil fuels to be created, and the adverse effects of fossil fuel usage become the adverse effects of electricity production.

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### **Other Sources of Information**

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National Renewable Energy Laboratory. [www.nrel.gov/learning](http://www.nrel.gov/learning).

United States Department of Energy. "Energy Efficiency and Renewable Energy." [www.eren.doe.gov](http://www.eren.doe.gov).

**INSERT *GEOLOGY* TAB HERE**



# Geology



*“Among these mighty cliffs and domes there is no word of chaos, or of desolation; every rock is as elaborately and thoughtfully carved and finished as a crystal or shell.”*

*—John Muir*

## Introduction

Geology is not simply a science of rocks. It is a broad, integrated science which includes the study of plate tectonics, volcanoes, landslides, earthquakes, erosion, rocks, minerals and fossils. The study of geology can be awe-inspiring. Sir Francis Galton said, “When I contemplate the aeons of Geologic Time thru which Evolution has proceeded, I feel my life is as a tiny wave lifted up for a moment on an Inland sea.”

Spend time examining rocks in your park and discuss the geomorphology (the study of landforms and the processes by which they were created) that make your park unique. In a historic park, you could visit a stone building. Where did the rocks come from? Who brought them to the site? One example: The summit building at Mount Diablo State Park contains ancient marine fossils embedded in its sandstone walls.

From the outset, it is important to distinguish between landforms and the rocks from which they're made. They can, and often do, have different origins and ages. A mountain uplifted by local faulting may contain rock material formed millions of years earlier in an ocean basin hundreds of miles away. Whenever discussing geology with park visitors, the interpreter must keep this distinction in mind; otherwise, confusion will result.

When interpreting geology, you may want to give the Junior Rangers a sense of the scope of the science, but don't forget to be specific, as well. Alternatively, you may choose to focus (in depth) on one area of this vast science.

At an introductory level, geology allows the visitor to exercise his or her powers of logic and deduction. Rocks often provide common-sense clues to the ancient environments that once existed in an area. Rub your hand over a piece of sandstone,

loosening the grit. Children can easily equate the sand with beach or dune settings they've visited in the past. Similarly, a piece of conglomerate may denote a long-vanished stream bed; "limy" rock, a shallow sea; and lava, volcanic vents not too far away. If you learn the relative ages of the rocks in your area (consult geologic maps for this), then a rough outline of your park's geologic history can often be pieced together . . . using the deductive skills of both interpreter and audience.

## Interesting Geology Facts

- Tsunamis can barrel through the ocean at 600 miles per hour. That's as fast as the cruising speed of a jet plane.
- California is moving because of plate tectonics. In 100 million years, part of California will be up near Alaska. Brrrr!
- All of the continents on the planet (Europe, Asia, Australia, Africa, South America, North America, Antarctica) were once (about 250 million years ago) combined into a super-continent scientists have named Pangaea.
- When Mount St. Helens erupted on May 18, 1980, it sent a cloud of ash 12 miles into the air, some of which was deposited hundreds of miles to the east by prevailing westerly winds.
- Mauna Kea, a Hawaiian volcano, is the tallest volcano in the world. When measured from its base on the ocean floor to its summit, it is over 33,000 feet high—more than 4,400 feet higher than Mt. Everest!
- In the winter of 1811 to 1812, a series of earthquakes in New Madrid, Missouri set off geysers, caused islands to disappear from the Mississippi River, and rattled windows in Washington, D.C.



## Sample Program: Geology

- I. Introduction
  - Introduce yourself to the group.
  - Introduce the Junior Ranger Program.
- II. Focus

## Junior Ranger Program Handbook: Geology

Ask the Junior Rangers what they think geology is (they will probably say “the study of rocks”). Tell them that geology is much more than just the study of rocks.

### III. Objectives

Today we are going to find out about the rocks in the park. How were they formed? How did they get there? How was the earth formed?

### IV. Inquiry/Discussion

#### A. Formation of the earth

1. How long ago do you think the earth was formed?

4.5 billion years ago

2. Is the earth solid?

No—The earth is made up of many layers. At the center there is a hard iron core. On top of that, there is a layer that is so hot it oozes very slowly. And our continents are on plates that move. The sea floor moves too.

3. Describe the characteristics of the different “layers” of the earth.

4. Activity: The Earth, Inside and Out (see activity section below)

#### B. Earthquakes

1. Have any of you ever experienced an earthquake?

2. How long do they usually last?

A few seconds to a minute

3. Can earthquakes happen anywhere?

Yes

4. Are they more likely to happen in one place than another?

Yes, they are more likely to occur on or near plate boundaries.

5. Can you name an earthquake fault line in California?

The San Andreas Fault, the Hayward Fault, etc.

6. How do scientists measure how big an earthquake is?

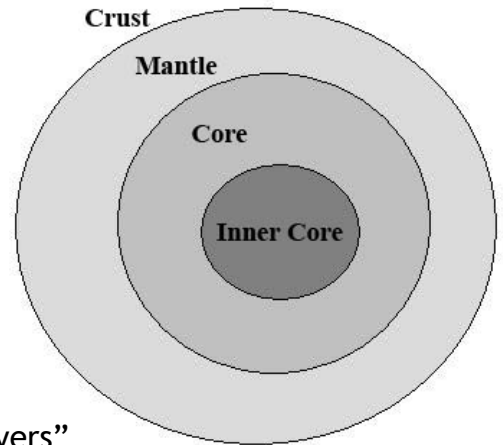
They use the Richter Scale. With every point on the Richter scale the degree of ground shaking changes by a factor of ten (the amount of energy released changes by a factor of 32). For example, an earthquake that measures 5 points on the Richter Scale results in ten times the level of ground shaking than an magnitude 4 earthquake.

#### C. Volcanoes

1. What is a volcano?

A volcano is one or more openings, or vents, in the surface of the earth through which molten rock, gases, solid material (such as ash and solid rock) and steam are forced out. Volcanoes often form near plate boundaries. Where plates are moving apart, lava may ooze out of vents on the ocean floor.

2. How do volcanoes erupt?





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The way a volcano erupts depends on the characteristics of the magma (hot, molten rock from deep in the earth), the shape and length of the vents, and whether or not the vents are plugged by rock. For example, some eruptions are very quiet and the lava that flows out is very runny. Other eruptions are violent, flinging out 20-mile (32 km) columns of ash or forming ash clouds that are loaded with bits of lava. The type of eruptions a volcano produces influences the way it looks. For example, if a volcano usually ejects runny lava, a gently sloping, dome-shaped mountain will form.

3. Activity: Make a volcano (see activity section below)
4. Do volcanoes do anything good?  
Although the eruption of a volcano can be one of the most destructive forces on Earth, volcanoes also build new land, produce mineral-rich ash that helps fertilize the soil, and produce gases that are important to life on earth.
5. Volcanoes don't always extrude ash. What else comes from volcanoes?
6. Name a rock that comes from a volcano.  
Obsidian, pumice, others
7. The kind of rock that comes from a volcano is called igneous. Show a sample of a glass-like igneous rock (obsidian, for example). What do you notice about this rock?  
It's shiny and smooth in places, like glass.  
Some kinds of igneous rocks look glassy because when they came out of a volcano they were very hot and cooled very quickly on the earth's surface. Not all igneous rocks look like this. Basalt, for example, is an igneous rock that is not shiny. Other kinds of igneous rocks cool very slowly under the earth's surface. These rocks have well-formed crystals. Sometimes, changes in temperature and pressure within the earth's crust change a rock into another kind of rock. These new rocks are called metamorphic rocks.
8. Show examples of original and metamorphic rocks (limestone/marble or shale/slate, for example).
9. To represent how a rock changes into a metamorphic rock, take a piece of bread and squeeze it into a ball. Explain that if you then heated (or toasted) this bread ball, it would be like a metamorphic rock: still made up of the same "ingredients," but now in a different form and with different characteristics.
10. Still other kinds of rocks are formed on river, ocean, and lake bottoms from layers of sand and mud. Over time, pressure or evaporation cements these layers into rocks. These are called sedimentary rocks. Sometimes shells and animal bones can become part of sedimentary rocks. Show an example of a sedimentary rock—one that shows the layers of material, such as sandstone, shale, or limestone.
11. What type of rock would have fossils in it?  
Sedimentary

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12. Take time to investigate your own park's geologic environment. Show examples of local rocks. Are they igneous? Sedimentary? How can you tell? Smell! Touch! Taste! Examine in detail. Have the children imagine how the rock may have gotten there. Was it brought down by a river? Extruded from a volcano? Look for signs of nature's impact on landforms. Are there land or mud slides? Wind, water, or ice erosion? What evidence of erosion can you find? Discuss how wind, water, and ice can be "stronger" than solid landforms by eroding them over time.
13. Your park will have its own individual character. Discuss relevant geology: mountain formation, stream erosion, sand dune formation, beach migration, etc.
  - a. Why are pebbles round and smooth?  
From the action of water
  - b. If a rock is rough with sharp edges, what does this tell us?  
It could have been broken by plant roots or it fell and was broken by a hard landing, or possibly it was eroded by ice.
  - c. What is soil?  
Broken down rock, dead plant and animal material, and flood deposits that plants have started to grow on.
  - d. Is soil the same down to the rock?  
No—only the uppermost layer has nutrients from decayed plants and animals. It is the only layer that can be used by farmers.
14. Encourage the children to investigate their own yard. What types of rock might they find?

### V. Application/Conclusion

- A. Ask Junior Rangers to tell you what they have learned.
- B. How can we be safe in an earthquake?
  1. Get under a sturdy table or desk, or stand in a doorway.
  2. Stay away from windows and objects that may fall.
- C. Announce the next Junior Ranger program and other interpretive programs.
- D. Stamp logbooks.

## Activities

### Make a Volcano

Equipment needed: dirt or damp sand, small jar with wide neck, quart size container,  $\frac{1}{4}$  cup white vinegar,  $\frac{1}{4}$  cup dishwashing liquid,  $\frac{1}{2}$  cup water, 4 tablespoons baking soda, red food color

Make a mountain of dirt or sand about a foot high. Bury the small jar in the top of your mountain with the opening sticking out. Put the baking soda in the small jar. In the large container, mix the water, soap, vinegar, and a few drops of red food coloring to make the mixture look like hot lava. Pour some of the mixture into the

small jar to create an eruption. You may have to stir it slightly. When baking soda and vinegar are mixed together they form carbon dioxide, a bubbly gas. These bubbles mix with the soap and come pouring out of the top of the volcano like lava.

### **Picture It**

Unless you've seen a volcanic eruption or experienced an intense earthquake, it's hard to comprehend the incredible forces that exist within the earth. Try showing pictures of volcanoes, faults, earthquake damage/effects, tsunamis, and geysers.

### **Rockin' and Rollin' Ground**

Have the kids form two lines facing each other. Tell them that they represent the two plates on either side of the San Andreas Fault in California. Have one child join hands with the person opposite him or her and explain that they represent a fence that stretches across the fault. On your signal, have the two lines take ten sideways steps in opposite directions. The "fence" should stretch and finally break during the shift.

### **Racing an Avalanche**

Have the kids line up, then place a marker 100 feet away. Explain that they'll be trying to run faster than the hot mud and ash that flowed down Mount St. Helens' slopes after its 1980 eruption. Give the signal and time the kids as they run to the marker. When they catch their breath, tell them that they were all beaten by the avalanche. It sped down the mountain at about 100 miles per hour and would have finished the race in less than one second! (Point out that not all lava, mud, and other material ejected from volcanoes flows this fast.)

### **Timed Quakes**

Divide the kids into pairs and have one person in each pair keep time while the other one shakes. Tell the "shakers" they should shake until one minute is up. Were they right? Then have the kids switch roles. Afterward tell the kids that most earthquakes last for less than one minute, but a severe earthquake in Alaska in 1964 shook the ground for several minutes.

### **Rock Hunt**

Take the group on a rock hunt so the kids can search for their own special rock samples. Have them try to find four or five interesting and different-looking rocks to study. Study each of the rocks carefully. (You can pass out hand lenses to let them get a closer look). Explain that they should think about how each rock feels and looks.

Have each Junior Ranger pick out a favorite rock and put the others aside for the time being. Have them think up words that describe their rocks. Now have the children get into small groups and put all their collected rocks into a pile. Tell each group to separate their rocks into two piles according to any of the characteristics they just

came up with. For example, the kids could sort their combined collections into piles of rocks that are dark or light, smooth or rough, shiny or dull, and so on. Let them come up with some other ways to sort the rocks, such as by color, size, or shape. Point out that scientists also make categories for rocks based on the rocks' similar features. (After the activity, ask the Junior Rangers to put the rocks back where they found them).

### **Metamorphic Bread**

During a discussion on types of rocks, use a slice of bread to take the place of a "normal" rock. Then show how metamorphic rocks are changed by pressing and shaping the bread slice until it is a ball of dough. This activity demonstrates that although the bread ball is made up of the same ingredients as the original slice, its shape, consistency and features have been changed. (If you then "toasted" or baked the bread, it would be even more like a metamorphic rock!)

### **Stone Identification**

Ask each Junior Ranger to find a stone. With the group sitting cross-legged in a circle, ask everyone to feel their stones carefully without looking at them. Give them a minute or so to do this, then ask everyone to pass their stones to you. After jumbling them up, cover each stone with your hand and pass it to your right. Tell everyone to try to identify the stone they chose by its feel. Each time a person receives a stone, she will feel it to see if it is hers. When she thinks she has found her stone, she is to let it drop to the ground and continue passing any other stones that are passed to her. Do not tell them in advance why they are to feel the stone, and emphasize the importance of not looking at it. When all stones have been claimed, have each person check to see if he/she was right! (Afterwards, ask the Junior Rangers to put the stones back where they found them.)

*From The Interpreter's Guide by William J. Krumbein and Linda Levya. Sacramento: Department of Parks and Recreation, 1977.*

### **The Earth, Inside and Out**

Number of children: 12 or more

Environment: Open space

Equipment Needed: None

Purpose of Activity: To learn about the structure of the earth by acting out the characteristics of its different layers

Activity:

1. Explain that the group is going to work together to build the earth. First give each Junior Ranger a part to play. Then, explain what each part does. (See Background Information on page 7-8.) Let the kids practice any sounds or movements and then build the earth from the inside out.
2. Have the child playing the part of the inner core flex his or her muscles or pretend to lift weights and stand in the center of the area. Tell the kids that this represents that the inner core is very dense and is solid metal.

3. Next have the outer core form a circle around the inner core. They should face in, toward the inner core. Then have them walk counterclockwise around the inner core while holding their arms out to the sides and waving them up and down. Tell the kids this represents the fact that the outer core is liquid and is moving.
4. Have the children playing the deep mantle join hands to form a circle around the inner core. (Have them chant “hot rock, hot rock, hot rock.”).
5. Have the asthenosphere kids surround the deep mantle. (Have them slowly sway their bodies back and forth to represent the movement that occurs in this layer).
6. Finally, have the lithosphere kids form a circle around the entire rest of the earth. Have them face outward and slowly walk around the rest of the earth. (Have them chant “Moving plates, moving plates.”)

## Background Information: Geology

### Composition of the Earth<sup>1</sup>

The earth is divided into three main layers: a thin outer crust, a thicker mantle, and a core. The outer crust is a thin rocky skin that covers the planet. In comparison to the rest of the earth, it is like a stamp on a billiard ball. At its thickest, it is only 22 miles deep. There are two kinds of crust: continental and oceanic. Continental crust consists of relatively light (and often light colored) rocks made of elements like aluminum, silicon, and oxygen. Although the continental crust is thicker than oceanic crust, oceanic crust is made of denser, heavier rocks (like basalt) containing iron, magnesium, silicon, and oxygen. The heavier oceanic crust underlies the lighter continental crust.

The layer underneath the crust is the mantle, which is made up of much denser material than the crust. The mantle is made up of solid rock in several zones. The mantle and crust, which compose the “lithosphere,” are cooler and more rigid than the lower parts (“the asthenosphere”). The asthenosphere is a hot, unstable zone which is solid, but can flow at very slow rate. Geologists think the lithosphere floats on this more mobile zone and slowly slides around on it.

Underneath the lithosphere and the asthenosphere lies the core, at the center of the earth. The core is a mass of hot, heavy metals like iron and nickel, and is a source of heat deep within the earth.

### Plate Tectonics

In the 1960s geologists developed the plate tectonics theory. According to this theory, the lithosphere is not a continuous sheet of solid rock, but is divided into

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<sup>1</sup> Geology information and activities are from Ranger Rick’s *NatureScope*. “Geology: The Active Earth.” National Wildlife Federation, 1987.

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several huge plates and many smaller plates that float on the top of the asthenosphere. (A plate can be hundreds or thousands of miles across).

Plate tectonics explains how major geological events occur. Most mountain building, earthquakes, and volcanic activity take place along the margins of the plates. The plates interact with each other to affect the crust.

Where two plates pull apart from each other, new oceanic crust is formed. Magma (hot, molten rock from deep in the earth) oozes out of cracks along rifts and hardens to form new crust.

When two plates carrying continents run into each other, the collision crumples both plates and, over millions of years creates mountain ranges. If two plates collide and one is made up of continental crust and the other is made of oceanic crust, the denser oceanic plate gets pushed under the edge of the continental plate. As the lower plate is pushed under, it begins to heat up in the hotter mantle. The ocean sediment on the plate begins to melt, and this melted rock (magma) begins to move upward, often fueling volcanoes in the mountain ranges that have formed on the upper plate.

When two plates slide sideways past each other, the slipping motion often causes earthquakes. In some places, a narrow plume of hot material rises up through the mantle and creates a hot spot under the plate. As the plate slowly moves over the hot spot, a line of volcanoes is formed. As a volcano is carried past the hot spot, it becomes inactive, but in time a new volcano will be formed over the hot spot.

Most of these changes are so slow they go unnoticed, but earthquakes and volcanic eruptions are sudden, dramatic results of plate movement. Land along the San Andreas Fault, the boundary between the Pacific and North America plates, is moving an average of two inches per year. This is about the same rate that fingernails grow.

### **Volcanoes**

Volcanoes usually form along plate boundaries. Where plates are moving apart, lava may ooze out of undersea vents. A volcano is one or more openings, or vents, in the surface of the earth through which molten rock, gases, solid material (such as ash and solid rock), and steam are forced out. The way a volcano erupts depends on the characteristics of the magma, the shape and length of the vents, and whether or not the vents are plugged by solid rock. For example, some eruptions are very quiet and the lava that flows out is very runny. Other eruptions are violent, flinging out 20-mile (32 km) columns of ash or forming ash clouds that are loaded with bits of lava.

The type of eruptions a volcano has influences the way it looks. For example, if a volcano usually ejects runny lava, a gently sloping, dome-shaped mountain will form. Although the eruption of a volcano can be one of the most destructive forces on Earth, volcanoes also build new land, produce mineral-rich ash that helps fertilize the soil, and produce gases that are important to life on earth.

## **Earthquakes**

Earthquakes can happen anywhere that movement occurs along a fault. But most earthquakes occur near plate boundaries. To compare earthquakes, scientists measure each quake's intensity and magnitude. The intensity of an earthquake is a measure of how badly it shakes people and people-made objects. It is measured on the Mercalli Intensity Scale from 1 (only detectable by sensitive instruments) to 12 (causing complete destruction of buildings and other objects).

The magnitude of an earthquake is a measure of how much energy it gives off and is independent of how much damage it causes. Magnitude is recorded by seismographs and is measured on the Richter Scale from about -3 (barely detectable by seismographs) to about 9 (earthquakes that can cause severe damage). Each point on the Richter scale means an earthquake's strength changes by a factor of ten (an earthquake registering 6 points on the Richter scale is ten times bigger than an earthquake measuring 5 points on the Richter scale).

Though a big earthquake can cause a lot of damage, sometimes a greater amount of damage is caused by the fires that rage afterward. As the earth shakes, it often disrupts electrical and gas lines that can, in turn, start fires. And broken water lines make fighting the fires almost impossible.

## **Geysers**

It takes three things to form a geyser: water, a series of irregularly shaped “tubes,” and a heat source hot enough to boil water. The water that is shot out of geysers is usually groundwater, which originates from rain or snow melt that has trickled deep into the ground through cracks and pores in the rocks. As this water circulates deep underground it is heated by hot rocks that in turn have been heated by an underlying body of magma.

How often a geyser “blows” and how long its eruption lasts can vary from geyser to geyser. Some geysers erupt every hour or so, while others may have several hours, days, or weeks between eruptions. And while some geysers may gush for only a few minutes, others may have eruptions that last 45 minutes or more.

Almost all of the world's geysers are in New Zealand, Iceland, and Yellowstone National Park in Wyoming. Yellowstone has approximately 200 geysers—more than the rest of the world combined.

## **Tsunamis**

A tsunami is a giant ocean wave that starts when a sudden motion in the earth jolts and displaces the water in the ocean. Undersea earthquakes, coastal earthquakes, and volcanic activity are the usual causes of tsunamis. Most tsunamis occur in the Pacific Ocean.

The height and speed of a tsunami are affected by the depth of water it is traveling through. Out in the middle of the ocean, a tsunami may be only three feet high, but when it reaches the shore it may tower above land 100 feet or more. The wave is so large that a boat at sea may rise and fall without being aware that a huge wave is passing under it. A tsunami can travel through the ocean at 600 miles per hour.

## **Fossil Formation**

Fossilization occurs when organisms, either plant or animal, or evidence of activities, such as droppings, pollen grains, footprints, etc., are covered in sediment of some kind before scavenging animals or the natural processes of erosion or decay completely destroy them. Rapid burial of this kind is most likely to occur in the sea where a continuous rain of debris (like silt and fine sand) falls onto the sea floor. As a result, scientists have found many more fossils of sea creatures than land creatures. Land dwelling animals are generally preserved as fossils when their bodies are washed into lakes or into the sea, although some have been preserved in sand dunes. Usually only the hard parts like teeth, shells, and bones get preserved, since soft tissues—skin, muscles and sinews, for example—tend to decompose quickly. However, soft-bodied jellyfish and worms have been fossilized. A fossilized bone isn't exactly the same bone because even parts of bone can decompose. New minerals from the water or soil around the bone enter the pores (spaces) left by the decomposed material, making the bones strong and hard again, and heavier.

## **Rock Formation**

### Igneous Rocks

Igneous rocks are formed when molten rock material called magma cools and hardens.

- **Volcanic Igneous Rocks:** These rocks are called extrusive igneous rocks. Some of these extrusive rocks (such as obsidian) appear glasslike because they cool rapidly on the earth's surface (However, not all appear glassy: basalt is an extremely common non-glassy extrusive rock). These rocks are very fine grained and have small, poorly formed crystals.
- **Plutonic Igneous Rocks:** These rocks are called intrusive igneous rocks because they cool very slowly beneath the surface of the earth. Intrusive rocks form when magma is pushed up toward the crust, but cools and crystallizes before it reaches the surface. Because of this slow cooling, intrusive rocks have large, well-formed crystals.

### Sedimentary Rocks

Sedimentary rocks originate from fragments of other rocks, from minerals that are deposited chemically, or from accumulation of organic material. These rocks accumulate on the surface of the planet, often underwater. Sedimentary rocks cover 75 percent of exposed land mass, but compose only 5 percent of the crust. Sedimentary rocks are often layered rocks. Most get their start when wind, ice and water wear down rocks into bits of sand, soil, mud, pebbles, clay and other loose



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sediment. As this sediment washes into rivers, lakes and oceans, it piles up, layer upon layer. Over time, as the pressure on the bottom layers increases, the sediment compacts and cements together to form solid rock. For example, sandstone is a sedimentary rock that is made up of layers of compressed and cemented sand grains (usually quartz). And shale is a sedimentary rock made up of layers of mud (very fine-grained quartz, feldspar, and clay minerals).

Sometimes sedimentary rocks and minerals are formed by the evaporation of water that contains various dissolved substances. When the water evaporates, the minerals crystallize. Two examples of sedimentary rocks that form in this way are halite (formed from dissolved sodium chloride) and some types of limestone (formed from dissolved calcium carbonate).

Coal, chalk, and a few other sedimentary rocks form from organic material, such as the shells or skeletons of plants and animals. For example, shellfish can use calcite dissolved in the water around them to build their shells. When these animals die, their shells pile up on the bottom. As the shells become cemented together, limestone often forms.

The four processes involved in the creation of sedimentary rocks are:

1. Disintegration: The chemical and mechanical breakdown of rock on the earth's surface. (e.g. by wind, ice)
2. Transportation: The movement of these particles to an endpoint (e.g. by river).
3. Deposition: The act of dropping these particles at their endpoint.
4. Compaction/Cementation: The conversion of the particles into solid rock layers.

### Metamorphic Rocks

Metamorphic rocks undergo changes deep within the planet's interior. They generally occur because of temperature, pressure, or chemical differences that result in the melting and re-crystallization of the rock.

When igneous and sedimentary rocks are subjected to intense heat and pressure deep within the earth, their mineral composition and grain size can change, and they become metamorphic rocks. For example, metamorphism can recrystallize the calcite grains in limestone, forming marble. And shale, when subjected to intense heat and pressure, changes into the metamorphic rock called slate. You can often see new minerals in metamorphic rock, such as garnets, as well as once-flat sedimentary layers that have been bent and twisted from the heat and pressure.

Metamorphic rocks yield compelling clues about past dynamic interactions of the tectonic plates of the earth's crust. Metamorphic "belts" are commonly associated with mountain ranges. In addition, metamorphic rocks can provide a window to the past, even when all topographic and surface evidence has faded.

## Suggested Resources: Geology

Alt, David D. and Donald W. Hyndman. *Roadside Geology of Northern and Central California*. Missoula, MT: Mountain Press Publishing, 2000. A very useful and readable geologic guide to regions and roadsides in the northern and central part of the state.

Bachert, Russell E., Jr. *Outdoor Education Equipment*. Danville, IL: Interstate Printers and Publishers, 1974. This is a valuable collection of instructional aids that can be easily and inexpensively assembled for use in field investigations.

Bates, Robert L., and Julia A. Jackson, Eds. *Dictionary of Geological Terms*. 3<sup>rd</sup> ed. New York: Anchor books, Doubleday, 1984. Geological dictionary that defines terms used in the field of geology.

California Division of Mines and Geology. *California Geology*. This very useful publication is no longer in print, but is still available in some libraries.

Collier, Michael. *A Land in Motion: California's San Andreas Fault*. San Francisco: Golden Gate National Parks Association, 1999. Written in a journalistic style, this source offers lay readers an up-to-date introductory overview of "the most famous fault on earth."

Harden, Deborah. *California Geology*. Upper Saddle River, NJ: Prentice Hall, Inc., 1998. An interesting overview of California geology.

Hill, Mary. *California Landscape: Origin and Evolution*. Berkeley: University of California Press, 1984. A well-written guide to earth processes which have created today's landforms.

Hill, Mary. *Geology of the Sierra Nevada*. Berkeley: University of California Press, 1977. A good reference on the development and geologic history of the Sierra Nevada mountains.

Iacopi, Robert. *Earthquake Country*. 4<sup>th</sup> Ed. Tucson, AZ: Fisher Books, 1996. This work contains updated discussions of plate tectonics, earthquake mechanics and measurement, historic shocks, future seismic prospects, and preparedness tips.

Jaeger, Edmund C. *The California Deserts*. 4<sup>th</sup> Ed. Stanford, CA: Stanford University Press, 1965. Written by an authority on the subject, this source gives a very nice overview of Southern California desert natural history.

Kious, W. Jacquelyne and Robert I. Tilling. *This Dynamic Earth: the Story of Plate Tectonics*. U.S. Department of the Interior, U.S. Geological Survey, 1997. An excellent primer on plate tectonics.

## *Junior Ranger Program Handbook: Geology*

Logan, William Bryant. *Dirt: the Ecstatic Skin of the Earth*. New York: Riverhead Books, 1995. A collection of short essays contemplating soil.

Norris, Robert M. and Robert W. Webb. *Geology of California*. 2nd edition. New York: John Wiley & Sons, 1990.

Oakeshott, Gordon B. *California's Changing Landscapes: A Guide to the Geology of the State*. New York: McGraw-Hill Book Co., 1978. A good overview of the state's geologic history, features, and processes, updated to include plate tectonics.

Pellant, Chris. *Rocks and Minerals*. New York: Dorling Kindersley, Inc., 1992. A good key to rock classification.

Quinn, Kaye. *Planet Earth*. Los Angeles: Enrich, 1986. Contains games, activities and puzzles about earth science.

Ranger Rick's *NatureScope*. "Geology: The Active Earth." National Wildlife Federation, 1987.

Raymo, Chet. *The Crust of Our Earth: an Armchair Traveler's Guide to the New Geology*. Englewood Cliffs, NJ: Phalarope Books, Prentice-Hall, Inc., 1983. Modern geology presented by a master storyteller.

Sharp, Robert P. *Geology: Field Guide to Southern California*. Dubuque, IA: W.C. Brown Co., 1976. Contains detailed road guides to the geologic provinces of Southern California.

Sharp, Robert P., and Allen F. Glazner. *Geology Underfoot in Southern California*. Missoula, MT: Mountain Press Publishing Company, 1993. The authors present twenty "vignettes"—each a story focused on some geological subject of particular interest and significance. Several involve California state park units.

Shelton, John S. *Geology Illustrated*. San Francisco, CA: W.H. Freeman, 1966. Well-illustrated with aerial photos; emphasizes Western U.S. geology, with many topics specific to California.

Sussman, Art. *Dr. Art's Guide to Planet Earth: for Earthlings ages 12 to 120*. White River Junction, VT: Chelsea Green Publishing Company, 2000. This book explores how our planet works and how our actions can affect the environment.

Watts, May T. *Reading the Landscape of America*. New York: Macmillan Publishing Co., Inc., 1975. These essays about selected American habitats are well-crafted pieces of interpretation, blending personal experience with natural (and human) history.

## Other Sources of Information

American Geological Institute has books and pamphlets on many geology topics, including *The Making of a Continent*, a companion volume to the PBS series of the same title. *Earth Science*, a quarterly geology magazine for the general public and “A Study in Time,” a poster on geologic time periods, are also available. For more information write American Geological Institute, 4220 King St., Alexandria, VA 22302. [www.agiweb.org/geoeducation.html](http://www.agiweb.org/geoeducation.html).

Department of Conservation. “California Geological Survey.” A good resource for California-related geologic information. It contains publications and links to other organizations. [www.consrv.ca.gov/CGS/index.htm](http://www.consrv.ca.gov/CGS/index.htm).

Department of Conservation. Division of Oil, Gas and Geothermal Resources. “Kids & Educators.” This webpage contains good illustrative drawings of oil machinery and easy to understand information on natural energy resources. [www.consrv.ca.gov/dog/kids\\_teachers/index.htm](http://www.consrv.ca.gov/dog/kids_teachers/index.htm).

*Earthquake Information Bulletin* is available by single copy or by subscription from the U.S. Government Printing Office. Other geology publications are also available. Write U.S. Government Printing Office, Superintendent of Documents, Washington, DC 20402-9325.

Massachusetts Audubon Society has reprints from the *Curious Naturalist* on geology topics including “Snow Geology,” “Pangaea—Drifting Continents,” and “Energy From the Earth.” “The Rock Cycle” and “Geologic Time” are charts that are also available. [www.massaudubon.org](http://www.massaudubon.org).

*Rocks* is an activity guide available from British Columbia Teachers Federation. For a catalog, write to B.C. Teachers' Federation, Lesson Aids Service, 2235 Burrard St., Vancouver, BC V6H 3H9. [www.bctf.bc.ca](http://www.bctf.bc.ca).

U.S. Geological Survey has many pamphlets, books, maps, lists of resources, and a “Selected Pack of Geologic Teaching Aids” among other items. Many of these materials are free. For more information, write U.S. Geological Survey, Geologic Inquiries Group, 907 National Center, Reston, VA 22092. [earthquake.usgs.gov/learning/kids.php](http://earthquake.usgs.gov/learning/kids.php).

**INSERT *HISTORY* TAB HERE**



# History



## Introduction

Because the history of California can inspire fascinating interpretation, a Junior Ranger program that allows children to step back in time through their imaginations can be both thought-provoking and fun.

The most exciting thing about a history program is all of its great possibilities. Find out about historic events that occurred at or near your park. Are you located in a gold rush region? A mission? A fort? Near a railroad? One of the best ways to help the history of our state become real to Junior Rangers is to have them re-enact events that occurred at a park, either by playing the role of a historic figure or by doing something the way it was done in the past. A child can better understand who he or she is by learning about the people who came before. For example, at Sutter's Fort SHP children have an opportunity to relive history as historic characters. Among other activities, they learn how to make tortillas over a fire, weave baskets, start a fire without matches, weave at a loom, and make things out of leather. You can do the same sorts of things on a smaller scale in your Junior Ranger history program.

We have included three sample programs and lots of interpretive ideas from veteran program leaders. Choose those most relevant to your park's history and have fun.

## Interesting History Facts

- There are estimates that at least 135 different Indian languages were spoken in California in the mid 1700s.
- Scholars believe about 300,000 California Indians lived within the present borders of California before the Spaniards and other Europeans arrived.
- Early Spanish explorers of California's coastline were looking for riches and a passage through North America to Europe (the legendary Northwest Passage).
- Twenty-one missions were established, from San Diego in the south to Sonoma in the north. They were located approximately 30 miles apart, or a single day's journey along the royal road (El Camino Real).
- California became part of the independent Mexican empire in 1822.
- Mexicans who wanted land in California had to draw a sketch map (*diseño*) showing the trees, rivers, and other features on the property. This was submitted with a petition to the government. Each grantee surveyed his or her land from horseback, planting stakes and measuring the acreage with rope between natural landmarks. Possession of the land was done ceremoniously and included stones being cast to the four winds.
- Flags of the Spanish Empire, England, Russia, the Mexican Empire, and the Bear Flag Revolt once flew over California.
- On board ships of many nations, sea otter pelts and later cattle hides and tallow were traded by *Californios* for cloth, shoes, hardware, tools, and furniture.
- The first overland immigrant train to California, led by John Bartleson and John Bidwell, arrived at John Marsh's ranch on November 4, 1841.
- Immediately following James Marshall's discovery of gold on January 24, 1848 (at Sutter's mill on the American River), there was no mad rush there, simply because nothing like this had ever happened before. A San Francisco newspaper in early May of that year noted that "A few fools have hurried . . . but you may be sure there is nothing in it."
- During the gold rush, fortune seekers from the eastern United States trekked across the great plains, made the voyage around Cape Horn, or sailed by way of the Isthmus of Panama. These routes took four to nine heartbreaking, dangerous months of travel.
- In 100 years, miners in California found two billion dollars worth of gold.



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- California became the 31st state of the Union on September 9, 1850, after nearly a year of debate in Congress over whether it would be a free or a slave state.
- In a five year period, California had four different capitals. The first capital of California was San Jose, in 1849; the second was Vallejo, in 1851; the third was Benicia, in 1853; and fourth was Sacramento, in 1854.
- California's first railroad, the Sacramento Valley Railroad, opened in 1856. It was twenty-two miles long and ran between Sacramento and Folsom.
- Prior to 1860, nearly every manufactured article used in California had to be imported from the East Coast, Europe, South and Central America, or China.
- Some of the worst flooding in California history occurred in 1861-62. It was reported that the San Joaquin Valley became an inland sea the size of Lake Michigan. After his inauguration in January 1862, Governor Leland Stanford had to climb into the second story of his house from a boat.
- In 1902 Big Basin became the first redwood area set aside as a state park.



## Sample Programs: History

### Architecture

- I. Introduction
  - Introduce yourself.
  - Introduce the Junior Ranger Program.
- II. Focus
  - A. What is this? And, how was it used? (Carefully show a carpenter's plane or a broad axe.)
    - That's right, these are tools that were used by early carpenters to construct buildings.

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### III. Objectives

Today we are going to look at some of the old buildings here at \_\_\_\_\_ State Historic Park, to see how they were made, and to learn something about the people who built them.

### IV. Inquiry/Discussion

A. What kind of building do you live in? What is it made of?

- adobe
- wood
- brick
- concrete
- steel and glass
- aluminum and wood
- plastic

B. What do all of your homes have in common?

- windows
- doors
- roofs
- floors
- living rooms
- bedrooms
- kitchens
- stoves
- refrigerators
- lights, electricity
- bathrooms, plumbing

C. Americans have been constructing buildings in which to live (go to school, work, or have fun) for several hundred years. Over time, the styles of these buildings have changed, as have the materials, sizes and ways in which they are built. Even though these things change, people still need somewhere to live (go to school, work, or play).

1. (Use historic photographs of the buildings in the park to illustrate.) We are lucky to be at \_\_\_\_\_ State Historic Park, where so many old and valuable buildings have been protected and cared for.
2. How about stepping back in time with me to find out more about how buildings were made in the past? Let's visit the \_\_\_\_\_ house (or store, or other structure). This place was built in 18\_\_ for \_\_\_\_\_. The owners were \_\_\_\_\_ ("*Californios*," early settlers, farmers, store owners, ranchers, etc.)
3. (Walk to the structure.)
4. Imagine yourself back in 18\_\_. I want you to walk through this building with me and look at how it was made. Who would you hire to build a house like this? Or, what crafts or skills would you have to know to create a building like this?
  - adobe making
  - stone masonry



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- brick mason—to build a good foundation and chimney
  - carpenter—to cut, shape, and nail together the wood
  - plasterer—to coat the walls and ceilings with plaster for a smooth finish
  - paper hanger—for applying wallpaper
  - painter—to apply paint that protects the building and makes it pretty
  - architect—to design the building
5. Architecture is the science, art, or profession of designing and constructing buildings. Is there anything different about how this 18\_\_s building was made from your house today?
    - No electricity was used in its construction.
    - It may also have had no indoor plumbing—sinks, toilets, showers, etc.
    - There may be thick planks of wood used for walls, ceilings or floors.
    - Adobe walls with a dirt or tile floor.
    - Windows of different shapes and sizes.
    - Short height doorways.
  6. There were very few "labor saving devices" in the 1800s. Builders had no electric saws, drills, or nail guns to help them get the work done quickly. One hundred fifty years ago, nearly everything had to be made by hand, from chopping down the tree to producing fine moldings for windows and doorways. Think of how much time it took to build something—the care, and the craftsmanship. In the past, most houses were built to last.
  7. If you lived far away from town, where no builders could be hired, or if you couldn't afford one, you and your family (and friends) probably constructed the building yourself. You had to rely upon your own skills and abilities to design and build it. Many of these skills would have been taught to you by family members or you may have worked for someone else (as an apprentice), who taught them to you.

### V. Guided Discovery

- A. Let me show you more tools used by early carpenters. (Display old tools—hammers, adzes, drawknives, planes, etc. and, if possible, demonstrate one or two of their uses. If tools are not available, use illustrations from books like Eric Sloane's *Museum of Early American Tools*.)
- B. Let's look for examples of how the planes (or another tool) might have been used on the \_\_\_\_\_ house. (Let the kids find examples.)
- C. How about making a drawing of a door, window, or other building feature we have seen today that is different from one on your home? (Provide paper and pencils.)
- D. If time allows, have the Junior Rangers draw a floor plan of the building to compare with their own home. Look at the number and size of the rooms. What is the same? What is different from their own?
- E. Do you see any parts of the building that are worn? (floors, doors, etc.) If the walls could talk, what kind of stories do you think this building would tell you?

### VI. Application

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Buildings are everywhere—whether you live in the city, the country, or in between. Buildings provide the basic shelter that all people need to survive. The design of buildings is called architecture. Most old buildings were built by hand and made to last. If we take good care of them, they may be here for a hundred more years.

### VII. Conclusion

- A. When you go home, look for old buildings in your neighborhood or town. Think about the stories they could tell you.
- B. Announce the next Junior Ranger program.
- C. Stamp logbooks.

*The architecture program was developed by Mary Helmich.*

## **Railroads**

In most state parks, visitors find the nearby presence of railroads. This can be seen in the form of tracks, signs, stations, and support structures. Railroading is most evident in the central and southern coast and along the Sacramento and San Joaquin valleys.

The railroad has played a major role in the development of the United States and especially the state of California. With the completion of the first railroad across the United States in 1869, people could ride in relative comfort from sea to sea in less than five days.

- Before the railroads were constructed, how long did it take to walk across the United States along the established Indian trails?  
Five to six months
- When stagecoaches were invented, this shortened the time considerably in crossing the country. How long did it take then?  
Fifteen to twenty days

The invention of the steam engine and its application to a mobile form of transportation led to railroad development. Great changes accompanied the transition from horse-pulled wagons to the huge iron machines. When constructing steam engines, parts were often shipped via horse-pulled wagons. You can imagine the strange sight to the American Indian as he saw a train approaching from the distance over the sleeping iron rails.

At first, steam engines were very small and were not capable of pulling any great weights. In addition, the railbed was modified from wood to stone to various types and sizes of steel and iron.

- What name did the American Indian give to trains in general?

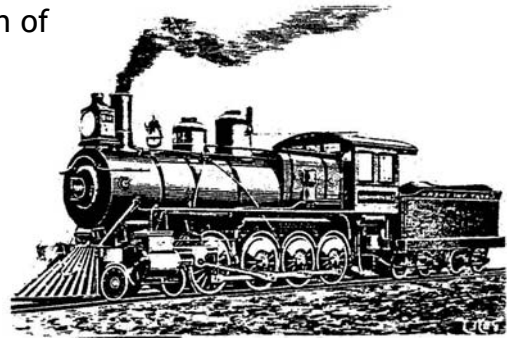
## *Junior Ranger Program Handbook: History*

“Iron horse” was close to their way of thinking in describing this foreign object.

As steam engines were perfected, their pulling capacity improved. Still, even as strong as they became, they were unable to climb grades or hills of any size. This resulted in the railbed having to be built with a gradual gradient. This worked well when the railroad crossed the Central Valley of California or the Great Plains of mid-America.

- When it became necessary to cross high mountains such as the Sierra Nevada, how did the railroad get across?  
Tunnels and switchbacks.

The invention of the steam engine on wheels brought about rapid development of towns and land along the ribbon of steel. Steam engines operated off wood, coal, and, later, oil. These materials acted as a heating source when burned. The fire heated water in tanks, which turned into steam. The huge steam-powered pistons turned the wheels and pulled the train. Steam engines needed lots of stops for fuel and, even more importantly, for water. Towns sprang up where the railroad operated, especially at water and fuel stops, entrances or exits from tunnels, bridge crossings, and supply yards.



- Do any of you live near a railroad or does a railroad go through your town?
- Do you know if your hometown was started around a railroad station or railroad maintenance yard?

Railroads had no competition in speed and comfort for freight and passengers. After the success of crossing the country, other railroads began to build in the West. By the 1880s the coast of California had several railroads operating in competition with each other. Gradually, the smaller companies were bought up by the larger and wealthier ones. Eventually, only a few large companies remained.

- With competition reduced to a few companies, what do you think happened to the cost of rail tickets?  
Prices went up.

When prices went up, only those who could afford to ride or ship freight did so.

- What did this do to the average person in California?  
They could not afford to ride and if they did not pay high freight costs they went out of business.

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About this time, automobiles were invented. They were able to go over most mountain passes at a speed faster than trains. In addition, they were cheaper to operate and could be purchased by many people. This created competition for railroad passenger traffic and freight business. The railroads became threatened by this new form of transportation. Railroad companies had expanded their empires across the United States. In order to meet the railroads' needs, steam engines required more and more fuel and water to operate in many new locations. Forests were cut for wood; coal and oil were developed for fuel. In deserts, water had to be shipped to isolated locations. Steam engines had become very expensive to operate.

- The end of steam came about due to the cost of operation and competition from the automobile. What type of engine replaced the steam engine?  
The diesel engine.

The diesel engine proved a much more economical alternative to the steam engine. This economy, along with the ability of these engines to pull great loads, made the modern diesel engines popular. Diesel engines required little water, and could go hundreds of miles before needing to be refueled.

- Do you know where old fashioned steam engines can still be found? Name a place.  
Old Sacramento, local parks, rail clubs, etc.

Today, railroad companies still operate in the United States. These companies manage the freight systems that operate many types of railroad cars. Often these trains are one mile or more in length. Railroad freighting is very economical and is perhaps the cheapest form of transportation available.

- Can you think of the name of the railroad company that operates the freight trains in your community or near this park?
- Railroad freight cars were designed for the material they would carry. Do you know the purpose of...
  - The caboose?
  - The box car?
  - The hopper car?
  - The flat car?

Over recent years the importance of railroading for passenger traffic has declined. This is due to faster air travel and expanding motor vehicle ownership. However, in the past twenty years, Americans have found that the country still needs rail transportation for passengers. This is in part because railroads are a very scenic way to travel, and railroads are the safest form of mass transit. With this in mind, the U.S. Congress formed AMTRAK. Today, AMTRAK can be seen in many parts of California and the United States, linking cities and towns from coast to coast.

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- Have any of you ridden on AMTRAK? Describe the experience.

Railroad tracks are no place to play around. A freight or passenger train takes approximately its entire length to come to a complete stop. If a train is a half mile long, it will take that distance to stop. This is because of the great weight of the train and the fact that steel wheels do not stop quickly on steel tracks.

- When a road crosses train tracks and a crossing arm is down or red lights are flashing, what should drivers, bicyclists, and hikers do?  
Stop and stay back!
- Do not walk on railroad tracks!

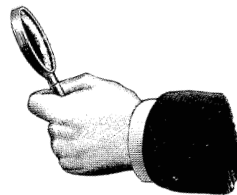
Railroads appear less important than cars since we seldom travel that way today. They do still play a major role in moving freight across the country. Many items that we eat, wear, or use are shipped by a train. Trains will continue to play an important role in America's future as a cost-effective nationwide rapid transit system.

Conclusion:

- Announce next Junior Ranger program and other interpretive programs.
- Stamp logbooks.

*Railroad program was designed by Jim Fife.*

### **Junior Ranger Gumshoes**



#### **I. Introduction**

Introduce yourself.  
Introduce the Junior Ranger Program.

#### **II. Focus**

I'll bet every one of you knows more about this park than you think you know.

#### **III. Objectives**

Today, I want each of you to become a detective. Through your special skills, we are going to discover who lived or worked here a long time ago, and why these grounds were preserved as a California state park.

#### **IV. Inquiry/Discussion**

- A. I am glad each of you is wearing "plainclothes" today. We don't want to draw attention to ourselves and our "secret mission." We will just pretend to wear our detective hats and capes. (Put on your imaginary detective hat and cape.)
- B. This is our first clue to the mystery of \_\_\_\_\_ (name your state park).

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1. Bring out a unique artifact or show a feature related to the historic use of the park, and have the Junior Ranger detectives guess what it is or how it was used.
2. What does the \_\_\_\_\_ tell you about the people who lived here? (Use the item to bring out characteristics of the people who once lived/worked here and how they may have behaved in earlier times.)

Examples:

- “The \_\_\_\_\_ was made from nearby plants and shrubs by people of the area. The work demonstrates close knowledge of the environment . . .”
- “The \_\_\_\_\_ was brought from somewhere else to be used here. People who worked with it were skilled in \_\_\_\_\_ (crafts)—once commonly practiced—now rarely used or unknown. Today, the work is done by a \_\_\_\_\_ . . .”
- “People took great care of this \_\_\_\_\_ because they could not replace it easily and it was special to them. We believe the \_\_\_\_\_ originally came from \_\_\_\_\_ and had to be transported here by ship, wagon, and later mule—a total of \_\_\_\_\_ miles . . .”

C. Let's look for more clues. Look around. What other signs do you see that tell you about who might have been here in the past?

1. Let the “gumshoes” point out evidence for earlier uses—bedrock mortars (food grinding), lumbering, harnessing water, mining activities, farming, etc. Discuss them, as above.

D. Many people came to this park from far off lands. What would they have brought from their homelands?

- Clothing
- Food traditions
- Tools and skills
- Building styles
- Music, songs, dances, games, etc.
- Dreams, ideas, plans



(Point out evidence of these in the park).

E. \_\_\_\_\_ State Park has a very rich and interesting history because of the people who once lived here and their culture. “Culture” is defined as the ideas, customs, skills, arts, etc. of a given people in a given period of time. Culture didn't just happen in the past. We are part of a culture today, too. What do you think our culture includes today? What clues will we leave for detectives like you in the future?

### V. Guided Discovery

A. Often the best detectives learn by copying something. We can, too.

1. Have the Junior Ranger detectives make something that fits in with the culture of the people associated with the park.

Examples:

- Grind acorns with a mortar and pestle
- Grind corn with a *mano* and *metate*



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- Prepare a food using period-style equipment and techniques—hot chocolate, taffy, ice cream, bread, tortillas, etc.
- Churn butter
- Hand-dip candles
- Wash clothes, using a scrub board and tub
- Card and spin wool
- Weave
- Iron clothes the old fashioned way, heating the irons on a cast iron stove.



- B. What have you learned from this activity?
- It is hard work.
  - Doing it requires a lot of skill, patience, and time.
  - If you made it, you probably would want to take care of it and not waste it.

### VI. Application

- A. If you could come to live here today, what would you bring to the park (to make your work easier, more pleasant, or to remind you of your former home)? Now step back in time. Detectives, if you were coming here from \_\_\_\_\_ in 18\_\_, what would you bring from your homeland? Are there similarities between the things of yesterday and today?
- B. What do you see in this park that you don't see at home?
- C. What do you believe made people decide this place was worth preserving and protecting? (Follow the discussion with an explanation about when the park was established and by whom.)
- D. What would this area be like today if people hadn't protected and preserved the land for the future as a state park?

### VII. Conclusion

- A. As you take off your detective hats and capes today, don't forget to look for the hidden clues in other historic places and parks. You might also want to share these "secrets" with your friends and family and maybe help them become better detectives, too.
- B. Announce the next Junior Ranger program.
- C. Stamp logbooks.

*"Junior Ranger Gumshoes" was developed by Mary Helmich.*

## Activities

### Gold Rush Game

Number of Children: 4 or more

Environment: Open space

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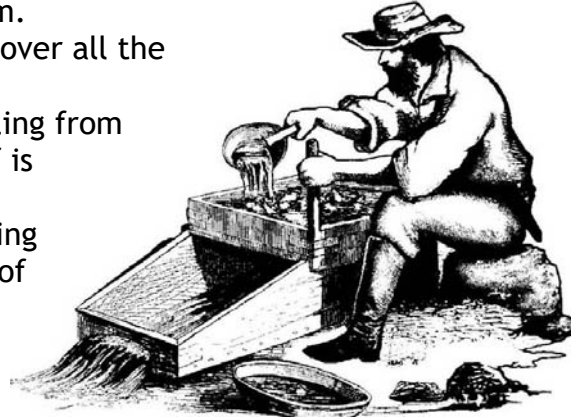
Equipment Needed: String or something to stake out claims, gold pieces (beans, candy, etc.)

Purpose of Activity: This game shows the effects of gold rush fever: gambling, stealing, owning property, profit, and investment

Activity:

1. Give each child a "Gold Rush plot" as a claim.
2. Spread kidney beans, which represent gold, over all the plots.
3. Let the Junior Rangers mine for gold. (Stealing from others' plots is a fine of 25 beans if the thief is caught).
4. Beans can be used to buy food, shelter, mining supplies. If you have no beans, you are out of the game.

Note: Round, wrapped candies also make good gold pieces.



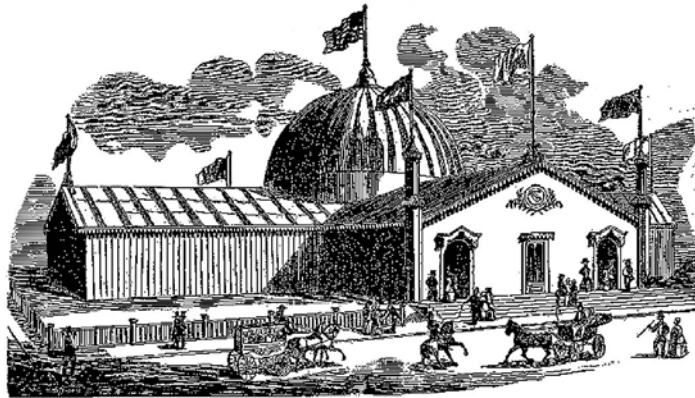
### **Additional Ideas for Activities**

- Teach a historic skill, like candle making, gold panning, field grading and packing citrus, making a corn husk doll, making rope, etc.
- Demonstrate a piece of machinery or a skill that ties in with your park's history, such as operating a pelton wheel, or working with carpentry or blacksmithing tools.
- Explain the history of your park unit and some of the changes that have happened through time. Use old photographs to show the area in the past. What has changed? Why? Which changes have been beneficial, which have been detrimental? Has opinion changed as to whether the differences are good or bad?
- Using hand-held objects is a great way to make history real to kids. Compare what was used then to what is used now for a specific task (mortar and pestle/food processor, for example). You might fill a bag, basket or trunk with tools, toys, clothing, etc. from the past and have the Junior Rangers guess what they were used for, or use each one to tell a story.
- If there is a museum at your park, try a scavenger hunt in which Junior Rangers are given a description or illustrations of different objects in the museum that they have to find.
- Provide paper and soft chalk or crayons for rubbings of gravestones, an inscription on a cannon, or cast metal designs on buildings, etc.
- Having the Junior Rangers act out history by taking the parts of historic figures is one of the best ways to make a lasting impression on the group. Simple costumes, such as hats, aprons, etc. help the kids get into the role. Give each child a personality, then read a historic story and have them act it out as you are reading.
- You can take the Junior Rangers back in time using their imaginations. Have them pretend it is 18\_\_ and have them look for things (electric wires, telephones, television, etc.) that should not be in this period.

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- If you have journals or diaries from historic figures, why not read portions of them to the group to make the people who wrote them come alive?
- Ask the group, “Why do people save things from the past to share with the future? Do you have any artifacts at home (heirlooms, antiques, etc.)?” Are there any historic buildings, monuments, or artifacts in the city where you live?
- Have Junior Rangers draw a map of the town or historic site, noting streets, important buildings and special features (like wells, mines, etc.).
- Have children draw pictures of historic buildings or their decorative details: ornamental brackets, fancy shingle siding, railings, columns, etc.
- If you could leave something for someone to find in the future that represents you, your life, and who you are, what would it be?

*Many of these ideas were contributed by Ken Huie of Malakoff Diggins State Park, Wendy Harrison of Calaveras Big Trees State Park, and Mary Helmich.*



## Background Information: History

California has developed rapidly. Although often considered a young state, it lays claim to a long and interesting history. As it would not be possible to provide a complete account of this rich history here, we have outlined some of the major events and significant periods of this state's past. Depending on the history of your park, you may choose to emphasize one of these periods. Keep in mind, too, the dramatic development of the areas surrounding your park during the last half century. This may have had a significant impact on the park's creation, development, and use. For more information on California history, consult James J. Rawls and Walton Bean's *California: an Interpretive History*.<sup>1</sup>

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<sup>1</sup> Information on the history of California has been summarized from “History,” from *California: Past, Present, Future* (The California Almanac Company, 1971, (pages 9-32)), James D. Hart's *A Companion to California*, James J. Rawls and Walton Bean's *California, an Interpretive History*, and other sources.

## **California's First Inhabitants**

Although we do not know exactly when people first came to California, we do know that California Indians have been here for many thousands of years. Native people of California would say that they have been here from the beginning (Please see the California Indians section for information on their cultures and lifestyles). California Indians led a peaceful life before contact with Europeans, and did not generally engage in warfare. Tribal conflict was usually the result of intrusion upon tribal lands by other groups.

## **European Discovery of California**

Most scholars agree that the name "California" was taken from a 15th century Spanish novel, *Las Sergas de Esplandian*, which described a mythical island lying on "the right hand of the Indies, very near to the terrestrial paradise." This island was believed to be inhabited by beautiful, but warlike women whose weapons and armor were made of gold, the only form of metal to be found there.

Fired by these stories and dreams of wealth, discovery, and conquest, Spanish adventurers were eager to explore the Pacific Coast. The King of Spain urged Hernando Cortés (Spanish conqueror of Mexico) to dispatch exploratory expeditions to the Gulf of California.

The first European explorer to reach California was Juan Rodríguez Cabrillo, who entered San Diego Bay on September 28, 1542. Cabrillo died on San Miguel Island four months later. Following Cabrillo's orders, shipmate Bartolomé Ferrello took command of the expedition and sailed northward to a point near the California-Oregon boundary, but starvation and scurvy forced their return in April 1543. Sixty years passed before a second expedition followed. Other explorers who later saw California include Francis Drake from England, Pedro de Unamuno from Macao, and Sebastian Vizcaíno from Spain.

In 1769 Spain sought to colonize California before rivals England and Holland did. The Spanish planned to control the land and make it productive. Three types of settlements were developed by the Spanish in their colonization: the mission, the presidio, and the pueblo. The missions played the central role, becoming both religious and economic centers. The Franciscan friars who established the mission system in California were remarkable men. Endowed with keen foresight, tireless energy, and practical ability, they were, or had to become, skilled craftsmen, practical stockbreeders, trained agriculturists, and gifted executives. Father Junípero Serra served as president of the Franciscan missions in California. Under his guidance and that of other later Franciscans, a chain of 20 missions was built roughly one day's march apart along California's coastline. (A 21st mission was later established at Sonoma under Mexican rule.)

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The Franciscans taught the California Indians to be: saddlers, blacksmiths, coopers, freighters, candle-makers, vintners, hatters, guitar-makers, muleteers, ranchmen, doctors, rope-makers, shepherds, woodcutters, painters, sculptors, bell-ringers, masons, acolytes, sacristans, stonecutters, farmers, herders, barbers, and carpenters. All these skills and the technology introduced by the Spaniards had a lasting impact on California Indian culture and economic traditions, ultimately changing their relationship to their environment.

The presidios at San Diego, Santa Barbara, Monterey, and San Francisco were military establishments built to protect the missions from the Indians and to guard against foreign invaders. Both the presidios and the pueblos were important in the colonization of frontier California. San Jose was the first pueblo, founded near Mission Santa Clara in 1777. Next was Los Angeles near Mission San Gabriel in 1781, and Villa de Branciforte, near Santa Cruz, in 1797.

Each pueblo was built according to a plan, consisting of four square leagues of land, constructed around a rectangular plaza. Facing it were government buildings, a church, and some prominent homes. Adjacent to it, each settler was given a lot for a house and garden.

The remoteness of the California frontier from Spain's other holdings, however, promoted lawlessness, and it was difficult for the government to recruit settlers. Spanish California towns were settled mainly by a racially mixed group of Europeans, Native Americans, and African Americans.

### **Mexican Rancho Period**

When Spanish colonists in California learned in 1822 that the Mexican struggle for independence from Spain had resulted in an independent government, Governor Pablo Vicente de Sola declared California's allegiance to the new nation. In 1825 jurisdiction of the Mexican government in California was asserted by the appointment of a new governor, José Maria de Echeandía. Life changed little during the first ten years of California's possession by Mexico.

In 1833 the Mexican government made a major change by beginning the process of secularization of the missions and apportioning the mission lands to private owners. One-half of the mission properties were to be handed over to the California Indians (although they were not allowed to sell their lands or possessions, and were to perform community work), and the rest became controlled by secular administrators who were to support the church and to act in the general public interest. The plan, however, did not go as prescribed. The mission properties were distributed to the Indians in whatever manner the administrators thought fit. Dishonest ones enriched themselves, their families and their friends from the spoils of the missions; incompetent ones squandered the mission lands and properties. California Indians, deprived of lands and livestock, became servants or ran away to join tribes in the interior. Most became laborers on the private *ranchos* (ranches) into which the

mission lands had been divided. Many became homeless, unemployed, and neglected by Mexican society. Others died of disease or starvation.

A native-born or naturalized Mexican citizen could petition the government for land in the new territories. The smallest of these *ranchos* was 4,500 acres, and the largest was more than 100,000 acres. From 1834 until the late 1840s, the large *ranchos* with its cattle and horses dominated the economic life of California. The *rancheros* built spacious adobe structures and used California Indians as laborers and servants. They sold little meat, but traded hides and tallow for consumer goods and manufactured items of all kinds.

## **Mountain Men, Russians and Fur Trapping**

Beginning in the 1780s, the Spanish encouraged California Indians to snare sea otters. The skins could be bartered for goods in China, where they were highly valued. A larger fur trapping enterprise was begun by the Russians. While looking for food to support a fur-expedition in Alaska, the Russian-American Company sailed to San Francisco in 1806. The *Kodiak*, after dropping anchor in Bodega Bay (north of San Francisco), returned to Alaska with 2,350 sea-otter pelts and reports that the northern California coast was unoccupied and had plentiful food resources.

In June 1812, a crew of 95 Russians and 40 Aleuts of the Russian-American Company began work on Fort Ross. They attempted to control the area by closing the coast north of San Francisco to all but Russian ships. (This attempt was responsible for that part of the Monroe Doctrine of 1823 which stated that the New World was no longer open to aggression by force and that European countries could not extend their holdings in it.)

In association with the Russians, Americans and independent hunters like George Nidever also sought fur-bearing sea mammals. Other U.S. frontiersmen—Ewing Young, George Yount, and William Wolfskill among them—established a trade in beaver and otter trapped in California's rivers.

Mountain men James Pattie and Jedediah Smith were encouraged to explore by the business of fur trapping and trading. That same purpose brought Peter Ogden and other Canadians of the Hudson's Bay Company south to California to trap its rivers for beaver.

When sea otters and fur seals disappeared, the Russians turned to agriculture and manufacturing, but without great success. By the end of 1839, Moscow officials ordered the colonists to return to Alaska. Captain John A. Sutter then bought the property.

## **Westward Expansion and California**

The first Americans to come to California were fur traders from the East. American and European settlers soon followed. Several of these early traders and settlers, including John Sutter, John Bidwell, and John C. Frémont, became influential in California history.

John Sutter (1803-1880), born in Germany, was raised in Switzerland. He emigrated to New York in 1834. From there, his travels took him to St. Louis, where he joined fur traders enroute to Santa Fe. He traveled overland to Oregon and later sailed to Honolulu and Sitka, Alaska, before arriving in Yerba Buena (San Francisco) in 1839. Governor Alvarado granted to Sutter a large plot of land—11 square leagues (48,400 acres) at the junction of the Sacramento and American Rivers. Sutter, using Indian labor, planted wheat, orchards, and vineyards, beginning a kind of barony he called Nueva Helvetia. In 1841 he bought the Russian land at Bodega and Fort Ross. His holdings expanded further in 1845, with a new grant of 22 leagues from Governor Micheltoarena.

John Bidwell (1819-1900) arrived in 1841 with the first party of American immigrant settlers to travel overland. For several years he worked for John Sutter before becoming a naturalized Mexican citizen and obtaining a large land grant. Bidwell, responsible for drawing up the resolution of independence from Mexico in 1846, served as a lieutenant in John C. Fremont's California Battalion. He later discovered gold on the Feather River, but in 1849 turned his attention to agriculture. He acquired a 22,000 acre ranch in Chico and became a leading proponent of agriculture. Bidwell also served as a congressman from 1865 to 67.

Some settlers had a difficult time getting to California. The tragedy of the Donner Party occurred during the winter of 1846-47. After making a late start, the group lost precious time by taking an unfamiliar route. They were caught in one of the most severe winters in the history of the Sierra Nevada. Snow fell to a depth of more than twenty feet. Forty-two of the ninety immigrants who left Illinois lost their lives before the survivors reached Sutter's Fort.

The increase in settlement spurred California's development. Coastal towns became shipping centers for the hide and tallow trade. Fur traders, especially those who made their way over the southern routes from New Mexico, settled down, and many became influential citizens.

## **American Rule**

Americans in Northern California were distrustful of Mexican rule. Encouraged by the presence of American troops under John C. Frémont, a small band of settlers led by William B. Ide captured General Vallejo at his home, that also served as his headquarters, in Sonoma. After seizing the town of Sonoma on June 14, 1846, they

proclaimed California an independent republic. This action has become known as the Bear Flag Revolt, because of the hastily designed flag raised by the settlers over the plaza of Sonoma. On the flag, a grizzly bear faced a red star. The bear had been chosen because it was the strongest animal in California. The crude lettering on the flag proclaimed: "A bear stands his ground always, and as long as the stars shine, we stand for the cause."

California was swept into a war with Mexico. Unknown to the Californians or the American settlers, Mexico and the United States were already at war at the time of the Bear Flag Revolt. Commodore Sloat, commanding U.S. Naval forces, seized Monterey on July 7, 1846, and formally announced the annexation of California to the United States. The Mexican government in California was not able to render any effective opposition to the occupation, since the province was generally without military supplies and the population appeared indifferent. Loyalties to Mexico and the Mexican government were divided at the time of the Mexican War, although there was some opposition to the occupation in Southern California. At the Battle of San Pasqual American forces under General Stephen Watts Kearney met *Californio* forces directed by Andrés Pico. Although 21 American lives were lost in that battle, it proved to be the last victory for the *Californios*. On July 7, 1846, the Capitulation of Cahuenga was signed on the banks of the Rio de San Gabriel.

The war between the United States and Mexico ended in February 1848, with the signing of the Treaty of Guadalupe Hidalgo. It established the Rio Grande as the new boundary between the two countries, granting the United States the territory comprising the present states of California, Nevada, Utah, New Mexico, Arizona, and parts of Wyoming and Colorado.

## **The Gold Rush**

On January 24, 1848, gold was discovered in California by James W. Marshall, who was overseeing construction of a sawmill at Coloma on the American River for John Sutter. As news spread, gold-seekers began to converge on the so-called diggings. The rush for gold touched everyone in California and deeply affected countless lives elsewhere. With dreams of riches, men eagerly headed for the mining districts. Often this meant leaving home and family for long periods of time. Some families were not happy about seeing the men leave. Early gold-seekers came from Oregon, Utah, Hawaii, Sonora and other parts of Mexico, as well as Chile and other coastal areas of South America. In 1849, the stream of newcomers became a flood. Growth was disorderly and uncontrolled; committees of vigilantes endeavored to enforce some semblance of law and order. The City of Sacramento, founded near the confluence of the Sacramento and American Rivers, became an important supply depot for the mines, with roads radiating out across the plains to the various mountain settlements. Food and equipment shipped to the mining areas often came from ports as far away as Boston, Europe, South America, and Asia. Consequently, prices were high.



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The steady arrival of people into California's gold country brought a demand for meat, and thus a cattle boom for the *ranchos*. However, the sudden prosperity most of the *rancheros* enjoyed proved temporary. Ruined by land litigation, interest, taxes, and inexperience in business and financial matters, some lost their ranches to Americans or Europeans. (Between 1862 and 1864, a severe drought hit California and thousands of cattle died, forcing many surviving *rancheros* into bankruptcy.)

Prospectors headed for the so-called Mother Lode region, extending roughly from Mariposa in present Merced County to Nevada City on the north in present Nevada County, or to the mining area farther northwest in the region of the Trinity, Klamath, and Salmon Rivers. Other likely places were also tried in the quest for the best sites.

Conditions at the mines were primitive and the work hard. More than one miner had second thoughts about California, and some advised relatives in the East to spend their time working the family farm rather than seeking riches in the West. The spirit of the time is revealed in the names miners gave their new towns: Whiskeytown, Rough and Ready, Hangtown, Drytown, Fiddletown, etc. Other settlements were named for the origin of the people who lived there: French Gulch, Dutch Flat, Chinese Camp, Mormon Bar, Mexican Flat, Chile Bar, Scotch Flat, etc. A population of about 6,000 in the mining area in 1848 grew to about 100,000 in the peak year of 1852.

Miners formed rules and regulations for the protection of claims. Every miner in the district was required to respect the claims the others had "staked." However, not everyone was treated the same in the mines. "Foreigners" were required to pay a special tax before they could search for gold. Chinese and French miners were included in this group.

Several types of mining tools and techniques were used: miner's pans, cradles, "long toms," sluice boxes, ground sluicing, booming or gouging, hydraulic mining, and dredging. In the "wet diggings," gold was washed or panned from gravel beds and bars of streams and rivers. When this gave out, miners used hydraulic methods devised in 1853. Through penstocks they conducted or channeled water to hillsides, then sprayed it with such force that entire slopes collapsed and the gravel ran into long sluices, where riffles contained the heavier gold.

Hydraulic mining was destructive; whole mountainsides were washed away. Their scars remain visible today. The silt flowed downstream and was deposited on the floor of San Francisco Bay. In many places the river levels were raised above the adjacent land by the deposits, causing devastating floods. Legislation in 1884 that put an end to hydraulic mining became one of the first important conservation laws enacted in California. (Note: For more information on mining, please see Bean's *California, an Interpretive History* or California Division of Mines and Geology Special Publication #41 *Basic Placer Mining*.)

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In time the free-lance miner gave way to partnerships and corporations. Mining-company stock became active in the speculators' market. Assay reports on ore samples indicated what the profit of a mine might be. The dramatic rise of California's population during the gold rush, combined with the development of the mining economy, abruptly closed the pastoral period of California history and hastened enormously the rise of modern California.

### **Statehood**

In 1849 Bennett Riley, 7th military governor of California, called for a convention of 48 delegates from the 10 districts into which he had divided California for representation. The delegates met at Colton Hall, Monterey (from September to November in 1849) to work on the State Constitution. The document was written in both English and Spanish and provided that future legislation be written in both languages. In addition to writing the Constitution, delegates established the state's boundaries, chose the site of its capital, and designed its Great Seal. The Constitution was ratified by popular vote on November 13, 1849, the same day officials were elected to office, so that California began to act as a state before its official admission to statehood. Congress, however, failed to take any action. Meanwhile, gold had been discovered and when the news spread, a tremendous wave of immigration began. This delayed official statehood, which finally occurred on September 9, 1850.

California's capitol moved often. San Jose was designated the first capital. In 1851, the government transferred to Vallejo, and in 1853 to Benicia. Finally, in 1854, the legislature decided that Sacramento would be the most suitable seat for state government.

### **Treatment of California Indians**

In 1851 18 treaties were negotiated with groups of California Indians. The treaties promised over 7 million acres of land to the Indians in exchange for the entire state. These treaties were never ratified by the United States Senate, as vocal anti-treaty sentiment developed within the state's newer population. Already stripped of most of their ancestral lands, California Indians were denied even the nominal protection of treaties. Impatient settlers and miners clashed repeatedly with the native people. The outbreaks took on a pattern of attack and reprisal, as raids or killings set off a spreading cycle of revenge. The California Indian population decline during the period 1850-1880 has been estimated to be in the neighborhood of 80 percent.

### **Development of California**

The gold rush had a great impact on California. During this period, the population increased six-fold. People of diverse cultural and economic backgrounds, ethnic origins, and religious beliefs settled here. Transportation and communication needs

were met by express companies, such as the short-lived Pony Express, the Butterfield Overland Mail, Adams Company, Wells Fargo & Company, and by development of the transcontinental telegraph. Early on, some of the shrewder men in search of gold soon recognized the profits to be made providing food and supplies to the miners. Many of those who later became prominent in California began their careers as merchants during the gold rush, including Collis P. Huntington, Leland Stanford, Mark Hopkins, and Charles Crocker. These men—"the Big Four"—dominated the state through their interests in the Central Pacific Railroad and later the Southern Pacific Railroad. It was through their support that the dream of a transcontinental railroad was realized in 1869.

Settlement in California spurred the growth of agricultural industries in wheat, wines, and citrus. The development of irrigation allowed for the expansion of farming in previously arid lands. Real estate boomed, with California often being marketed for the health-giving effects of its climate. Small utopian communities, like the African-American town of Allensworth, flourished.

## **Lumbering**

Like fur trading, lumbering became an important industry in California. Commercial lumbering began with Americans and other immigrants: J.B.R. Cooper built a water-powered sawmill on the Russian River (1834); Isaac Graham established a power sawmill in the Santa Cruz mountains (1854); Captain Stephen Smith created a steam-driven sawmill near Bodega Bay (1844); and John A. Sutter and James Marshall built a mill on the American River (1848), where gold was discovered. The gold rush prompted a need for wood for: sluices, flumes, dams, tunnels, fences, and the construction of towns. Sawmills soon arose in present-day Mendocino, Humboldt, and Santa Cruz Counties and in the Sierra.

By 1870 the best and most accessible pine and redwood forests had been logged from nearly 100,000 acres (less than 1 percent of the state's forests). From 1870 to 1890, less accessible pine stands of the Sierra were cut in the present Plumas National Forest region for timber and for turpentine. Flumes—V-shaped troughs holding flowing water—made possible the transportation of lumber from the Sierra to Sacramento Valley lumber companies. From the 1890s to the mid-1930s, forest exploitation worsened, as clear cutting without reforestation was commonly practiced and steam donkeys (engines) and logging railroads severely damaged forests. Concern about their depletion and the use of destructive practices led to the creation of a State Board of Forestry (1885) and a State Forester (1905). The first forest rangers were funded by the counties in 1919.

During the 20th century, greatly enhanced protection of California's forests has been achieved through the 17 national forests, which contain about half of the state's commercial forest lands; the national parks, which protect great groves; the state forests, which practice conservation and do research; and California State Parks.

## **Twentieth-Century Innovation and Progress**

In 1895 the Folsom powerhouse began operating, delivering to Sacramento 11,000 volts of electricity—a new achievement in long-distance, high-voltage transmission. Technological breakthroughs, like the automobile and motion picture photography, transformed the state, shaping both the environment (through roads and freeways) and impressions of the California lifestyle.

Competition for limited jobs in California in the 19th and early 20th centuries caused widespread discrimination and the harassment of Chinese and other ethnic groups. Exclusion Laws, first enacted in 1882, decreased or prevented their entry into California. From 1910 to 1940, the Immigration Station on Angel Island detained many individuals for interrogation who were trying to enter the United States, sometimes for long periods of time. The Exclusion Laws were repealed in 1943.

Wartime expansion boosted California's shipbuilding and aircraft industries. Older military facilities, like those on Angel Island, were enlarged, as new installations—Camp Pendleton, Treasure Island Naval Station, Castle and McClellan Air Force Bases, etc.—were developed. World War II also marked a dark period in California history, when, to quiet unfounded fears of sabotage and espionage, thousands of people of Japanese descent were interned in makeshift camps at Manzanar in Owens Valley and at Tule Lake near the Oregon border.

During the 20th century, further expansion of electric power and such engineering feats as the Central Valley and Colorado River water projects, permitted a growth and development of California unimagined in the 18th and 19th centuries. With the end of the Cold War and the resulting reductions in military and aerospace industries, many Californians have begun looking to the future through the expanding computer and bio-technology fields.

## **State Parks in California**

The story of California's state parks began in the mid-1800s, prior to any organized environmental or cultural preservation movement. The gold rush had attracted thousands of people in search of riches. New cities quickly sprang up as rich gold and silver deposits fueled economic growth. Mountainsides of ancient redwood forests fell as the need for lumber increased. Few people appeared to be concerned with the drastic consequences of the exploitation of the land.

The first step toward protecting some of California's key resources and landscapes began during the Civil War. At that time a group of Californians lobbied for federal legislation that would grant to the state some 20,000 acres of federal land in and around Yosemite Valley and the Mariposa Big Tree Grove specifically for their protection and for public recreation. President Lincoln signed the legislation on June 30, 1864, thereby establishing the nation's first state park, although later these lands

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would be transferred back to federal jurisdiction to become part of Yosemite National Park.

In the late 1800s, concern over the near-decimation of the ancient redwood forests on California's north and central coast prompted some citizens, including photographer Andrew P. Hill and members of the newly established Sempervirens Club, to lobby to acquire redwood property in Santa Cruz County. In 1902 the newly appointed California Redwood Park Commission acquired the first 2,500 acres in Big Basin for a public park at a cost of \$100 per acre. This "California Redwood Park" soon became a popular destination—and a symbol of the growing movement to protect some of the Golden State's finest natural resources and scenic landscapes for the enjoyment of future generations.

Around the same time, another movement began to preserve California's cultural resources. Interest in preserving California's history dates back to the gold rush as participants celebrated their involvement in this momentous event with the founding of the Society of California Pioneers in 1850 and the incorporation of the Historical Society of California in 1852 (today known as the California Historical Society). The lasting significance of the gold rush was memorialized in 1890 with California's first official historical landmark—a statue of James Marshall overlooking his 1848 gold discovery site on the American River near Coloma. Three years later, Sutter's Fort opened to the public as a state historic monument.

Official recognition of the state's colorful history was promoted by groups such as the California Historical Society and the Native Sons of the Golden West. These various groups gave rise to an alliance, the California Historical Landmark League, which secured funds to identify, preserve, and promote historic sites. Early achievements included the Monterey Custom House, San Pasqual Battlefield, Mission San Francisco Solano at Sonoma, Fort Ross, General Mariano Vallejo's Petaluma Adobe, and California's First Theatre in Monterey. Although many of these sites were deeded to the State of California, control of the state's historic monuments remained with independent boards and commissions until 1921. Today the Office of Historic Preservation, a branch of California State Parks, is responsible for overseeing state and federal historic preservation and designation programs.

Beginning in 1925, a coalition of groups and individuals led by the Save-the-Redwoods League began campaigning for the formation of a State Park Commission that would administer existing state parks and historic monuments and sites, conduct a statewide survey of potential state park sites, and establish a fundamental state park policy. Legislation passed in 1927 formally establishing the Commission, whose members soon began gathering support for a state park bond issue to fund park acquisitions. Their efforts were rewarded in 1928, when Californians voted nearly three-to-one in favor of a six-million dollar park bond act. Later that year, Frederick Law Olmsted, Jr. completed a statewide survey of potential parklands and issued a report that outlined general policies to guide the long-range acquisition and development of state parks.

## *Junior Ranger Program Handbook: History*

The new system of state parks began to grow rapidly, despite the stock market crash of 1929 and the ensuing Great Depression. California's park system had grown from a dozen parks and five historic monuments in 1928 to 49 parks and 11 historic monuments by 1934. Total state park holdings increased from 13,700 to about 300,000 acres, and park visitation jumped from about 60,000 to nearly 6 million during the same time. After 1934, however, depletion of the 1928 State Park Bond and depressed economic conditions limited further land acquisitions, prevented park development of public facilities, and restricted staffing.

In 1933 the Civilian Conservation Corps (CCC) and the Works Progress Administration (WPA) stepped in to assist with park development by providing architects, manual laborers, and historians. Established under President Franklin D. Roosevelt's New Deal program, the CCC employed young men, ages 17 to 28, on work projects throughout the nation's public parks and forests. About 3,800 enrollees worked in California's state parks, constructing roads and trails and building campgrounds, visitor centers, and other facilities, making it possible to open these parks to public use.

A distinct "park rustic" architectural style distinguished the work of CCC enrollees in California's parks. They used local, natural materials and hand-craftsmanship to construct buildings and other structures that blended into the surrounding natural landscape. Many of the facilities built by the CCC in the 1930s still remain as a tribute to their hard work.

After World War II there was a tremendous increase in tourism and recreation. To meet this demand, 24 new beaches and parks were acquired over the next decade. The growing diversity of park unit types had already resulted in an organizational change—the renaming of the Division of Parks as the California Division of Beaches and Parks. Newton Drury, one of the early leaders of the state park movement, was appointed Director in 1951. Under Drury's capable hand, the Division flourished so that, when he retired eight years later, more than 150 beaches, parks, and historic monuments comprised the State Park System.

During the 1960s, as public interest in preserving California's open land against encroaching development intensified, the State Park System was undergoing a transition. In 1967, Governor Ronald Reagan appointed William Penn Mott, Jr. as director of California's state parks. Despite the difficulties of budget cuts and hiring freezes, Mott successfully transformed the Division of Beaches and Parks into today's familiar Department of Parks and Recreation. Under Mott's innovative leadership, the administrative functions of the Department were centralized, with support staff positions moved to headquarters in Sacramento. Individual parks were reorganized under area managers who reported to district superintendents. New divisions were created within the Department to provide better management of historical and natural resources. A centralized and standardized ranger training program began at Asilomar in 1969, followed by construction of a formal training center there.

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During the 1970s, voters approved bond issues that permitted the acquisition and development of state recreation areas and other parklands. The decade also saw a new division—the Off-Highway Motor Vehicle Division—added to the Department. The 1980s and 1990s brought a focus on resource stewardship, with increased efforts to restore and protect the natural and cultural heritage preserved in state parks.

The 1990s were marked by a complete organizational restructuring of the Department of Parks and Recreation to improve service and efficiency. Modern business practices were implemented—identifying core program areas, monitoring performance carefully, and budgeting in accordance with results. Increasingly, the Department utilized a large, public-spirited corps of volunteers to help achieve its ambitious goals.

Today, California State Parks is the steward of more than 275 park units and properties encompassing more than one and one-half million acres. Within its purview are hundreds of miles of coastline, thousands of miles of hiking, biking, and equestrian trails, and more than twenty thousand picnic and camp sites. The Department is also responsible for the management of more than one million museum objects, two million archaeological specimens, and more than three million archival documents throughout the state.

The mission of the California Department of Parks and Recreation is to provide for the health, inspiration, and education of the people of California by helping to preserve the state's extraordinary biological diversity, protecting its most valued natural and cultural resources, and creating opportunities for high quality outdoor recreation.

California's parks reflect the diverse nature of this state's history, preserving sites important to the Spanish, Mexicans, California Indians, Americans, Russians, Chinese, African-Americans, and others. For many, visiting these parks can be like taking a step back in time. Not only is history preserved, but in many cases history comes to life, as visitors participate in the activities of the past.

### **State Parks Associated with Specific Historic Periods**

Below is a list of the state parks where park visitors can learn about California's rich historical and cultural diversity.

California Indians: In the foothills of the Sierra Nevada, the story of the Northern Miwok and their neighbors is told at Indian Grinding Rock State Historic Park. Here petroglyphs and bedrock mortars have been preserved and protected. A ceremonial roundhouse has been recreated so visitors can learn of this early culture. In the fall, a festival transforms the park with hand games, feasting and dancing. Descendants of the Miwok celebrate the coming of autumn much as their ancestors celebrated the acorn festival at this time every year.

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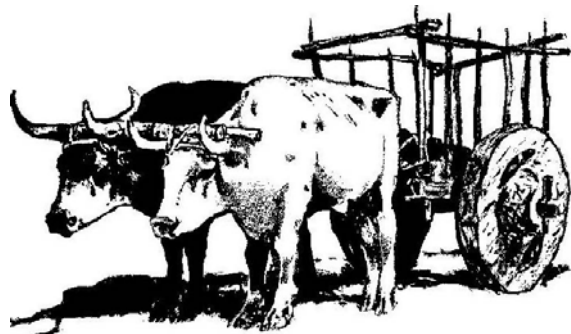
Parks interpreting California Indian culture include:

- Anderson Marsh SHP
- Angel Island SP
- Antelope Valley Indian Museum
- Anza-Borrego Desert SP
- Calaveras Big Trees SP
- Cuyamaca Rancho SP
- Fort Humboldt SHP
- Fort Ross SHP
- Fort Tejon SHP
- Indian Grinding Rock SHP
- La Purísima Mission SHP
- Lake Perris SRA: Mohave Desert Indian Museum
- Malibu Lagoon State Beach Museum
- Pfeiffer Big Sur SP
- Providence Mountains SRA: Mitchell Caverns
- Red Rock Canyon SP
- Santa Cruz Mission SHP
- State Indian Museum
- Wassama Round House SHP

Spanish/Mexican Era: Designed to share the faith and culture of the Spanish, the missions provided a vehicle for European settlement. At La Purísima Mission State Historic Park, the restored mission appears as it did more than a century ago. Today, mission life is revived during living history days.

Parks interpreting the Spanish/Mexican Era include:

- El Presidio de Santa Barbara SHP
- La Purísima Mission SHP
- Los Encinos SHP
- Monterey SHP
- Old Town San Diego SHP
- Petaluma Adobe SHP
- Pío Pico SHP
- San Juan Bautista SHP
- San Pasqual Battlefield SHP
- Santa Cruz Mission SHP
- Sonoma SHP
- Sutter's Fort SHP



The Gold Rush: Today at Marshall Gold Discovery State Historic Park, Sutter's Mill has been reconstructed, and a museum has been developed to tell the story of Sutter, Marshall, and the gold rush.

At Columbia State Historic Park, a gold rush town still lives. Try your hand at gold panning, take a ride on a stagecoach, or experience a gold rush vintage traveling show



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at the Fallon Theater. The gold rush brought people from all over the world to California. With them came new ideas, new cultures, and a new way of life. Today their stories have been preserved in a number of historic buildings.

Parks interpreting the gold rush and mining include:

- Bodie SHP
- Columbia SHP
- Cuyamaca Rancho SP
- Empire Mine SHP
- Malakoff Diggins SHP
- Marshall Gold Discovery SHP
- Millerton Lake SRA
- Old Sacramento SHP
- Picacho SRA
- Plumas-Eureka SP
- Shasta SHP

Pioneer Life: Many parks feature interpretation of early settlers in California. These include:

- Anza-Borrego Desert SP
- Benicia SHP: Fischer-Hanlon House
- Donner Memorial SP
- Lake Oroville SRA: Bidwell Bar tollhouse and bridge
- Los Encinos SHP
- Monterey SHP: Cooper-Molera Adobe
- Edwin L. Z'berg—Sugar Pine Point SP
- Sutter's Fort SHP
- William B. Ide Adobe SHP

Historic Towns and Communities: In some cases, much of a historic town or community has been preserved. These include:

- Bodie SHP
- Colonel Allensworth SHP
- Columbia SHP
- Malakoff Diggins SHP: North Bloomfield
- Marshall Gold Discovery SHP: Coloma
- Monterey SHP
- Old Sacramento SHP
- Old Town San Diego SHP
- Plumas-Eureka SP: Johnsville
- San Juan Bautista SHP
- Shasta SHP
- Sonoma SHP

Schools: Many of the historic towns listed above have an old schoolhouse, including:

- Colonel Allensworth SHP

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- Columbia SHP
- Malakoff Diggins SHP
- Marshall Gold Discovery SHP
- Old Town San Diego SHP

Ethnic Communities: North of Bakersfield, Colonel Allen Allensworth founded the farming community of Allensworth in 1908. Black pioneers built the town to live self-sufficient lives, free from the adversities brought about by racial prejudice.

Parks interpreting California's ethnic communities include:

- Angel Island SP: Immigration Station
- China Camp SP
- Colonel Allensworth SHP
- Columbia SHP: Chinese Herb Shop/Temple
- Fort Ross SHP
- Marshall Gold Discovery SHP
- Monterey SHP
- Old Town San Diego SHP
- Point Lobos SR: Whaler's Cabin
- San Juan Bautista SHP
- Shasta SHP
- Sonoma SHP: Toscano Hotel Complex
- Weaverville Joss House SHP



Homes of Influential Figures: In Chico, Bidwell Mansion State Historic Park interprets the life of John Bidwell, known throughout California as a pioneer, statesman, and horticulturalist.

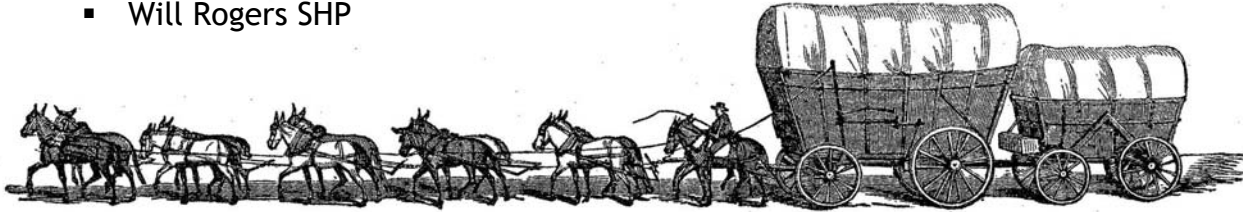
The home of William Randolph Hearst is an extremely popular unit of the State Park System. Every year, nearly 1,000,000 people visit Hearst Castle at San Simeon to see the priceless art and timeless architecture that reveal a man whose impact is still felt on our politics, journalism, and art.

Parks interpreting the homes and lives of influential figures include:

- Bidwell Mansion SHP
- Emerald Bay SP: Vikingsholm
- Empire Mine SHP
- Governor's Mansion SHP
- Hearst San Simeon SHM
- Jack London SHP
- Leland Stanford Mansion SHP
- Marshall Gold Discovery SHP
- Monterey SHP: Larkin House, Sherman Adobe, Robert Louis Stevenson House
- Petaluma Adobe SHP
- Pío Pico SHP

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- Sonoma SHP: Vallejo Home
- Edwin L. Z'berg—Sugar Pine Point SP: Ehrman Mansion
- Sutter's Fort SHP
- Will Rogers SHP



Ranching, Agriculture, and Lumbering: California's history has been affected by these industries, which are interpreted at the following parks:

- Anderson Marsh SHP
- Bale Grist Mill SHP
- Butano SP (lumbering)
- Calaveras Big Trees SP
- California Citrus SHP
- Cuyamaca Rancho SP
- Fort Humboldt SHP
- Henry W. Coe SP
- Marshall Gold Discovery SHP
- Mendocino Headlands SP
- Petaluma Adobe SHP
- Sonoma SHP: Vallejo Home
- Wilder Ranch SP (dairy/butter making)

Military: Many parks interpret California's military history, including:

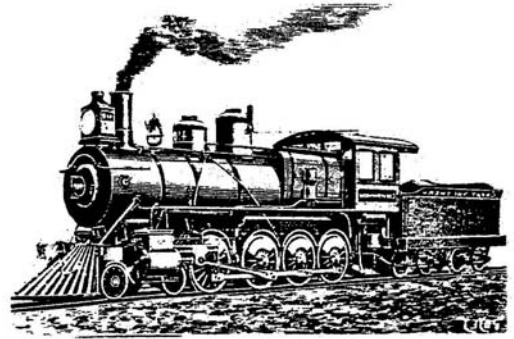
- Angel Island SP
- Fort Humboldt SHP
- Fort Tejon SHP
- San Pasqual Battlefield SHP
- Sonoma SHP
- Sutter's Fort SHP

Government:

- Benicia Capitol SHP
- California State Capitol Museum
- Millerton Lake SRA: Millerton Courthouse
- Monterey SHP
- Old Sacramento SHP: B.F. Hastings Building
- Old Town San Diego SHP
- Shasta SHP

Transportation, Communication, and Power Generation:

- California State Railroad Museum
- Folsom Lake SRA: Folsom Powerhouse
- Old Sacramento SHP: B.F. Hastings Building
- Old Town San Diego SHP
- Plumas-Eureka SP: Hydroelectric plant
- Railtown 1897 SHP
- San Juan Bautista SHP: Stable



Early Recreation and Entertainment:

- Columbia SHP: Fallon Hotel and Theater
- Lighthouse Field State Beach: Santa Cruz Surfing Museum
- Monterey SHP: First Theater
- Old Sacramento SHP: Eagle Theater
- Plumas-Eureka SP: Skiing
- Edwin L. Z'berg—Sugar Pine Point SP
- Woodland Opera House SHP

## Suggested Resources: History

Bloch, Louis M., Jr. *Overland to California in 1859: A Guide for Wagon Train Travelers*. Cleveland, OH: Bloch & Company, 1990. How to prepare for wagon train travel, based on 19th century guidebooks and newspapers. Integrates geography and technology with other disciplines.

Bright, William. *1500 California Place Names: Their Origin and Meaning*. Berkeley: University of California Press, 1998. This little volume gives name explanations for well-known geographic features of the state—and some lesser-known ones, too.

Brown, William E. *Islands of Hope: Parks and Recreation in Environmental Crisis*. Arlington, VA: National Recreation and Park Association, 1971. This book reflects the idealism and energy of the environmental movement in its prime.

*California History*. Published quarterly by the California Historical Society, 2099 Pacific Avenue, San Francisco, CA 94109.

Clark, William B. *Gold Districts of California*. Bulletin 193. San Francisco: California Division of Mines and Geology, 1970. Comprehensive look at gold mining throughout the state, citing specific mining districts and mines. Includes bibliographies.

Cook, Sherburne F. *The Conflict Between the California Indian and White Civilization*. Berkeley, CA: University of California Press, 1976.

## *Junior Ranger Program Handbook: History*

D'Alelio, Jane. *I Know That Building! Discovering Architecture with Activities and Games*. Washington, D.C.: The Preservation Press, National Trust for Historic Preservation, 1989. Activities and adventures in this book will show you what architecture is all about—how buildings are designed, who creates them, where the models for certain structures come from, how buildings changed over the years.

Dasmann, Raymond F. *Environmental Conservation*. New York: John Wiley & Sons, 1966. Textbook on general conservation principles by one of the leaders of the conservation education system.

Engbeck, Joseph H., Jr. *By the People, For the People: The Work of the Civilian Conservation Corps in California State Parks, 1933-1941*. Sacramento: California State Parks, 2002. A wonderful exploration of President Roosevelt's Civilian Conservation Corps program and its role in the development of California's state parks.

Engbeck, Joseph H., Jr. and Philip Hyde. *State Parks of California from 1864 to the Present*. Portland, OR: Charles H. Belding, 1980. Published for the park system's fiftieth anniversary, this book does not reflect more recent developments—some of them significant. Yet it remains one of the most useful general state park history references.

Gudde, Erwin. *One Thousand California Place Names: Their Origin and Meaning*. 3rd revised edition. Berkeley: University of California Press, 1959. Stories behind the names of cities, towns, rivers, mountains, lakes and other places. Look up your park name or the names of nearby cities. You can use this book for name games, as well.

Hannaford, Donald. *Spanish Colonial or Adobe Architecture of California, 1800-1850*. New York: Architectural Book Publishing Company, 1990. Pictorial survey of Hispanic architecture in California; photographs and drawings of exteriors, interiors, floor plans, chimneys, details, and hardware. Few of the buildings remain. First published in 1931.

Hart, James D. *A Companion to California*. New York: Oxford University Press, 1978. A wonderfully easy-to-use reference guide for just about any topic in California history. The perfect reference for quick questions of fact.

Helmich, Mary and Pauline Spear. *A Gold Rush Merchant's Manual: Or How to Appear as a Mid-19th Century Store in a 21st Century World*. 2 vols. Sacramento: California Department of Parks and Recreation, 1989.

Helmich, Mary. *The Old Town San Diego Retailer's Reference and Historic Account Book: Or Advice for Merchants Re-creating a c. 1835-1872 Period Store*. Sacramento: California Department of Parks and Recreation, 1992.

## *Junior Ranger Program Handbook: History*

Helmich, Mary. *Park-to-Park Index*. Sacramento: California State Parks, 2000. This loose-leaf document gathers, in one place, a great store of information about natural, cultural, and recreational park resources—and about interpretive facilities and activities as well.

History-Social Science Curriculum Framework and Criteria Committee. *History-Social Science Framework for California Public Schools, Kindergarten Through Grade Twelve*. Sacramento: California State Department of Education, 1988. This is the basic guidebook used by teachers and curriculum specialists for presenting history and social science to California grade schools. Anyone preparing a history program for a park should adopt the thematic approaches suggested.

Hoover, Mildred Brooke, Hero Eugene Rensch, Ethel Grace Rensch, and William N. Abeloe. *Historic Spots in California*. 4<sup>th</sup> Ed. Stanford, CA: Stanford University Press, 1990. This guide to California's historically-significant sites is an authoritative, comprehensive, and long-familiar reference work.

Kirker, Harold. *California's Architectural Frontier*. New York: Russell and Russell, 1970. Best general history on California's architectural development in the nineteenth century.

Kuska, George and Barbara Linse. *Live Again Our Mission Past*. Larkspur, CA: Arts' Books, 1983. Sections on Indians, Spanish explorers, missions, visualizing history, humanizing historical characters, and mission crafts. Simple text, large clear type, and line drawings present a fun workbook.

Laurgaard, Rachael. *Patty Reed's Doll: The Story of the Donner Party*. Caldwell, OH: Caxton Printers, 1989. True biography of Patty Reed and her small wood doll who traveled to California with the Donners. Look for Patty's doll at Sutter's Fort. (Not morbid)

Marinacci, Barbara and Rudy Marinacci. *California's Spanish Place Names: What They Mean and How They Got There*. San Rafael, CA: Presidio Press, 1980. Essays on Spanish place names and their origins.

Pelz, Ruth. *Black Heroes of the Wild West*. Seattle, WA: Open Hand Publishing, 1990. Biographies of nine heroic men and women in the West between the 16th and 20th centuries: explorers, settlers, businesspeople, a journalist, a rodeo rider, and Stagecoach Mary.

Quontamatteo, Nancy. *The Gold Rush Era*. Conceptual Productions, 1981. Learn and have fun with crossword puzzles, reading sheets, vocabulary lessons, money tables, outlaw handouts, transportation worksheets, map skills, word finds, and more. Clear writing, simple drawings, comprehension tests.

### *Junior Ranger Program Handbook: History*

Rawls, James J. and Walton Bean. *California: an Interpretive History*. New York: McGraw-Hill Book Company, 1998. Good concise basic history with excellent references at each chapter's conclusion.

Reisner, Marc. *Cadillac Desert: the American West and Its Disappearing Water*. New York: Viking Penguin Inc., 1986. The author weaves history, biography, engineering, politics and economics into a fascinating story—a story of the quest to control and allocate the West's precious supply of water.

Rice, Richard B., William Bullough, and Richard Orsi. *The Elusive Eden: a New History of California*. New York: McGraw-Hill Companies, Inc., 1996.

Rolle, Andrew F. *California: a History*. (fourth edition). Harlan Davidson, 1987. Considered the standard history of California, this book begins with California's early inhabitants and covers Spanish rule, Mexican control, American exploration and settlement, the gold rush, immigration and statehood.

Scarry, Rick. *Things that Go: From the Wheel to Modern Engines*. New York: Derrydale Books, 1986. Almost every form of transportation, well-illustrated and explained.

Short History Series: *Los Angeles*, Gordon de Marco, 1988; *Sacramento*, Dorothy Leland, 1989; *San Diego*, Michael McKeever; *San Francisco*, Tom Cole, 1986. From native cultures to modern times, these four city histories tell the story of each place, the people who defined them and their roles in California. Clear writing, photographs, and drawings provide a solid foundation for visitors or students.

*Story of the American West*. Pleasantville, NY: The Reader's Digest Association, Inc., 1977. Excellent use of historic graphics, maps, and explanatory illustrations, from prairie schooners to mining techniques to railroad construction technology.

Weitzman, David. *My Backyard History Book*. Boston: Little, Brown and Company, 1975. Packed with fun, inexpensive, and easy-to-accomplish projects and activities, from making time capsules and family oral histories to rubbing details. "How-to" history book for children to discover personal, family, and local history.

Weitzman, David. *Underfoot: An Everyday Guide to Exploring the American Past*. New York: Charles Scribners & Sons, 1976. A how-to primer on methods for discovering historical records of your family and/or community.

Wilcox, Del. *Voyagers to California*. Elk, CA: Sea Rock Press, 1991. Good brief sketches of California history with short biographies of historic people.

Yep, Lawrence. *Rainbow People*. New York: HarperTrophy, 1989. Traditional tales told among Chinese in California: of love, tricksters, fools, vice, virtue and life.





**INSERT *PARK CAREERS* TAB HERE**



# Park Careers



## Introduction

Many park employees have been influenced by a childhood experience in a park, which eventually led to a career in the California State Park System. Not only does a unit on park careers expose Junior Rangers to future job possibilities, it also makes the connection between park careers and good stewardship of California's valuable resources.

Look for enthusiastic speakers from your district, neighboring districts, and regional offices. The Junior Ranger Program provides opportunities for service staff to share their knowledge and be involved with interpretation in the field. By sharing the values that inspired the speaker's involvement with the state parks, the stewardship message will be gently reinforced.

To give you some ideas on how to interpret state park careers, Kathryn Yee, as a Ranger I from the former San Francisco District, has included a script from her Career Day slide show. Try the Jobs webpage on the Department's website for more ideas ([www.parks.ca.gov/jobs](http://www.parks.ca.gov/jobs)).

## *Junior Ranger Program Handbook: Park Careers*

The Park Careers segment offers opportunities to involve all levels of park staff. Junior Rangers will be exposed to people with different gifts and talents who work together to protect California's state park resources.

Some state parks have developed profession-specific "Junior" programs (such as Junior Historian, Junior Engineer, Junior Curator) as a creative way for children to learn about other jobs available within state parks. The Park Careers section of the Junior Ranger Handbook and logbook is an excellent place for these programs to be incorporated. These profession-specific "Junior" programs shouldn't be created as stand-alone programs but should utilize the Junior Ranger materials, awards, and awards structure. Staff who are developing profession-specific programs should report on, and request supplies/awards for their program, through the Junior Ranger Program.

More information on selected professions, such as archaeology, will be included in Appendix C: Additional Program Information as it is developed and made available.

## **Sample Program: Park Careers**

### **Outline**

- I. Pre-Planning
  - A. Confirm with your guest speaker the date and time of the program.
  - B. Ask the speaker to include the following in the talk:
    1. Hands-on activities
    2. Stewardship application (in the park and at home)
  - C. Ask the speaker if he/she will need any supplies or equipment for the talk.
- II. Introduction

Introduce yourself.  
Introduce the Junior Ranger Program.  
Introduce your guest.
- III. Participate in the Program
  - A. Assist the speaker with any displays or props.
  - B. Actively listen and participate with the Junior Rangers. They will catch your enthusiasm.
- IV. Concluding the Program
  - A. Ask if the Junior Rangers have any questions.
  - B. Quickly review the highlights of what the Junior Rangers have learned.
  - C. Ask what they learned about stewardship.
  - D. Stamp logbooks.
  - E. Thank the speaker!

## Sample Talk

“Hello, my name is Kathryn Yee. I'm a California State Park Ranger, currently stationed at Candlestick Point State Recreation Area in San Francisco. Have any of you ever visited Candlestick Stadium? Well, Candlestick Point SRA is right across the street, but many people in the San Francisco Bay Area do not know that a state park even exists within the city and county of San Francisco!

It might be easier to say that I have three functions as a park ranger and perform these functions in three ways. First, California state park rangers and state park lifeguards are fully sworn peace officers. Just like the police officers and sheriff's deputies, we have to go through a regular police academy. Unlike those officers and deputies, we also have to be trained in resource management and interpretation (which is like being a teacher or naturalist).

In general, I have to:

- Protect the park from the people;
- Protect the people from the park; and
- Protect the people from other people.

In many park units, people either do not know the rules or feel they are free to do the same things they do at home when they visit a park. Park regulations exist primarily for the safety of the visitor and the park.

Sometimes, potentially hazardous situations exist within parks, like cliffs, caves, undertows, and slippery areas. Park visitors need to be protected and warned of potential danger. Sometimes, they even have to be rescued from these situations.

The last item refers to people who try to either bring their problems to the park or behave in inappropriate ways. They may disturb their neighboring campers, commit crimes like vandalism within the park, or drink and drive their cars or boats while on park property. To protect visitors so that they may feel safe in the park environment and enjoy their visit, state park rangers and lifeguards are peace officers and will enforce local and state laws.

To maintain park units so future visitors will enjoy and experience each park's unique features, park personnel have to manage the resources within each park. Resource management may range from knowing what flowers, trees, and animals live within the park to taking care of historical objects, buildings, and artifacts significant to the park's history.

However, this is not enough. People visit parks not only to relax and use the facilities, but to also learn about the significance of the area. Most state park units are established because they have scenic value, are the home of endangered or threatened species, were the site of famous people, or contain cultural significance.

## *Junior Ranger Program Handbook: Park Careers*

State park rangers and lifeguards must be able to relate these things to visitors. Then the visitor will feel a bond and perhaps be inspired to learn more or change his or her behavior to improve our environment.

There are many different jobs available within the California State Park System besides that of state park ranger or lifeguard.

The field operations that are visible to the park visitor are supported by many people who aren't visible to the public. In fact, many visitors will only see the park aids (who work to collect fees, clean bathrooms and remove litter) or park volunteers (who give interpretive programs, perform search and rescue, or ride on horse patrol).

When a park is first considered for inclusion within the State Park System, employees must work to determine if the property is of significance to the people of the State of California. Land agents, architects, surveyors, contractors, engineers, and financial advisors may be needed for the business end of this. Historians, archaeologists, wildlife or marine biologists, and others may also be called in.

Once the property is purchased, facilities may be built for staff and visitors. Landscape architects, building contractors, resource ecologists, and engineers will be needed. As soon as possible, the area is opened to the public.

Once an area is open, staff is usually assigned to monitor and maintain the area. Maintenance is a very large part of park work. Think about the parks you have visited. I'm sure you would have noticed dirty bathrooms or overflowing garbage cans. Maintenance people try to keep state park facilities clean and neat. They may also be involved in the maintenance and care of the plants, removal of hazardous trees, care of historic buildings, and repair of park equipment. Landscape technicians, groundskeepers, sewage and water treatment operators, heavy equipment operators, electricians, plumbers, and other skilled people work for California State Parks to keep everything working properly so the visitor can enjoy his or her stay safely and without worry.

Of course, backing up all of the field staff are those who make the decisions. Managers and superintendents, along with supervising rangers and lifeguards, work to run each park district efficiently and professionally. They are assisted by regional administrative officers and technicians, office clerks, account clerks, dispatchers, and other support personnel. As most of us know, almost everything important must be communicated in writing—and that's a lot of paper!

Behind all of these people are the administrators, attorneys and legislators in Sacramento, who make policy, set the budget, and coordinate efforts throughout the state.

Whether you seriously consider a career in the field of Parks and Recreation or decide to pursue some other field, you need to stay in school, gain some work experience

(volunteer or paid), and set realistic goals for yourself. Many employers will accept applicants with a variety of education and experience, but they insist that verbal and written English skills are essential. Take English composition and rhetoric courses. If you cannot write or speak well, you will lose credibility and be misunderstood when attempting to communicate thoughts, ideas, actions, or discoveries. Most jobs require some public speaking skills, whether you have to address large groups of people, make a business presentation, or interview a witness.

Competition for jobs is keen. Whether you want a career that will garner a high salary or a career that is long on personal satisfaction and job development potential, remember that others will want that, too.

Although currently California state park rangers and lifeguards only need to have two years of college, most have at least a bachelor's degree. This is partially because of the competition for jobs. Many people have to work seasonally in parks before acquiring enough experience to land a full-time, permanent position. During the winter months, they either go to school or find other employment. Park rangers and lifeguards also have to be versed in a wide variety of skills like emergency medical response, search and rescue techniques, teaching, and scientific and historical knowledge for a variety of areas.

So, set your goals, work and study hard, and reach your dreams!"

## Activities

### Working in Parks

Number of Children: One or more

Environment: Any

Equipment Needed: Working in Parks Crossword Puzzle (see Appendix B)

Purpose of the Activity: To explore various park careers

Activity:

1. Discuss the different types of positions within the State Park System. To make this interesting take the Junior Rangers on an investigative tour of the park so they can watch different employees in action or have different employees talk with them.
  - What is each individual doing?
  - What skills, training or education do they need to complete their work?
  - Why are they important to the park?
2. Ask the Junior Rangers to share three personal qualities or skills they think they have that would enable them to work in parks. What position is best suited to their qualifications or interests?
3. Provide the Working in Parks Crossword Puzzle (Appendix A).
4. For their log book ask the Junior Rangers to choose a park position they think they would enjoy and have them draw themselves as that employee.

5. Emphasize to the Junior Rangers that an important part of any park employee's job is the preservation of the state's natural and cultural resources for the education and enjoyment of the people of California. How can they as Junior Rangers help protect our state parks? (pick up litter, stay on trails, etc.)

## Background Information: Park Careers

### Public Safety

California State Parks employs over 700 peace officers to safeguard both visitors and the resources themselves. Rangers and lifeguards provide not only public safety, law enforcement and aquatic rescue services, they also provide public education through interpretation. Lifeguards and state park rangers are trained and designated as sworn peace officers. They perform patrol duties primarily by vehicle, boat, and foot patrol; issue citations; write reports; make physical arrests for misdemeanors, felonies, and warrants; take command in emergencies; perform search and rescue activities, including detecting and rescuing persons or vessels in distress; assist in wildland and structural fire suppression; provide emergency medical aid; train personnel in all phases of life-saving activities, operate and maintain emergency rescue equipment; and other related work.

- Lifeguard—Performs a wide variety of aquatic services at state ocean and inland beaches, underwater parks, and recreation areas. Lifeguards may perform scuba diving and ocean, surf, river, and lake rescue. They may specialize in assignments such as cliff rescue; off-highway vehicle and motorcycle patrol; or canine team handler. Park units where lifeguards work include state parks, reserves, recreation areas, beaches, wayside campgrounds, and underwater parks.
- State Park Ranger—Is involved in the law enforcement and visitor services functions of the State Park System. Rangers perform professional and technical duties in state park units involving park operation, interpretation, resource protection/management, patrol, safety and law enforcement. They assist with program management activities, and may supervise and/or serve as a lead to seasonal and lower level permanent staff. Rangers work primarily in field districts of the State Park System including state parks, reserves, historical units, recreation areas, beaches, wayside campgrounds, and underwater parks. Positions are also assigned to Off-Highway Motor Vehicle Recreation Division units located throughout the state.

### Interpretation and Education

Interpretation is a special form of communication that helps people understand, appreciate, and emotionally connect with the rich natural and cultural heritage preserved in parks. It is the mission of interpretation in California State Parks to convey messages that initially will help visitors value their experience, and that ultimately will foster a conservation ethic and promote a dedicated park constituency.



## *Junior Ranger Program Handbook: Park Careers*

- Guide—Interprets exhibits and historic objects to the public; guides visitors; arranges, maintains, and protects exhibits.
- Interpreter—Plans, researches and develops interpretive projects for the Department; participates in or directs small interpretive projects or portions of large interpretive projects; conducts interpretive/educational programs for park visitors.
- Exhibit Technician—Produces skilled artwork using a variety of media and techniques in the preparation of interpretive exhibits, graphic presentations, and house museum displays; assists with related exhibit construction and installation work.
- Exhibit Designer/Coordinator—Is responsible for the design of interpretive exhibits, using all forms of media. Participates in planning and budgeting for exhibit development; coordinates departmental and public review, working drawings, and fabrication of exhibits.

### **Recreation**

Recreation is a key component of the State Parks mission and legislative mandate to provide recreational opportunities and experiences to the public. Recreational experiences are sometimes provided directly (such as guided nature walks or guided ski tours), while in most instances parks provide the opportunity for visitors to direct themselves in a wide assortment of outdoor-based activities, such as hiking, bicycling, fishing, swimming, horseback riding, off-highway vehicle recreation, jogging, camping, and picnicking.

- Park and Recreation Specialist—Performs program development and evaluation, and analytical and administrative work to identify and improve methods for meeting the outdoor recreational needs of the citizens of California.

### **Cultural Resources Management**

The Department's mission clearly defines the responsibility to preserve and protect the state's most valued cultural resources, both inside and outside of state park boundaries. The preservation of cultural resources within California State Parks from both natural and human effects involves:

- Acquisition and preservation of all types of cultural resources
- Survey, recording, assessment, protection, monitoring and maintenance of archaeological resources
- Recording, condition assessment and development of management plans for historic structures, sites, districts and landscapes
- Cataloging, description, preservation and housing for historical objects
- Administration of documentary materials
- Ensuring compliance with state and federal law and state policy regarding potential impacts on cultural resources
- Development of policy and provision of training necessary to carry out State Parks' cultural resource mission
- Research, documentation and interpretation of archaeological, ethnographic and historic objects and cultural materials

## *Junior Ranger Program Handbook: Park Careers*

- State Historian—Performs basic historical research; recommends and executes programs of identification, description, evaluation, preservation and resource management of historical and cultural objects, sites, and buildings; and directs the development of employee training programs concerning California historical resources and historic preservation.
- State Archaeologist—Performs or directs the performance of work in cultural resource management programs; recommends and executes programs to locate, identify, describe, evaluate, preserve, and manage archeological and ethnographic sites, features, structures, and materials; conducts or directs field surveys, archaeological excavations, and related archival research; provides research data of archaeological significance to various programs in State departments; directs the development of employee training programs in California archaeological resources; and does other related work. See Appendix C for additional information and ideas for programs on archaeology.
- Museum Curator—Plans, organizes, and manages programs of acquisition, conservation, registration, interpretation, and/or storage of museum objects at established museum facilities. Museum curators supervise a subordinate staff engaged in curatorial and preservation duties.
- Restoration Work Specialist—Performs a variety of skilled carpentry, masonry, and other tasks in connection with the restoration, preservation, and stabilization of historic buildings and sites; checks on details bearing on authenticity and does research as required; consults with other craftspersons and leads less skilled assistants; assists in maintaining project safety; keeps tools, materials, and equipment in good condition and keeps simple records.

### **Natural Resource Management**

California State Parks is the steward of some of the most diverse ecosystems in the world. With the role of stewardship comes the responsibility to protect and, when necessary, restore and maintain these natural systems of state and national significance. Natural resources within the State Park System and throughout California face a variety of risks:

- Continuous urban development
  - The introduction of non-native or exotic plant and animal species
  - Loss of critical habitat for rare, threatened, and endangered species
  - Interference with natural fire cycles leading to a buildup of fuels that prohibit natural propagation of certain species
- Environmental Scientist—Performs a broad range of staff work involved in the management of natural, scenic, and recreational resources of the State Park System. Resource ecologists conduct major and complex ecological investigations and studies dealing with degradation, enhancement, and perpetuation of natural, scenic, and recreational resources; assess human impacts and use intensities; survey natural areas of local, state, and national significance and recommend acquisition priorities based on ecological values and degree of threat; collect and evaluate information on terrestrial and aquatic ecosystems in existing and proposed State Park System lands; conduct technical evaluation of soil-vegetation-animal relationships; identify present and potential long-term resource

## *Junior Ranger Program Handbook: Park Careers*

degradation; formulate and direct broad programs and specific projects, such as exotic plant and animal control, tree hazard control, re-vegetation, pesticide use and control, wildland disease and insect control, erosion control, wildfire control, and prescribed fire management; set forth resource management guidelines and policies; perform technical review and analysis of planned developments in or near State Park System lands that may impact the environment; prepare unit resource inventories and the resource element of the Department's general plans; administer the Department's statewide resource management program with budgetary and contractual responsibilities; and provide technical guidance and assistance to park managers and their staff.

- Geologist—Provides interpretive geologic services and conducts geologic investigations. Principal work assignments include gathering, analyzing, and disseminating geologic data, crustal strain and seismic risk investigations; completing geological and geophysical mapping; and geologic hazards identification, analysis, and reporting. Geologists inventory mineral and marine geologic resources, publish geologic information, maintain a geologic data center, and review and analyze geologic reports submitted by governmental agencies.
- Forester—Deals with forest, range, and watershed management by providing encouragement, advice, and assistance to landowners; regulating use; demonstrating good wildland management; and seeking through research and studies the necessary knowledge to utilize and protect forest, range, and watershed lands while protecting all forest benefits. Foresters are also required to assist in the suppression of fires and the rehabilitation of lands and their natural resources damaged by such incidents.

## **Facilities**

Facilities are a key element in the realization of the Department's mission.

Campsites, trails, visitor centers, museums, roads, water systems, and restrooms are all essential in meeting the demands of protecting resources, educating the public, and enabling recreation.

- Park Maintenance Worker—Does skilled and semi-skilled structural and facility maintenance and repair work, including carpentry, painting, electrical, plumbing, masonry, and roofing; clears and maintains trails; fights structural and forest fires; protects natural resources from destruction by constructing erosion control, diversion and drainage facilities; maintains trees, shrubs, lawns, flowers, and native vegetation; cleans campgrounds, picnic sites and other public facilities, and collects and disposes of refuse; operates and performs routine preventive maintenance on a variety of vehicles, such as trucks, beach cleaners, small tractors and mowers; and leads and trains a crew of maintenance employees.
- Museum Custodian—Performs routine housekeeping and preservation duties in museum facilities; applies and regularly uses knowledge of preservation and handling techniques on and around valuable objects; maintains antique furnishings and other objects of historical or artistic value; does semi-skilled manual tasks in the maintenance and preservation of museum objects; and does other related work.

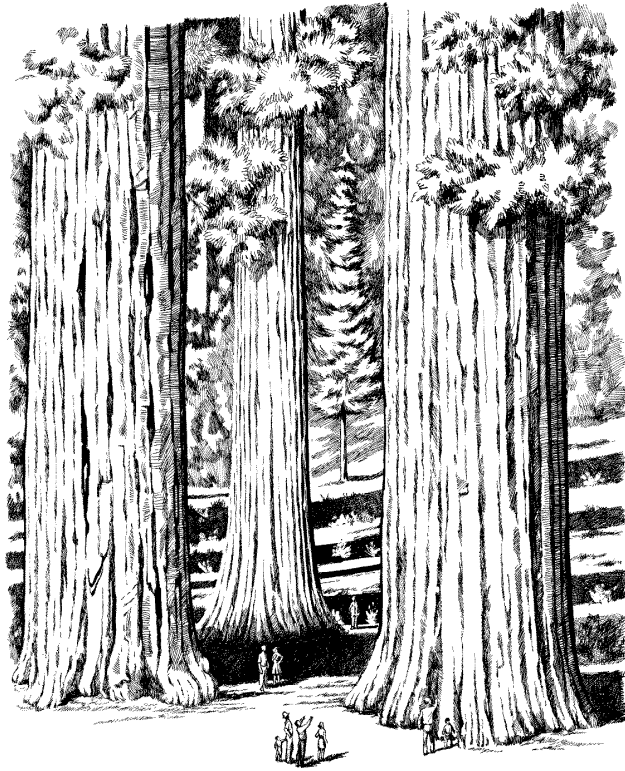
*Junior Ranger Program Handbook: Park Careers*

- Carpenter—Conducts or supervises the construction, maintenance and repair of various buildings and structures; the drawing of working sketches and preparation of cost estimates; the maintenance of tools, materials and equipment in good repair; and the preparation of simple reports.

**INSERT *PLANT LIFE* TAB HERE**



# Plant Life



*“It has been said that trees are imperfect men, and seem to bemoan their imprisonment rooted in the ground. But they never seem so to me. I never saw a discontented tree. They grip the ground as though they liked it, and though fast rooted, they travel about as far as we do. They go wandering forth in all directions with every wind, going and coming like ourselves, travelling with us around the sun two million miles a day, and through space heaven knows how fast and far.”*  
—John Muir

## Introduction

From giant redwoods to delicate wildflowers to the occasional blade of grass in the crack of urban asphalt, plant life is everywhere. The only life forms able to create energy directly from sunlight, plants serve many important functions. They provide food and shelter to wildlife, stability to soil, oxygen to the atmosphere, and beauty to the eye. At times we forget how much we depend on plant life. From plants, humans obtain food and create other products to enrich life, including paper products, pharmaceuticals, fuels, and building materials.

When interpreting plant life, you will have the opportunity to explore the beauty and wonder of plants. Each park has its own plants, plant life cycles, and food chains. In addition to including generalized information about plants, you should be sure to spend time discussing your own park's unique diversity of plant life.

## Interesting Plant Facts

- The tallest living thing life forms a coast redwood tree (378' tall).
- The largest living individual ever found on earth is a giant sequoia tree.
- The largest leaf is found in the Amazon jungle, and can be 65 feet across.
- The California State Tree is the California redwood.
- The California State Flower is the California poppy.
- The average American uses seven trees a year in paper and wood products.
- Rainforests are destroyed at a rate of about 100 acres per minute.



## Sample Programs: Plant Life

### Plant Life

- I. Introduction
  - Introduce yourself.
  - Introduce the Junior Ranger Program.
- II. Focus
  - A. Where are plants found?

Plants are everywhere: mountains, valleys, meadows, deserts, oceans, rivers, streams, lakes, cracks in urban asphalt, and homes.
- III. Objectives

Today we're going to find out how amazing plants can be. There are many different types of plants, each with its own distinctive features and uses. We'll see these features and learn some of the uses for plants, as well as the value of preserving plant life.



#### IV. Inquiry/Discussion

##### A. Plant Uses

1. Did any of you eat a plant today? If so, what kind?  
Fruit, vegetable, cereal, grains, juice, etc.
2. Are any of you wearing a plant today? If so, what kind?  
Cotton, linen, etc.
3. What else do plants do for us?
  - a. Plants produce oxygen (explain that oxygen is a byproduct of photosynthesis. (For information about photosynthesis, please see “Energy Information.”))
  - b. Plants create building materials.  
What is your school made of? Your house? (You can think of your house as a “tree house.” Look at the walls, floors, doors, and furniture. Most of these are made out of wood.)
  - c. Plants can be made into fuel (coal, firewood, petroleum, methane).
  - d. Plants can be made into medicine (many drugs are plant derivatives).
  - e. Plants can be made into paper (newspaper, writing paper, toilet paper, etc.).

#### V. Guided Discovery

##### A. Feel Like a Plant

1. Hike down a trail that has a variety of plant life. After a few minutes of quiet hiking, tell the children to “freeze,” roots firmly embedded in the ground. Have them stand quietly and feel the sun beat down. Have them look around to see their surroundings. Are they warm or cool? Is there any water nearby or is the soil moist? Where do they get their food? Energy to grow? Explain how roots anchor plants to one spot. Although they cannot move, they can probe deep into the soil for water.

##### B. Look for different kinds of plants

Vines snaking up trees

Trees

Grasses

Shrubs

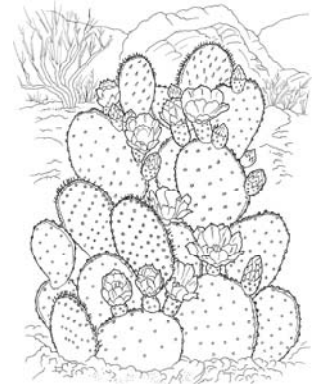
1. Discuss what makes a tree different from a bush, etc.
2. Look at the plants' leaves. Do they all have the same shape?
  - a. Explain the roles of leaf shape (water retention, gathering sunlight)
  - b. Are they the same color, texture, thickness? Why? (Explain adaptations)
  - c. Look at the veins on the leaf. Explain that the veins carry water and nutrients to all areas of the leaf, like the blood vessels in our bodies.
3. Remind the group not to pick the plants. Why not?
4. Point out potentially harmful plants like poison oak (“leaves of three, let it be”). Don't touch or eat plants you don't know (hemlock, mushrooms, etc.).
5. Discuss erosion and staying on the trail.

### C. Plant Energy

1. How do plants get their energy?
2. Are you a plant? Let's do an experiment to find out. Did everybody have something to drink today? Good. Now plant your feet firmly in the ground, take a deep breath, and stretch your hands up toward the sunlight. Do you feel full? No? I guess we're not plants, then.
3. Explain how plants make sunlight into food energy.
4. Activity: Photosynthesis Relay Race (see activity section below)

### D. Plant Adaptations

1. Plant species can, over time, adapt (or change) to increase their chances of survival in their environment.
2. Find a plant that has adapted to its environment. How has it?
  - a. Water adaptations
  - b. Predator adaptations
  - c. Solar adaptations
3. What would a plant look like that could:
  - a. Catch insects? (Venus fly trap)
  - b. Hold onto rock in a swift current? (kelp)
  - c. Store water? (cactus)
  - d. Live on the surface of a pond? (water lily)
  - e. Withstand high winds? (palm tree)
  - f. Avoid being eaten by grazing animals? (thistle)
4. Why do plants flower?
  - a. Flowers are like flags that attract insects and other pollinators to them with bright colors, exciting shapes, or intriguing smells.
  - b. Explain pollination.
5. Activity: Plants that Hitchhike (see activity section below)



### E. Trees

1. If you come across a stump, go over annual growth rings (one ring per annual growth cycle).
  - a. How old is the tree? (Count annual growth rings)
  - b. Was there a drought, fire, or other type of stress to the tree? (Evidenced by narrow growth rings)
  - c. Can you see any disease or injury? (Broken annual rings, fire scars, or dead or decayed portions)
2. Activity: Build a Tree (see activity section below)

## VI. Application/Conclusion

- A. Why are plants important?
- B. What can we do to protect plants?
- C. Remember to take only pictures and leave only footprints while in the park.
- D. Announce next Junior Ranger program and other interpretive programs.
- E. Stamp logbooks.

## Trees

1. During sign-up time ask kids to be thinking of as many parts of trees as they can and what each part does.
2. After sign-up, briefly discuss tree parts and functions. Have the students describe the parts and functions.



3. Do activity “Build a Tree.” This activity illustrates the functions of the different parts of trees.
4. Discuss how tree parts can be used to identify trees. Mention bark patterns, cone shapes/sizes, other seed-holders, leaves, needles/needle clusters.
5. Wrap-up: Using a hand-held piece of bark, cone, and needles, have the Junior Rangers describe the functioning of each and see if they know what type of tree they come from.

*This sample program was designed by Wendy Harrison for Calaveras Big Trees State Park.*

For other activities, try:

- Heartbeat of a Tree
- Tree Keying
- Tree Cookies
- Meet a Tree
- Tree Rubbings

(See activity section below)

## Nature Walk

Introduce yourself and the Junior Ranger program.

### I. Plants:

- A. Let’s see how plants live and why they do not move about like animals. But first I’d like to point out a few cautions. Do not pull plants from the ground or there won’t be any left for those who follow. Secondly, with poison oak remember “Leaves of three three, let it be.” With this in mind please stay on the trail.<sup>1</sup>
- B. Now is the time to look for nature’s treasures—a living museum for us to explore. Open your eyes, listen with your ears, smell with your nose. Silence can be a learning process.
  1. How many seeds have you eaten today? Leaves? Fruit? Roots?
  2. We also live in a type of tree house. Think of it. The floor, furniture, door, anything else? Without trees you wouldn’t have books, magazines or comics

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<sup>1</sup> This Plant Life Program was developed by Rodi Fregien, Folsom Lake SRA.

to read, nor would you have tissue or toilet paper. Some paper is made of cotton and linen rags rather than wood, but they are also from plants.

3. You may be wearing a plant (have children check themselves). Cotton and linen are plants. (Show a piece of rope and burlap). Rope and burlap are made out of jute plant fibers.
  - a. A Frenchman who studied insects (Rene-Antoine de Reaumu) noticed that the female wasps were chewing up small bits of wood until they had a mushy pulp (show a paper wasp). They spread it out to form their next cells. The Frenchman suggested that chemicals be found to break down wood to make paper. Paper as we know it got its start because someone closely watched some busy wasps.
- C. Walk down the path to an open area. Have everyone “freeze.” Imagine that you cannot move and your feet are buried in the ground. The sun is hot and shining on your head. You become thirsty, but you cannot move. Just like a plant, your roots are held in the ground. Roots are anchors. They keep plants from blowing away. Roots also provide water and nutrients. Water in the soil enters the roots and is carried from the root into the stem and out the plant's leaves and flowers.
- D. Move on:
  1. Look at the different plants and what their roots and stems are doing. Roots and stems may change direction as they grow, reacting to the world around them. Plant movements are called tropisms. Most plants move too slowly for us to see. (Point out stems, trunks, roots.) Why do they move? Roots grow toward water; stems and trunks grow toward light.
  2. Find a vine:
    - a. Vines are not strong enough to stand alone. They feel their way along by sending out hair-like strands called tendrils. Tendrils are a special kind of leaf. Plants respond to touch when something is nearby, and grab with their tendrils. Some vines have leaves that bend over something while waiting for the stem to catch hold—like climbing a ladder.

## II. Leaves:

- A. Leaves come in many sizes, shapes and shades of green. They can be almost round. They can be like your hand with your fingers spread. They can be long and narrow, heart or arrow shaped. There are leaves that are made of small leaflets joined on a stalk such as poison oak, blackberry and walnut. How many shapes, sizes and shades of green can we see from where we stand? (Show the children mounted leaves of various shapes, sizes, and colors that were put together before the walk).
- B. Pick up a leaf at random, and look at the veins. They look like a small collection of trails. Veins carry water and minerals from the roots and stem to the leaves. They are the pipelines. Veins also carry food which is made by the leaf to the rest of the plant.
- C. What about needles of a conifer? Did you know that they stay alive all year? Some leaves are poisonous to most animals. Leaves of the milkweed plant are

eaten by the caterpillars of the monarch butterfly. The caterpillars eat nothing but milkweed leaves. By the time they change into butterflies they are poisonous because of all the poisonous milkweed leaves they have eaten (show a monarch specimen along with a photo of caterpillar and milkweed).

- D. Some leaves are covered with tiny hairs. Animals don't like the feel of the hairs so they leave those plants alone. Leaves are the food factories of plants. They make food from air, water, and sunlight. The leaves need a gas from the air which is carbon dioxide, which is poisonous to animals. Water and sunshine are also needed to make food. Chlorophyll, the green color in leaves, is a special chemical which allows the plant to use energy from sunlight shining on its leaves to make food from carbon dioxide and water. Without chlorophyll the plant cannot make food. Oxygen, which we need to breathe, is a gas. Leaves make oxygen and let it go into the air. Without plants to eat, animals would not be able to live.

### III. Flowers (name State Flower):

- A. Flowers are like flags or gems—they catch the eye with their color and shape. Some have a heady fragrance. Flowering plants are found just about anywhere. Why do plants have flowers? Flowers have two important parts: pistils and stamens. These parts work together to create mature seeds, which will eventually become new plants. Here's how it works: the pistil is shaped like a vase and has undeveloped seeds at the bottom. Pollen is the fine powder on the end of the stamens. When the pollen lands on the pistil, a pollen tube grows into the pistil, and fertilization occurs. The seeds then begin to mature. Sometimes insects help this process along. When an insect drinks a flower's nectar, pollen coats its body. As the insect visits other flowers of the same kind, the pollen on its body may be deposited and fertilize the seeds. Some insects are specialists who stay with one type of flower (example: yucca moth).
- B. Some plants, like pine trees, depend upon the wind to spread their pollen. Although pollen carried by the wind may come into contact with pistils less frequently than other types of pollen, it may spread farther out when carried on the wind.

### IV. Fruits

- A. Find an acorn, pine cone, or seed pod. Fruits are simply the part of the plant containing the seeds. A fruit can be a tomato, pumpkin, grape, buckeye, strawberry, or pine cone. (Carrots and beets are roots, celery is a stem, and lettuce is a leaf.) A milkweed pod is a fruit. Fruits develop from flowers; the ovary, where the pollen is deposited, grows and grows and becomes the fruit.

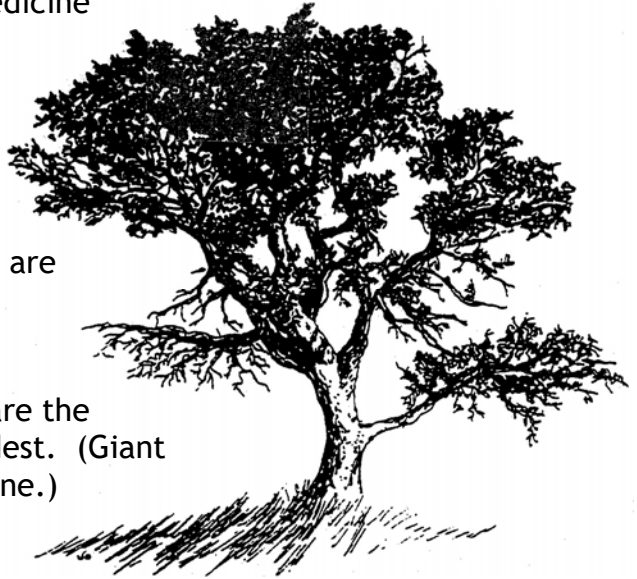
### V. Seeds

- A. Search along the path for seeds or examine socks. Some seeds are like corkscrews or arrows; some have blades or parachutes to be carried by the wind. There are burrs and explosive pods. Different modes of transportation are important for plant distribution. Animal fur and clothing, as well as water,

help in transporting seeds. When birds eat seeds and fly from place to place, they leave their droppings, which contain the undigested seeds. Fire is needed to pop open certain cones and shells. Not all seeds get a chance to grow into a new plant. How many of you had cereal, nuts, bread, apples, strawberries, etc. today?

## VI. Trees

- A. Trees provide shade, shelter, food, and medicine for animals. When it is hot, shade and coolness is nice to have. A large tree can pump up 200 gallons of water on a hot day. Leaves of a tree let go of some of their water, which cools the air. As the trees provide shade and cool the air, they also clean the air of carbon dioxide. Trees are always busy.
- B. It would be difficult to live without trees. Trees help all animals live. This is why we should save and enjoy living trees. Trees are the largest plants on earth and some of the oldest. (Giant sequoia, coast redwood, and bristlecone pine.)
  1. Do you know California's State Tree?  
California redwood, of which there are two species: the coast redwood and the giant sequoia.
- C. Trunks are tree stems. They continue to grow each year. The bark is the "coat" of the tree. It can be thick, thin, rough, or smooth. The sapwood is the living part of the trunk; it carries water and minerals to the rest of the tree. Heartwood is at the center of the trunk; it is the dead hard core of the tree. Each year part of the sapwood closest to the heartwood becomes part of the heart, making the center stronger and thicker.
- D. Find a stump. A ring forms for each year of growth. Every year the tree is alive a ring is formed. Animals stop growing at a certain point, but trees don't.



## VII. As we wander back:

- A. Point out the difference between the trees.
  - blue oak
  - live oak
  - buckeye
  - gray pine
- B. Count the number of different kinds of seeds in socks or shoes.
- C. Stamp logbooks.
- D. Tell the children to always look at the beauty around them!

# Activities

## Photosynthesis Relay Race

Number of Children: Eight or more

Environment: Open area, approximately 40' x 40'

Equipment Needed: Any objects that can be used to mark boundaries

Purpose: To learn about plants as producers, and about the elements necessary in photosynthesis

Activity:

1. Introduce plants as producers—making their own food through photosynthesis. Introduce the elements needed in photosynthesis (sun, carbon dioxide, and water).
2. Divide the group into two teams. Each team is divided into two groups. One group becomes “water molecules,” and the other becomes “carbon dioxide molecules.” One person (possibly the instructor) is the sun. One person from each team is the “producer.” The producer starts at the sun.
3. On “go,” each producer runs to and hold hands with one “carbon dioxide,” and brings him/her to the sun. The producer then runs and gets a “water molecule” and brings her to and connects her with the carbon dioxide that is connected to the sun. Once connected, the producer must start at the sun and alternately weave through each member, then go back and pick up another molecule. This progresses until one team has all its molecules connected, when they shout “Photosynthesis!”

## Plants that Hitchhike<sup>2</sup>

Number of Children: Three or more

Environment: An area where plants or grasses are going to seed

Equipment Needed: Burlap bag or other loosely woven cloth, hand lens

Purpose of Activity: To discover how seeds transport themselves

Activity:

1. Drag a burlap bag or other piece of loosely woven cloth over an area that has not been mowed, and where plants and grasses are going to seed.
2. How many different kinds of seeds do you find on the cloth? Are there more of some kinds? How did the seeds hitchhike on the cloth? Use a hand lens to discover the fasteners if they are too small to be seen unaided.
3. What do you think these seeds hitchhike on besides the bag? Match the seeds to their plants.
4. This is a variation of checking your socks for seeds after a hike.

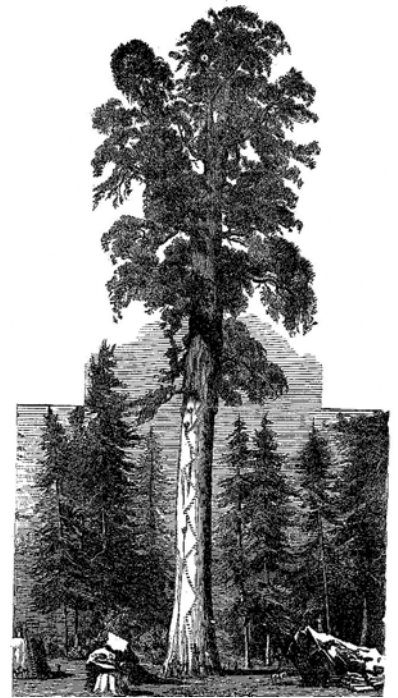


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<sup>2</sup> From *Indoor-Outdoor Natural Learning Experiences: Teacher's Guide*. Sacramento County Office of Education, 1978.

## Build a Tree<sup>3</sup>

- I. While choosing players to play each part of the tree, explain what their roles will be when the game begins.
  - Heartwood—Two or three tall, strong players stand with their backs to each other. Role: Stand straight and tall.
  - Taproot—Several players sit at the base of the heartwood, facing outward. Role: Hold the tree firmly in the ground.
  - Lateral Roots—Choose people with long hair who look as if they won't mind lying on the ground. Role: To suck up water from the ground. (“When I say, ‘slurp,’ you all make a slurping noise like this. Okay, let's practice. Slurp!”)
  - Sapwood—Choose enough players to form an unbroken circle around the heartwood, facing inward and holding hands. Role: To draw water up to the tree's highest branches. (“When I say, ‘bring the water up,’ you go ‘wheeee!’”)
  - Cambium/phloem—Have several players form a circle around the sapwood, facing inward and holding hands. Have them stretch their arms upward and outward and cross arms with the next player at wrists and forearms, leaving hands free to flutter like leaves. Role: To turn sunlight and nutrients into food. (“When I say, ‘Let's make food,’ raise your arms and flutter your leaves, absorbing the sun's energy and making food. When I say, ‘bring the food down,’ you go, ‘Whoooo!’ While making the Whoooo sound, bend at the knees and drop your arms and body toward the ground”).
  - Bark—All the remaining players circle the tree, facing outward. Role: To protect the tree from insect pests and weather. (“When I say, ‘Get tough, bark!’ growl and raise your arms like a football blocker, with elbows out and fists close to the chest.”)
- II. During the first round of play, announce, “Heartwood, stand strong! Get tough, bark!” Then shout the other players' commands several times (in the following order):
  1. “Let's slurp!”
  2. “Let's make food!”
  3. “Bring the water up!”
  4. “Bring the food down!”
- III. Tell the group to continue, and instruct the bark to guard against beetles. Then go away and come back impersonating a beetle (in costume, if possible), and try to get through the bark's protection.



<sup>3</sup> From *Sharing Nature With Children*, by Joseph B. Cornell. Nevada City: Ananda Publications, 1979.



IV. When the game is over, tell the players to give themselves a hand for being such a wonderful tree.

## Heartbeat of a Tree<sup>4</sup>

Number of Children: One or more

Environment: Any area with young trees

Equipment Needed: Stethoscope, tree about six inches in diameter with thin bark

Purpose of Activity: To listen to the life flow of a tree

Activity:

- Spring is the best time to try this, and deciduous trees work better than conifers.
- Explain that trees are living creatures that eat, rest, breathe, and circulate fluids as much as we do. Press the stethoscope firmly against the tree, keeping it still so as not to make interfering noises. Try several spots on the tree until you find the best one. You will be amazed at what you hear! What you will be hearing is the movement of fluids within the tree. You may also hear insect activity, such as bark beetles chewing wood.
- Try listening to each other's heartbeats.

## Tree Keying

Number of Children: One or more

Environment: Any area with trees

Equipment Needed: A tree (or leaves from a tree), bark sample, seed-holder (cone, berry, etc.), simple tree key such as *The Pacific Coast Tree Finder* (published by Nature Study Guild (only includes native trees))

Purpose of Activity: To use a simple key to identify trees

Activity:

1. You will need a copy of the tree key for each pair of Junior Rangers. Using the key involves making choices between two or more characteristics and following the directions given. If you haven't done this before, try it yourself before trying it in your program.
2. Now use the tree finders in the park! *The Pacific Coast Tree Finder* is pocket-sized, inexpensive, easy to use, and may be sold at the park visitor center.

## Tree Cookies

Number of children: One or more

Environment: Any

Equipment Needed: Cross section of a tree that shows growth rings, map pins, yarn, tags. For extension: Cross sections of tree limbs, crayons, paper

Purpose of Activity: To perceive time from the perspective of tree growth

Activity:

1. Tree trimming companies are a good source of tree limbs.

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<sup>4</sup> From *Sharing Nature with Children*, by Joseph B. Cornell. Nevada City, Ananda Publications, 1979.

2. Examine the annual growth rings on a cross-section of a tree, or “tree cookie,” with the Junior Rangers. Each pair of dark and light rings equals one year’s growth. The light wood is the spring and summer growth, and the dark wood is the fall and winter growth.
3. Look at the differences in ring size. Discuss possible reasons for these differences, such as: drought, fire, tree damage, competition with other trees, soil condition.
4. Using map pins, mark the annual rings and connect with string to a large bulletin board indicating events during that year in the tree’s life. How large and old was the tree when:
  - The park was established?
  - The Junior Ranger was born?
  - The last president was elected?

Extension:

Do this activity with sections of tree limbs so that each student can count the rings on his or her “cookie.” Is your tree limb older or younger than you? Students can also make a rubbing of the cut surface that will show the rings with the flat side of a crayon on paper.

From *Project Learning Tree*.

## **Meet a Tree**

Organize the Junior Rangers into pairs. One child in each pair is blindfolded, and the other is the leader. The leader guides the blindfolded student to a tree. The blindfolded student tries to find out as much as possible about the tree using the sense of touch, smell, and hearing. After five minutes or so, have all the kids come together. Remove the blindfolds, and let the Junior Rangers try to find the tree they have just met. Repeat the activity with the other partners. *Note: Choose the area carefully to avoid possible problems with poison oak, insects such as biting ants or yellow jackets, or pine pitch.*

## **Rubbings**

Using the flat side of a crayon on paper, make rubbings of bark, cones, and foliage.

## **Background Information: Plant Life**

### **Plant Adaptation**

Most animals can move to a new location if wind, water, heat, cold, sunlight, dryness, or other animals become a problem. Plants cannot move to avoid unfavorable conditions, but they have developed certain characteristics that enable them to survive in less-than-ideal conditions.

Plants that don't receive much water have shallow root systems that can draw water from a light rainfall or heavy dew. Some of these plants can retain water for months or years and use the water economically for the plant's metabolism. Some plants develop waxy outsides on their leaves that reduce moisture loss. Others develop hair on their leaves that sunlight cannot penetrate. These hairs also reduce water loss and discourage animals from eating the leaves.

Often plants have leaves that drop off during periods of drought to reduce the amount of surface area through which the plant loses water.

Another way plants have adapted to protect themselves is by growing thorns and producing bad-tasting oils which discourage hungry animals.

## **Pollination**

Flowers produce sweet nectar to interest insects and other animals. When the animals drink the nectar, pollen rubs off on their bodies, and when they visit other flowers, they deposit the pollen.

Pollen is the loose powder on the stamen of the flower. A pistil (shaped like a vase) has ova (unfertilized eggs) inside. When the pollen lands on the pistil, a tube grows into the pistil, and fertilization occurs. Seeds mature, and later they grow into new plants.

Pollination can also occur when wind or water transports pollen from one plant to another. Some plants have the special ability to pollinate themselves. Self-pollination occurs when pollen is transferred to the pistil of the same plant. Most plants have mechanisms to avoid self-pollination, because self-pollination discourages genetic mixing.

Seeds have many adaptations to ensure that they will be spread. Some are shaped like corkscrews or arrows, or have beads or wings to be better carried by the wind. Brambles and burrs get carried on animals' coats.

Fruits are actually specially designed "seed packages." They are the part of the plant which develops from a flower once it has been pollinated. The seeds of the fruit may grow on the inside (a peach) or on the outside (a strawberry).

When animals eat the fruit, they carry the seeds in their digestive systems to new locations. The seeds have hard outer seed coatings and pass unharmed through the animal's digestive tract. Once they have been disposed of by the animal, they then can germinate and grow.

In addition to wind-borne seeds and animal-borne seeds, there is the coconut, which is a seed designed to be spread by floating in water!

## Destruction of Rainforests

Rainforests affect us in ways we don't even realize. Your kitchen cabinets may be made of wood grown in tropical rainforests. Much of your breakfast (juice, cornflakes, bananas, coffee, sugar) is from plants that originated in tropical rainforests. Foods with rainforest origins include avocados, bananas, cashews, chocolate, cinnamon, coconuts, coffee, oranges, grapefruits, lemons, and vanilla. More than 25 percent of the current prescription drugs derived from plants have their origins in the rainforest. Rainforests cover only five percent of the earth's land surface, yet contain at least half of its plant and animal species.

Tropical rainforests are being destroyed at an alarming rate—approximately 100 acres a minute. This destruction is due to logging and burning to create new agricultural lands.

For information about effects of biodiversity loss, please see the Ecology section, and for information about photosynthesis see Energy.



## Suggested Resources: Plant Life

Abrams, LeRoy, and Roxana Stinchfield Ferris. *Illustrated Flora of the Pacific States: Washington, Oregon, and California*. Stanford, CA: Stanford University Press, 1940. A classic reference.

Alexander, Taylor R. and R. Will Burnett. *Botany*. New York: Golden Press, 1970. A handy guide.

*Audubon Field Guide Series*. New York: Alfred Knopf, 1977. Titles include: *Western Forests, Grasslands, Deserts, Pacific Coast*, etc. Series describes the ecological components of the various habitats described. Identification is based on photographs depicting plants, animals, and geology of the biotic regions.

Balls, Edward K. *Early Uses of California Plants*. Berkeley: University of California Press, 1972. This small book identifies and describes those plants that were used by California Indians and explains how they were used.

Barbour, Michael G., Bruce Pavlik, Frank Drysdale, and Susan Lindstrom. *California's Changing Landscapes: Diversity and Conservation of California Vegetation*. Sacramento, CA: California Native Plant Society, 1993. This book presents an excellent overview of California's wild vegetation.

Barbour, Michael G. and Jack Major. *Terrestrial Vegetation of California*. Davis, CA: California Native Plant Society, 1988. A more in-depth and technical publication on the terrestrial communities in California. An excellent reference for background knowledge on California floristic provinces.

Becking, Rudolph W. *Pocket Flora of the Redwood Forest*. Covelo, CA: Island Press, 1982. Identifies the plants associated with redwood forests and briefly describes the plants.

Benyus, Janine M. *The Field Guide to Wildlife Habitats of the Western United States*. New York: Simon & Schuster Inc., 1989. A guidebook to eighteen distinctive habitat types, most of which occur in California.

Brown, Vinson. *The Amateur Naturalist's Handbook*. Englewood Cliffs, NJ: Prentice-Hall, 1987. An excellent reference on how a naturalist looks at the world, subject by subject, region by region.

Brown, Vinson. *Reading the Woods*. Harrisburg, PA: Stackpole Books, 1969. Text, charts, and illustrations show how climate, soil, fire, animals and human activity each shape the forest.

"California Natural History Guides." University of California Press. Series titles include: *Native Trees of the San Francisco Bay Region; Rocks and Minerals of the San Francisco Bay Region; Mushrooms and Other Common Fungi of the San Francisco Bay Region; Native Trees of Southern California; Seashore Plants of Northern California; Butterflies of the San Francisco Bay Region; Seashore Life of Southern California*, etc.

Cornell, Joseph. *Sharing Nature with Children*. 2<sup>nd</sup> ed. Nevada City, CA: DAWN Publications, 1998. Written by a leading environmental educator, *Sharing Nature with Children* shares some of the environmental games Joseph Cornell uses in his interpretive programs for children.

Cornell, Joseph. *Sharing the Joy of Nature*. Nevada City: Ananda Publications, 1989. A complement to *Sharing Nature with Children* with additional environmental games to use in children's interpretive programs.

Dawson, E. Yale. *Seashore Plants of Northern California*. Berkeley: University of California Press, 1966. This short book identifies those plants that grow just off the California coast. Identification is through photographs and line drawings.

Fuller, Thomas C., and Elizabeth McClintock. *Poisonous Plants of California*. California Natural History Guides: 53. Berkeley: University of California Press, 1986. Handy as well as comprehensive, this manual catalogues the state's toxic vegetation; algae, fungi, and vascular ("higher") plants are included.

Grillos, Steve J. *Ferns and Fern Allies of California*. Berkeley: University of California Press, 1966. Identifies the numerous ferns and fern allies found in California with a brief description of the plant and some photos and line drawings for identification.

Head, W.S. *The California Chaparral: an Elfin Forest*. Edited by Florence Musgrave. Healdsburg, CA: Naturegraph Publishers, 1972. A basic introduction to the chaparral community.

Hickman, James C. *The Jepson Manual, Higher Plants of California*. Berkeley: University of California Press, 1993. The new "Bible" of higher plants of California, this manual replaces Munz's *California Flora* with current classification, name changes, and numerous illustrations.

Johnston, Verna R. *California Forests and Woodlands: a Natural History*. California Natural History Guides: 58. Berkeley: University of California Press, 1994. Engagingly written yet packed with facts, this book guides the reader on a naturalist's tour of California's tree-dominated biotic communities.

Keator, Glenn. *The Life of an Oak: an Intimate Portrait*. Berkeley, CA: Heyday Books in cooperation with the California Oak Foundation, 1998. Clearly written, sections of the book examine oak architecture, life cycle, diversity, and habitats.

Lanner, Ronald M. *Conifers of California*. Los Olivos, CA: Cachuma Press, 1999. This book considers the variety of California conifers individually, combining informative species accounts with high-quality color illustrations, photographs, and range maps.

Leite, Dalziel. *Don't Scratch!: the Book About Poison-Oak*. Walnut Creek, CA: Weathervane Books, 1982. Contains virtually everything a naturalist should know about poison oak, including clearing up common misconceptions and answers to common questions about the plant.

McMinn, Howard E. *An Illustrated Manual of California Shrubs*. San Francisco: J. W. Stacey Incorporated, 1939. This comprehensive work gives detailed descriptions of the hundreds of species of shrubs and shrub-like plants which are native to the state.

Murphey, Edith V. *Indian Uses of Native Plants*. Mendocino County Historical Society, 1959.

Niehaus, Theodore F., and Charles L. Ripper. *A Field Guide to Pacific States Wildflowers*. Boston: Houghton Mifflin Company, 1976. A convenient guide to nearly 1,500 species of Western wildflowers.

Ornduff, Robert. *An Introduction to California Plant Life*. Berkeley, CA: University of California Press, 1974. Describes plant communities of California and adaptations of California plants.

Pavlik, Bruce, Pamela C. Muick, Sharon Johnson, and Marjorie Poppin. *Oaks of California*. Los Olivos, CA: Cachuma Press, 1991. A coffee table book identifying and describing all oaks found in California. Included is their development, identification, life histories, and historical relations to humans.

Peattie, Donald Culross. *A Natural History of Western Trees*. Boston: Houghton Mifflin Company, 1953. Filled with interesting scientific facts, impressive statistics, noteworthy quotes, historical anecdotes, and romantic lore, this publication is a valuable resource for interpreters.

“Peterson Field Guide Series.” The first major field guide series, Peterson's has been updated somewhat over the years, particularly the *Field Guide to Western Birds*. All identification plates are drawn (no photographs) with written descriptions of each plant or animal.

Project Learning Tree. *Environmental Education Activity Guide: Pre K-8*. Washington, D.C.: Project Learning Tree, 1993. [www.plt.org](http://www.plt.org).

Russo, Ronald A. *Plant Galls of the California Region*. Pacific Grove, CA: The Boxwood Press, 1979. Galls are common to many plants. This book identifies many of these galls, their host plants, and the insects that cause them.

Sargent, Charles S. *Manual of the Trees of North America*. New York: Dover Publications, 1965.

Schoenherr, Allan A. *A Natural History of California*. Berkeley: University of California Press, 1992. A comprehensive and abundantly illustrated book which fosters an appreciation for California's natural diversity and unique beauty. Describes the climate, rocks, soil, plants, and animals in each distinctive region of the state.

Smith, Alexander H. *A Field Guide to Western Mushrooms*. Ann Arbor: University of Michigan Press, 1975.

Sugden, Andrew. *Longman Illustrated Dictionary of Botany*. Harlow, England: Longman, 1992. Botanical dictionary with numerous illustrations.

Vieira, Linda. *The Ever-living Tree: The Life and Times of a Coast Redwood*. New York: Walker and Company, 1994. This book for younger readers tells the story of a 2,000-year-old redwood tree, charting its development against a backdrop of world history.

Watts, May T. *Master Flower Finder*. New York: Warner Books, 1986. A layperson's guide.

Watts, Tom. *Pacific Coast Tree Finder*. Rochester, NY: Nature Study Guild Publishers, 2004. A layperson's guide.

Whitney, Stephen. *A Sierra Club Naturalist's Guide: The Sierra Nevada*. San Francisco, CA: Sierra Club Books, 1979. Describes the natural history of the Sierra Nevada by communities found within the Sierra Nevada biotic zone.

*Wow!: The Wonder of Wetlands*. St. Michaels, MD: Environmental Concern Inc./Bozeman, MT: The Watercourse, 1995. Exploring the potential of wetlands as an educational tool, this guidebook combines useful background material with more than forty wetland-related activities for kindergarten-through-twelfth-grade youths. [www.wetland.org/wowteacher.html](http://www.wetland.org/wowteacher.html).

## **Other Sources of Information**

California Department of Forestry. "Just for Kids." [www.fire.ca.gov/php/education\\_kids.php](http://www.fire.ca.gov/php/education_kids.php).

California Institute for Biodiversity. *CalAlive!* Produces educational materials for grades 4 through 8. [www.calalive.org](http://www.calalive.org).

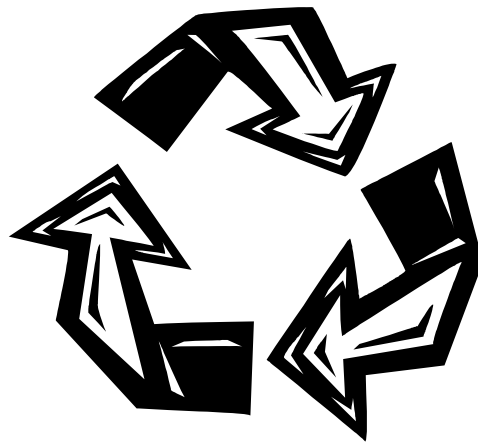
USDA Forest Service. "Just for Kids." [www.fs.fed.us/kids](http://www.fs.fed.us/kids).



**INSERT *RECYCLING* TAB HERE**



# Recycling



*“We have been educated to use; we shall now have to be reeducated to reuse, restore, renew and conserve.”*

*—Sam Levinson*

*New York Sunday News*

*28 November 1971*

## Introduction

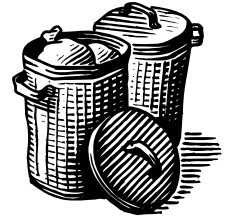
Recycling is the best way for us to take care of our waste. By recycling, we not only reduce our waste disposal problems, but we also keep from depleting our natural resources. Recycling is everyone’s job, and we all need to learn the right way to do it.

The natural world teaches us a great deal about recycling; nature uses its materials over and over, utilizing them in new and different ways. An important goal in teaching about recycling is to develop in children an awareness and appreciation for natural places. If they value a place for its natural beauty, they will be outraged at finding it filled with waste; they will want to protect it. In some ways natural areas are the perfect sites for learning about recycling. Children simultaneously see nature at work and learn how they can live more cooperatively with it. The answer to the question of “why recycle?” becomes clear.

This unit strives to teach children not only about how they can recycle, but also that the natural world utilizes its energy and materials in a variety of ways. We learn to reuse what we have not just to reduce our waste, but to embrace a cycle that reaches well beyond the human scale.

## Interesting Facts about Trash and Recycling

- Eighty-four percent of a typical American household's waste can be recycled.
- The San Francisco Zoo once recycled animal manure and sold it as fertilizer. They called it "Zoo Doo!"
- The United States has only five percent of the world's people, yet produces 30 percent of the world's garbage.



- Americans throw away about 40 billion soft drink cans and bottles every year. That's enough to reach the moon and back almost 20 times.
- Seals and sea lions often eat plastic bags floating around in the ocean, thinking that they are jellyfish.
- One recycled aluminum can saves enough electricity to power a TV for three hours.
- For every \$10 spent on fast food sales, we generate 2 pounds of trash.



- Putting old tires around tomato plants can help them grow faster.
- One discarded tire can produce enough electricity for one home for one day.
- In 1868 John Wesley Hyatt invented the first plastic (celluloid) to make billiard balls.
- Only about one-fourth of the world's paper, aluminum, iron, and steel is recycled.
- The average baby generates a ton of garbage every year.
- Americans throw away about 10 percent of the food they buy at the supermarket. That's the same as 21 million shopping bags filled with food.
- Japan and the Netherlands collect more than half of their aluminum, paper, and glass for recycling. Every other year these two countries require no extra materials to manufacture paper and glass.
- The average American uses 465 trees' worth of paper in his or her lifetime.

- 6.4 million tons of litter enter the world's oceans every year.
- Marine debris is known to have affected at least 267 species worldwide, including 86 percent of all sea turtle species, 44 percent of all seabird species, and 43 percent of marine mammal species, primarily through ingestion, starvation, suffocation, infection, drowning and entanglement.

## Sample Program: Recycling

### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

### II. Focus

- A. We hear about recycling all the time. Who can tell me what it means?  
To turn something old into something new.
- B. Has anyone heard of the three "R's"? Who can tell me what they are?  
Reduce, Reuse, Recycle.
- C. How are "reduce" and "reuse" different from recycling?  
Reuse means to adapt something for another purpose. Reduce means to minimize the amount of waste we make (before we make it!).

### II. Objectives

Today we will learn about recycling. We'll talk about how we can recycle and reuse our waste, and also how nature recycles.

### III. Inquiry/ Discussion

- A. How Can We Recycle?
  - 1. Who can give me examples of how we can reduce, reuse, and recycle?
    - a. Reduce:
      - Take a 10-minute shower instead of a 20-minute shower.
      - Walk or ride your bike instead of drive.
      - When you go to the grocery store with your parents, try to pick out food with little or no packaging. Packaging creates a great deal of waste.
      - When you're in the outdoors or on a picnic, use a water bottle instead of plastic cups, etc.
    - b. Reuse
      - Take a lunch box to school instead of a paper bag.
      - Reuse your plastic bags.
      - Turn your trash into something new. Yogurt containers can become pencil holders, shoeboxes can be filled with treasures, etc.

## *Junior Ranger Program Handbook: Recycling*

- c. Recycle
    - Cans, newspaper, bottles and glass, plastics.  
(See chart in “Information” for further discussion here.)
  - 2. Who can tell me the difference between recycling and littering?  
Littering means leaving our trash out in a place where it shouldn't be. By recycling, we don't have any waste to leave out.
  - 3. What happens when we throw trash away instead of recycling?  
It goes into a landfill, just moving our waste to another place. There isn't really any “away.”
- B. How Does Nature Recycle?
- 1. We've talked about how we can recycle, but today we're in a natural place. How does nature reuse and recycle? Everyone close their eyes for a couple of minutes and see if you can think of ways that nature reuses and recycles.
    - a. Water cycle: Water falls from the sky into rivers, streams, lakes and oceans; it evaporates into the sky, turns to clouds and falls again.
    - b. Most animals' homes are reused natural material. Birds use twigs and sticks to make their nest, hermit crabs use discarded shells for their protection, many animals use dead logs for food and home, etc.
    - c. Natural materials are always cycling in wilderness areas.
- C. Activity: Treecycle Charades (see activity section below)
- IV. Guided Discovery
- A. Let's see if we can find some examples of material cycling.  
(Lead children to a down log, decaying material, etc.)
  - B. How does this happen? How does a dead tree break down into soil and nutrients?
    - 1. Organisms called bacteria and fungi (mushrooms) feed on dying or dead material and break it down.
    - 2. Insects such as termites, beetles, and carpenter ants help them out.
    - 3. Worms bring air to the soil with their burrows; they also eat nature's “litter,” and when they excrete, this material adds richness and nutrients to the soil.
  - C. What is it called when dead material like this is broken down?  
Decomposition
  - D. What are good and bad conditions for decomposition? What kind of environment is good for decomposers?  
Moisture, little wind, not too hot or too cold
  - E. Activity: Natural Beauty, Big and Small (see activity section below)
- V. Application
- A. Review with me ways we can recycle at home.
    - Recycle aluminum, glass, plastic, newspapers
    - Reuse our things and reduce our waste
  - B. What are some important things that contribute to recycling in nature?
    - Dead material, bacteria, fungi, insects, earthworms

- A moist, temperate environment

## VI. Conclusion

- A. Announce when and where the next Junior Ranger session will be, and what the topic will be.
- B. Stamp logbooks.

## Activities

### Weave of Waste

Number of Children: Five or more

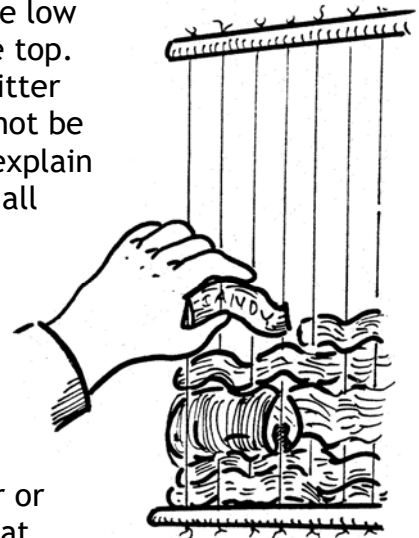
Environment: Along a trail, or in a site where children will be able to find litter

Equipment Needed: Two dowels or sturdy, straight sticks, approx. 2 to 3 feet long, string, scissors, litter bags, latex gloves, and a place to hang the waste loom (from a tree, pole, wall, etc.)

Purpose of Activity: To illustrate the volume of litter people leave in natural places

Activity:

1. In this activity, the Junior Rangers will construct a “weave of waste.” You can save time by setting up the loom beforehand if you’d like; otherwise the children can help you with it. To build the loom, cut 20-30 pieces of string the same length, anywhere from 2 to 4 feet long, depending on how big you want the loom to be. For each piece, tie one end to one stick or dowel, and the other end to the second stick or dowel. The strings should be about an inch apart.
2. Hang the loom from a tree, wall, or pole. It should be low enough for the Junior Rangers to be able to reach the top.
3. Explain that the Junior Rangers are going to go on a litter hunt. Designate boundaries and objects that should not be picked up. Hand out the litter bags and gloves, and explain that the Junior Rangers will have ten minutes to find all the litter they can.
4. When their time is up, call the Junior Rangers back. Now it’s time to weave their trash into the loom. Almost all litter except extremely small objects can become a part of the weaving. Have children take turns weaving their trash in and out of the pieces of string. Then look back at the waste weave. Does it seem like there’s a lot of trash? Leaving one wrapper or can on the trail doesn’t seem like a big deal...but what would happen if everyone did it?



### Time Capsule

Number of Children: Five or more

## ***Junior Ranger Program Handbook: Recycling***

**Environment:** Along a trail, or a place where children will be able to find litter

**Equipment Needed:** Litter bags, piece of butcher paper, and marker

**Purpose of Activity:** To learn cultural values and characteristics by searching for “artifacts”

**Activity:**

1. Explain that the Junior Rangers are going to go on a litter hunt. Designate boundaries and objects that should not be picked up. Hand out the litter bags, and explain that the Junior Rangers will have ten minutes to find all the litter they can.
2. When their time is up, call the Junior Rangers back. Have them sit in a circle and empty the contents of their bags in the middle. What kinds of things did they find?
3. Take an inventory of the litter. How many plastic bags, plastic containers, aluminum cans, cigarette butts, etc., are there? Make a list of the things they found. Beside each item, write the number of things in that category that the Junior Rangers retrieved. What item was found the most? What kind of litter did we NOT find?
4. Tell the Junior Rangers you are going to imagine that this pile of litter is a time capsule. It will be opened by human beings in 100 years...about the year 2100. The Junior Rangers can pretend that they are people living 100 years in the future. What could they learn about people living now? What does the litter reveal about our culture and lifestyle?

### **Who Am I? (a good ice-breaker!)**

**Number of Children:** 10 or fewer

**Environment:** Any

**Equipment Needed:** Pre-made tags for children and safety pins

**Purpose of Activity:** To learn about how nature recycles and the roles of individual decomposers

**Activity:**

Before the program: make ten tags, each of which has the name of one of the following decomposers on it. (The information in parentheses should not go on tags, but should be used in the discussion following this activity):

Carpenter ant (a soil mixer)	Dead tree (home for many decomposers)
Beetle (burrows in dead trees)	Mole (aerates the soil with burrows)
Snail (eats plant debris)	Termites (eat dead wood)
Earthworm (aerates and fertilizes the soil)	Turkey vulture (eats carrion)
Mushroom (scavenges on dead material)	Crayfish (scavenge along the creek bottom)

1. Bring the Junior Rangers together and explain that their job for the next few minutes will be to guess what “nature’s recycler” is on their back. Before they begin, brainstorm what it means to be a “nature’s recycler.” (An animal/fungus that eats dead material, dead plant material where critters can live, any organism that helps with decay.) Make sure you don’t show the Junior Rangers the tags yet.
2. Using the safety pins, attach a tag to the back of each child.



3. Explain that the children can only ask “yes and no” questions. Remind them that not all nature’s recyclers are animals.
4. If there are only a few Junior Rangers left who haven’t “discovered themselves,” you may want to suggest that they ask questions that aren’t only yes/no. Other Junior Rangers can even give them hints.
5. When all have been discovered, sit down in a circle. Going around the circle, ask the children individually how they think their decomposer helps to recycle natural materials.

## **The Un-Nature Trail**

(See “Ecology: Activities”)

Although this activity fits in the Ecology unit, it’s a great addition to learning about litter recycling and caring for natural places.

## **Scavenger Hunt**

Number of Children: Two or more

Environment: A site with an abundance of down trees or other dead material

Equipment Needed: Pens and paper (hand lenses, clipboards, and crayons if possible)

Purpose of Activity: To learn about natural recyclers and the roles of individual decomposers

Activity:

1. Brainstorm the best places to find nature’s recyclers at work. Explain to them that not all recyclers are animals—many are fungi. Send the Junior Rangers out in pairs to find ten critters or fungi feeding on dead material. Remind them that to see many recyclers, they’ll have to use a bug’s eye view.
2. Junior Rangers should not remove the recyclers, but instead draw them just as they see them. The children can take turns drawing recyclers with their partner. Encourage them to be as detailed as possible. How many legs? What colors? Junior Rangers can even draw a quick background for their recyclers, showing what kind of habitat they were in.
3. When all the pairs have found their ten, regroup and talk about their results. Try to name as many recyclers as possible. Which recycler was found most?

Variation: For younger children or larger groups, Junior Rangers could look for just five specimens instead of ten.



## **Build a Compost Pile!**

Number of Children: Five or more

Environment: A site with an abundance of down trees, etc.

Equipment Needed: Two large bins or crates, or six stakes and some wire, a bag of trash (you should have examples of things that can and cannot go in the compost pile in the trash bag), a pail of water, and newspaper

## *Junior Ranger Program Handbook: Recycling*

**Purpose of Activity:** To learn how and why composting is a good alternative to throwing organic wastes away

**Activity:**

1. Gather the children together and introduce the concept of composting. Composting is a way of keeping organic wastes out of landfills, an alternative to throwing them away. It conditions soil, adding nutrients that people would otherwise have to obtain from fertilizers that use up fossil fuels. Composting is easy, and it can be done at home.
2. If you don't have crates or bins, make a two-sided compost bin by putting the stakes in the ground to form a rectangular shape, three stakes long and two stakes wide. Wrap the wire around the stakes so that it closes off the entire rectangle. Then wrap it through the middle of the rectangle, dividing it into two squares, each two stakes long and two wide. The Junior Rangers can help you. Line one side of the bin with damp scraps of newspaper.
3. Have the Junior Rangers add organic wastes to that same side of the bin. This waste can include dead leaves, grass clippings (they'd have this at home), and the organic pieces of trash you've brought. See if they can guess which trash is organic and what is not. Paper products as well as vegetable and fruit scraps can go in; dairy and meat products should be left out. Break up the organic wastes into small pieces before adding them to the pile.
4. Add soil until it equals the amount of organic wastes in the bin. Pour water on top.
5. Discuss with the Junior Rangers how they would maintain the compost pile. They would need to keep it moist, and mix the pile a little bit every day. Mixing the material around will bring oxygen to the microbes essential for the decay process. Ask the Junior Rangers what would happen to the organic wastes in the bin.
6. Ask the children why they think the other side of the bin is still empty. Explain that the empty side will hold the material when it begins to turn to rich soil. As the decay process proceeds, they can move the rich soil to the other side. That way, they can keep adding compost to the bin without mixing it up with the nutrient-rich soil they've created. The new soil can be put in their garden or flower pots!

### **Natural Beauty, Big and Small**

**Number of Children:** One or more

**Environment:** Large natural area

**Equipment Needed:** Pens or pencils, paper, and clipboards if possible

**Purpose of Activity:** To gain an appreciation for natural places; to understand the value of areas uncluttered by human litter

**Activity:**

1. In this activity, the Junior Rangers will each find a place that is special to them. They must find a spot on their own, with no one else around them. Preferably, they won't be able to see anyone from their spot.



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2. Once at their spot, the Junior Rangers will spend ten minutes just observing. They picked their spot because it was attractive to them aesthetically. What makes this spot beautiful? Remind the children that beauty comes in all shapes and sizes. Each child should find at least three things that make their spot beautiful. One should be smaller than a penny, one smaller than themselves, and one bigger than themselves. They should observe every small detail of these treasures.
3. When their time is up, have the children share with each other what made their spot beautiful.
4. Have the children close their eyes, and imagine that someone threw a soda can in their spot. Then another person came along and tossed their lunch leftovers into the special spot. Someone else threw a cigarette butt down. (Try to give them a visual image of all the trash you can think of...candy wrappers, tin cans, scraps of metal and plastic, chewing gum, etc.) Pretty soon their special spot is piled high with trash. Does that place still have any value to them? Would they want to go back there if they were asked to do this activity again?
5. Have the children open their eyes again. Now, they can think back to the way the spot was before people littered in it. They can remember the three things that were the reason they thought the spot was beautiful.



6. Pass out paper and pencils. Explain to the Junior Rangers that they will each write a “Long-Skinny” about their special place. A “Long-Skinny” is a special kind of poem. Each line can only have two words. They can write as many lines as they have time for, creating a long and skinny poem. They can even make the poem curve and twist if they’d like. To make the poem beautiful, they should write about their spot just as they saw it, in its natural state. They can think about the three things they observed to get them started.
7. If time permits, have the Junior Rangers share their poems with each other (only if they want to). You can share your “Long-Skinny,” too.

### **Treecycle Charades**

Number of Children: One or more

Environment: Open space

Equipment: None

Purpose of Activity: To give children a sense of how natural recycling works

Activity:

1. Ask Junior Rangers if they think that nature knows how to recycle. Can they think of any examples?
2. The Junior Rangers can now act out the cycle of a tree. The first time through, they can follow your lead. The second time, you can do it all together.
3. What does a tree look like when it’s really small, before it has even begun to grow? It’s a seed!  
Crouch down into a ball; become as tiny as possible.

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4. Then it gets a little rain, a little sun, and some soil. What does it look like now?  
Children can slowly, slowly stand up and begin to stretch out their arms.
5. It keeps getting bigger, let's see those branches!  
Children can stretch as high as they can reach, fingers spread as far apart as possible.
6. Now we're full-grown trees. What happens if there's a big storm, with wind and rain? What happens if we're hit by lightning? Or if a forest fire comes rushing at us?  
Arms begin to drop, heads start to droop.
7. And finally we die!  
Children can "crash" onto the ground and spread themselves out into a "log."
8. Now we're just a dead log, lying on the ground. Do you think people should take us away? No! We're still going. Now we begin to decompose. Tiny insects, bacteria, and fungi come invade us, breaking down the material inside of us.  
Leader can now walk around the children on the ground, crawling his/her fingers over their backs and heads.
9. And finally, after a long time, we turn into rich new soil—soil that new seeds can grow in!  
Once again, children crouch down as small as they can, like little seeds.
10. Congratulations! What an amazing "tree-cycle!"

## **Background Information: Recycling**

### **The Three "R"s**

Knowing the three "R"s is the first step toward solving the garbage and trash problem in our parks and worldwide:

**Reduce**—to minimize our waste by buying fewer things (or using fewer things) that have to be thrown away. We would cut down on a lot of trash by simply being careful consumers. If we think about what kinds of things we can reuse or recycle before we buy them, we won't purchase as many things that will eventually turn into waste.

**Reuse**—to adapt something for another purpose. Reusing includes giving things away to friends or selling things at a garage sale.

**Recycle**—to turn what we call "trash" into useful, new products. These are things that may or may not be able to be reused in their original state, but are made of materials that can be used over again.

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RECYCLABLE	WHAT CAN BE RECYCLED	WHAT CANNOT BE RECYCLED	THE NEW PRODUCT
GLASS	Jars and bottles with plastic or paper labels on.	Lids, mirrors, vases, drinking glasses, windows, and lightbulbs.	New jars and bottles
ALUMINUM	Cans, pie pans, and aluminum foil.	Most everything <i>can</i> be recycled.	More cans
STEEL	“Tin” cans, cans that a magnet attracts.	Most everything <i>can</i> be recycled.	More tin cans
NEWSPAPER	Newsprint and advertisements that come with the paper.	Most everything <i>can</i> be recycled.	Newsprint to make more newspapers.
PHONE BOOKS	Old telephone books.	Most everything <i>can</i> be recycled.	Groundwood to make tiles, bookcovers, and home insulation.
CORRUGATED CARDBOARD	Boxes made of corrugated cardboard and sometimes brown bags.	Cracker, cereal, or shoeboxes (not with the corrugated cardboard at least.)	More boxes.
WHITE PAPER	Notebook paper, white stationery and envelopes, and index cards.	Unbleached paper, stickers, plastic, paper clips.	More white paper.
MISC. PAPER	Cereal boxes, shoeboxes, toilet paper rolls, junk mail, and wrapping paper.	Tissues, paper towels, paper plates and cups, wax paper.	Cereal boxes, cracker boxes, and shoeboxes.

## **Where Does Our Trash Go?**

There really isn't anyplace that's "away" when it comes to our trash. Most of it is taken to landfills. Modern landfills are big holes in the ground that are lined with plastic or clay that keeps the garbage from coming into contact with the soil. The trash is compacted with a bulldozer and put in the holes, the holes are covered with dirt, and oftentimes grass is planted on top...the landfill may even become a public park. There are about 5,200 landfills in the U.S. today; unfortunately, these modern-day dumps aren't the ideal solution to the garbage dilemma. First of all, we don't have enough space to accommodate all of our trash. Many of the landfills are already full, and the others are filling up fast. In fact, if no one in California recycled, all of the landfills in our state would be full within a year!

The area that landfills occupy takes away from the amount of space we have for schools, parks, or protected wilderness areas. Even if space weren't an issue, not many people want to live near a landfill. Sanitation, while it has improved significantly, continues to be a worry as well. When rain falls on a heap of trash, the mixture of water and decomposing garbage forms *leachate*, a toxic, soup-like substance. The leachate is a health hazard if it seeps into the ground water that we drink.

About one-tenth of Americans' trash goes to an incinerator to be burned. Unfortunately, incinerators are expensive. Also, they certainly don't make trash just disappear. At least one-third of what is burned remains as ashes. These ashes have to be disposed of somewhere, and once again end up in landfills. The rest of the burned trash is a source of air pollution.

Some of our trash is being washed through storm drains into streams, rivers and the ocean. The National Academy of Sciences estimates that 6.4 million tons of litter enters the world's oceans each year. Sixty to 80 percent of this marine debris is plastic materials. Made of synthetic materials, much of this debris does not degrade quickly and presents a major health hazard to marine life and even to humans.

Some people have even suggested shooting our trash out into space; but, aside from the expense, that means merely displacing the refuse that we've made. Minimizing our trash by reusing and recycling seems to be the best solution to the garbage problem thus far.

## **Reasons for Recycling**

Besides minimizing our trash problem, recycling also saves our natural resources, prevents pollution, saves energy, and helps communities.

Recycling saves both renewable and nonrenewable resources. Renewable resources are those that can be replaced by natural or human processes. Plants and animals,

## *Junior Ranger Program Handbook: Recycling*

forests, and water are all renewable resources, and yet require careful management to ensure their usefulness. Human interference often depletes these assets to the point where they are unable to replenish themselves. For instance, the number one cause of species extinction is habitat destruction by human beings. We can overgraze grasslands and meadows until they can no longer sustain themselves. We can pump groundwater out faster than precipitation can replenish the supply. The optimum rate at which a resource can be used without diminishing its long term availability or obstructing its ability to renew itself is called the sustainable yield. Also included in the category of renewable resources are sunlight, wind, geothermal heat, tides, and flowing water. More specifically, these are referred to as “perpetual resources” because they last forever in the context of the human time frame. Non-renewable resources include minerals such as iron, copper, phosphates, and bauxite, as well as fossil fuels like coal, oil, and natural gas. (For more on fossil fuels, see “Energy: Information.”)

We get items that we use every day from natural resources; when we recycle, we take less raw material from the earth. The animal habitats we destroy when we drill into the earth’s crust, clear-cut a forested area, or dump our trash into a natural environment won’t be lost when we reuse the materials we’ve already used. Recycling also creates less pollution, which in turn protects plants and animals. Of course, any manufacturing of new products makes some pollution, but using virgin materials to make new goods creates the most. For instance, manufacturing soda cans from recycled materials creates 95 percent less pollution than the production of those made from new aluminum. And for every two pounds of paper we recycle, we prevent seven gallons of water from being treated with chemicals.

Recycling can save us energy in two different ways. First, we save energy because we don’t have to obtain as many materials from the earth. We don’t expend energy digging, drilling, clearing, and cutting. Aluminum, for instance, is difficult to obtain from the ground. It is most abundantly found in the mineral bauxite, but for every ton of alumina ore in bauxite, there is an equal amount of leftover material called red mud. The red mud has not yet been classified as a hazardous waste, but has the potential to contaminate water supplies. People have yet to find an effective way to use this refuse. Second, we save the energy it takes to convert these raw materials into products in factories. Recycled materials are made into new products more easily and more efficiently than raw materials.

Recycling is also a good way for communities to save money. Making and running landfills is costly, as is paying people to pick up trash. Communities could be putting this money toward schools, parks, and other worthwhile uses.

## **Some Recyclables**

### Glass

Glass can be recycled over and over again. Recycling just one bottle saves enough energy to light a hundred-watt bulb for four hours. And for every ton of glass recycled, we save a ton of raw materials needed to make glass from scratch. New glass is made when sand, soda, feldspar, and limestone are mixed together and heated in a furnace. Glass can also be made by just melting down old glass. However, since old glass melts at a lower temperature, it saves heat energy.

Jars and bottles can be recycled together. Plastic or paper labels can be on, but lids should be removed. Dirt and sand should be washed out carefully. Recycling centers differ and some request that glass be sorted by color (clear, brown, or green). Mirrors, vases, drinking glasses, windows, and light bulbs can't be recycled.

### Aluminum

Recycled aluminum is melted like glass, and made into large aluminum sheets. In addition to aluminum soda and beer cans, pie pans and aluminum foil can also be recycled. Some recycling centers require separating this "other" aluminum from the cans. Some also ask that cans not be crushed.

### Steel

Not all recycling centers take steel cans (or what we usually call "tin cans"), but if they do, these cans are easy to recycle. As with glass, labels can usually be left on. Magnetism is a good way to distinguish between aluminum and steel. If the magnet sticks to the can, then it's steel.

### Paper

Recycling paper can be a little more challenging. As far as recycling goes, paper comes in five categories: newspaper, phone books, corrugated cardboard, white paper, and mixed paper.

1. Newspaper—Americans throw away more than two-thirds of their newspapers, or 500,000 trees' worth every week. Newsprint can be recycled and used for newspapers again. Nearly all recycling centers take newspaper. Some require that it be tied in stacks.
2. Phone books—Unlike newspaper, phone books are made with a very thin kind of paper called groundwood which isn't strong enough to be remade into paper. It can, however, still be recycled. Instead of becoming paper, recycled groundwood is used to make book covers, tiles, and home insulation. Some recycling centers will take phone books with miscellaneous paper; if not, sometimes the phone company will take old books.



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3. Corrugated cardboard—This cardboard must be separated from cereal or shoe boxes. Some recycling centers will take brown bags with corrugated cardboard since they're made of the same kind of paper.
4. White paper—This includes notebook paper, writing paper, white stationery and envelopes, computer paper, and index cards. White paper is especially important to recycle for two reasons. First, it's made with tightly woven fibers that make it stronger than most other paper so that when it's recycled it can still be made into high-quality paper. Also, white paper is already bleached. When it is recycled, it doesn't need to be bleached like other paper and saves added chemicals and water pollution. Stickers, plastic, and paper clips attached to white paper must be removed before recycling, but staples don't need to be undone.
5. Mixed paper—This includes paper egg cartons, shoe boxes, cracker and cereal boxes, toilet paper and paper towel rolls, junk mail, wrapping paper, and envelopes. Papers that can't be recycled include tissues, paper towels, paper plates and cups, and wax paper. Not all recycling centers take miscellaneous paper.

### Plastic

A great deal of recyclable plastic is made from a product called polyethylene terephthalate. Commonly this category of recyclables is referred to as "PET" or "PETE." PET bottles include plastic soda bottles, some detergent bottles, plastic peanut butter jars, and many other containers. If a product has a recyclable symbol with a #1 in the middle, then the plastic is PET. In fact, all six kinds of plastic are marked with numbers. (See the next page to learn which number corresponds to the different types of plastic.) PET, when recycled, is used to make park benches, carpets, pillows, paintbrushes, and clothing (polyester is made from PET). Plastic caps must be taken off the bottles before they can be recycled.

High-density polyethylene or HDPE is another kind of plastic that is used to make milk jugs, butter tubs, and other containers. (HDPE is symbolized by a #2 inside the recycling symbol. See the following page.) HDPE is recycled by melting down the plastic into tiny flakes, which are cleaned and then sold to plastic companies. They are then melted again and shaped to make new products. An old milk container may turn into a flower pot, plastic pail, or any number of recycled plastic goods. Plastic lids and rings must be taken off HDPE milk containers before the container is recycled.

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For information on other kinds of recyclable plastic, see the chart below.

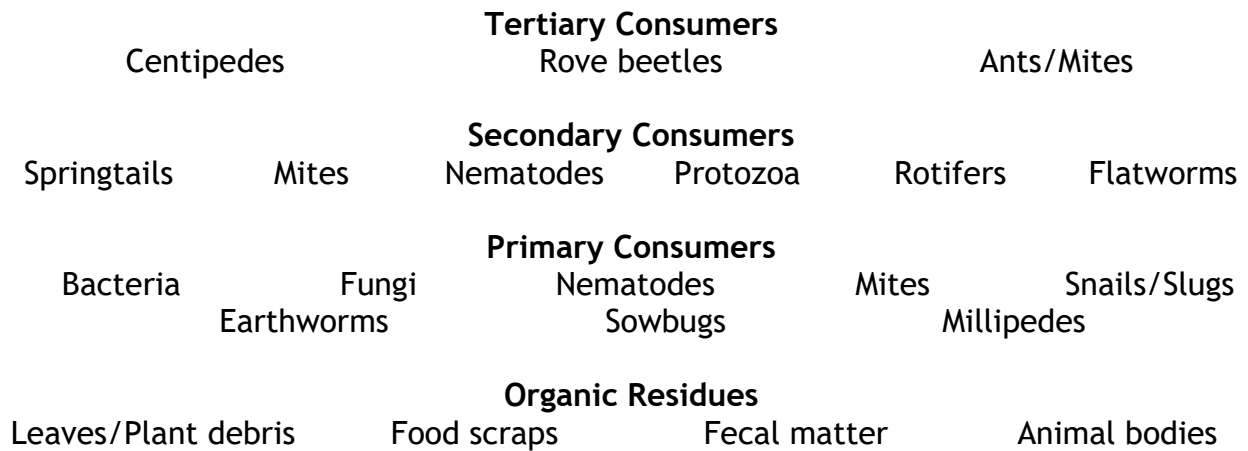
1	# 1 PET Polyethylene Terephthalate	Plastic soda bottles, plastic peanut butter jars, and other containers made of plastic.
2	#2 HDPE High-Density Polyethylene	Milk jugs and some other containers.
3	#3 PVC Polyvinyl Chloride	Garden hoses, credit cards, polyvinyl shower curtains, some plastic bottles.
4	#4 LDPE Low-Density Polyethylene	Clear plastic used to cover CDs or tapes, sandwich bags, and plastic grocery bags.
5	#5 Polypropylene	Plastic lids, bottle caps, straws. Usually these items cannot be recycled.
6	#6 Polystyrene	Styrofoam and clear hard plastic food containers.
7	Mixed Plastic	Try not to buy this kind. Most places do not recycle it.

### **Nature's Recycling**

Unlike our trash, nature's "litter" doesn't do any harm. In fact, reusing and recycling is absolutely essential for the maintenance of individual ecosystems and a healthy world environment in general. Nature recycles every minute of every day, through a process called decomposition.

When plants and animals die, this organic matter is broken down by organisms called decomposers. Most decomposers are in the fungi, bacteria, or protozoa kingdoms, but many animals also contribute to breaking down dead matter. Bacteria dominate fungi in agricultural and grassland environments, whereas fungi outdo bacteria in forest biomes. It is because of these decomposers that the "litter" on the forest floor doesn't keep piling up. As dead matter is broken down, nutrients are added to the soil, making it richer and allowing plants to grow and thrive. The decomposers, then, act as the last link in a food web, and allow a new food web to begin. The following provides some examples of organisms you may find in a "soil food web":

## The Soil Food Web



Most decomposers are microscopic. Bacteria are probably the most important. Their numbers are astounding. In fact, human beings do not know enough about bacteria to estimate the number of bacteria species to an order of magnitude. Twenty-five thousand bacteria can fit end-to-end in one inch, and a pinch of soil the size of a pea holds one billion. Bacteria are the most nutritionally diverse of all organisms; they can eat almost anything, making them fantastic decomposers. They also survive in all kinds of environments...everywhere on earth. The Monera (bacteria) kingdom is the only one whose members are prokaryotes, meaning their cells lack a membrane-enclosed nucleus.

Fungi take over the decomposition process that bacteria have begun. Like bacteria, fungi are neither animals nor plants, but are classified in a kingdom of their own. Unlike plants, they cannot make their own food. Most obtain their energy by breaking down dead organic material.

Earthworms contribute to decomposition by aerating the soil, as do small mammals such as gophers and moles. Millipedes, centipedes, and beetles all contribute by feeding on forest litter. Termites help in the disintegration of wood. Mites are tiny arthropods that attack dead vegetation and fungal strands.

The “water wheel” is another example of how nature recycles. Snow and rainwater drain into rivers, which carry water to lakes and eventually the ocean. Water evaporates from ocean and lake surfaces, then condenses in the sky to become clouds. The sun provides the energy needed for evaporation. Snow and rain again fall onto the earth, and the water cycle begins anew.

The carbon cycle and nitrogen cycle are both examples of how nature recycles crucial elements. These elements are used in various ways as they cycle through the environment.

## Suggested Resources: Recycling

Cornell, Joseph B. *Sharing Nature With Children*. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998. Written by a leading environmental educator, *Sharing Nature with Children* shares some of the environmental games Joseph Cornell uses in his interpretive programs for children.

*Education and Recycling*. Published by CA Department of Conservation, 1994.

Elkington, John and Julia Hails, Douglas Hill, and Joel Makower. *Going Green: A Kid's Handbook to Saving the Planet*. New York: Puffin Books, 1990.

*Fifteen Simple Things Californians Can Do to Recycle*. Published by The Earthworks Group and California Department of Conservation's Division of Recycling, 1991.

*Fifty Simple Things Kids Can Do to Recycle*. Published by The Earthworks Group and California Department of Conservation, 1994.

Gordon, Miriam. *Eliminating Land-based Discharges of Marine Debris in California: A Plan of Action from the Plastic Debris Project*. California Coastal Commission, 2006. A very eye-opening report on plastic in our waterways, supported by compelling and sobering statistics. Can be downloaded from [plasticdebris.org](http://plasticdebris.org).

Jorgensen, Eric, Trout Black, and Mary Hallesy. *Manure, Meadows, and Milkshakes*. 2<sup>nd</sup> Ed. Los Altos, CA: The Trust for Hidden Villa, 1986. Fun ideas for environmental education. Includes lots of activities and games.

McNaughton, S.J. and Larry L. Wolf. *General Ecology*. New York: Holt, Rinehart, and Winston, 1973.

Project Learning Tree. *Environmental Education Activity Guide: Pre K-8*. Washington, D.C.: Project Learning Tree, 1993. [www.plt.org](http://www.plt.org).

*Project Wild K-12 Activity Guide*. Bethesda, MD: Western Regional Environmental Education Council, Inc., 1992. [www.projectwild.org](http://www.projectwild.org).

National Wildlife Federation. *Ranger Rick*. Vienna, VA: National Wildlife Federation. Published monthly since 1967. A nature magazine "just for kids." [www.nwf.org/kids](http://www.nwf.org/kids).

Sussman, Art. *Dr. Art's Guide to Planet Earth: for Earthlings ages 12 to 120*. White River Junction, VT: Chelsea Green Publishing Company, 2000. This book explores how our planet works and how our actions can affect the environment.

*The No Waste Anthology: A Teacher's Guide to Environmental Activities K-12*. Sacramento, CA: Department of Toxic Substances Control, 2003.

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Wilson, Edward O. *The Diversity of Life*. Cambridge, MA: Harvard University Press, 1991.

### **Other Sources of Information**

California Integrated Waste Management Board. [www.ciwmb.ca.gov](http://www.ciwmb.ca.gov).

California Department of Conservation, Division of Recycling.  
[www.consrv.ca.gov/DOR/index.htm](http://www.consrv.ca.gov/DOR/index.htm).

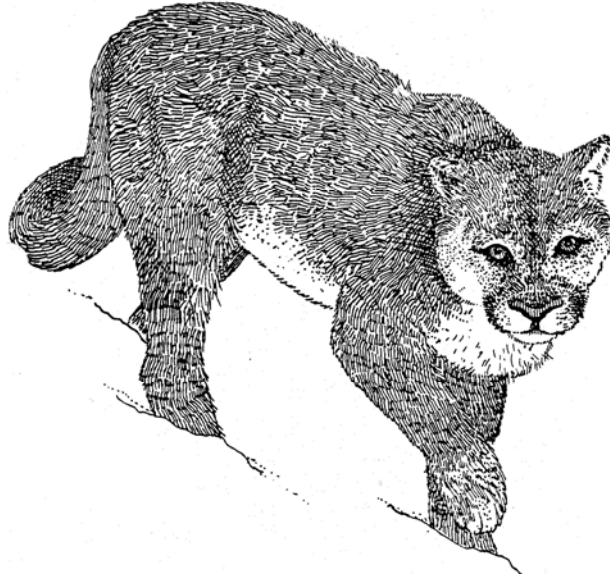


**INSERT *SAFETY* TAB HERE**





# Safety and Survival/Crime Prevention



## Introduction

Safety of visitors—especially very young ones—is always a concern of park staff. Since many potential dangers are aggravated by ignorance, the safety and survival/crime prevention program is one way to make Junior Rangers aware of precautions they can take while in the park to ensure that their visits are safe and enjoyable ones.

There are many safety topics Junior Rangers would benefit from, but the three that may be most important are fire safety, wild animal safety, and water safety. Since the majority of dangerous situations in state parks are related to these three topics, they are important topics to cover.

Another safety issue Junior Rangers should be prepared for is what they should do if they get lost. A child who has learned ahead of time what to do when lost has a better chance of being found. (See the sample program for interpretive ideas.)

Beyond these safety basics, you can also discuss wilderness survival. Kids find the techniques presented in a book such as Tom Brown's *Guide to Wilderness Survival* fascinating. They enjoy imagining how they would survive if cut off from civilization someday, and the information may be useful to them at some point in their lives.

Finally, crime prevention is, unfortunately, a necessary topic to cover. Junior Rangers should know how to protect their belongings from being stolen, what to do if a crime occurs, and what to do if approached by strangers.

Preparing Junior Rangers ahead of time for potentially dangerous situations gives them the skills to be safe, prevent crime, and survive.

## Interesting Facts About Safety and Survival

- Children of all ages set over 35,000 fires annually. Approximately 8,000 of those fires are set in homes.
- Twenty-five percent of all fires are started by playing with matches.
- A five minute delay in reporting a crime endangers life and property. (It also gives a criminal a 2/3 better chance of escape.)
- Over 90 percent of the lost children in state parks are found safe and unharmed within one hour.



## Sample Programs: Safety and Survival/Crime Prevention

### General Program

#### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

#### II. Focus/Objectives

The park is a fun place to be, but people can sometimes get into dangerous situations in the park. Today, we'll learn some of the things to be careful of, and ways to make sure your visit will be safe and enjoyable.

#### III. Inquiry/ Discussion

##### A. Hiking Safety

1. How many of you like to go hiking?
2. Whether you hike with your parents, with a group, or with friends, it's a good idea to be prepared to hike safely.

3. What kind of shoes should you wear on a hike?  
Sturdy, comfortable shoes.  
(Model a good hiking shoe and sock.)
4. What kind of clothes should you wear?  
In warm weather, cotton (like a T-shirt) is a good choice because it cools the body. In cold or wet weather, however, avoid cotton. Because temperature or weather conditions may change while you're on a hike, it's a good idea to dress in layers. For example, if it's hot when you start out, you can wear a T-shirt with a windbreaker tied around your waist. If you get cold later, you can put the windbreaker on, and the layers will keep you warm.
5. Should you take anything with you on a hike?  
Yes, it's a good idea to carry a few things in a small day pack or belt pack. (Show and discuss a day pack containing: high energy food snacks, water/water purifier, first aid supplies, and garbage bags.)
6. Should you stay on the trails when you hike? Why?  
Yes. If you stay on the trail and avoid switchbacks or shortcuts, you will be less likely to get lost, to run into poison oak or other harmful plants, and to cause erosion.  
(Hike to an area where you can show the erosional effects of shortcutting on the trails.)
7. Is it all right to touch all the plants and animals you see on your hike?  
No. Some plants are dangerous and many animals will be afraid of you. They have defenses to protect themselves from their predators, and they might harm you.
8. Can anyone think of an example of a defense a plant or animal has to keep threatening people and animals away from it?  
Examples: Rattlesnake/poisonous venom; stinging nettle/sharp bristles that irritate the skin; animals/claws and teeth that bite and tear.
9. Are there any insects we need to watch out for? Why?
  - a. Mosquitoes: Female mosquitoes use mammals' blood to nourish their young. They sometimes carry diseases. The enzyme the mosquito injects into your skin to keep your blood from clotting causes irritation. Protect yourself by using a good repellent, especially when hiking at dusk.
  - b. Wasps/bees: These insects sting as a defense. If a bee or a wasp lands on you, the best thing to do is to wait for it to fly away. It will usually only sting you if it feels threatened (for example, if you are swatting it away). If a wasp or a bee seems to be following you, change directions quickly several times. This usually throws them off.
  - c. Brown recluse or black widow spiders: These spiders are shy, and really like to avoid people as much as people want to avoid them. However, since they are poisonous, you should know how to identify them. The black widow is black with a characteristic red spot on its underside. A brown recluse is not so strikingly marked. You can tell a brown recluse by the violin-shaped markings on its back (show

photos). If you ever find a target-like marking on your body (rings of different shades), ask a doctor to check to see if you have been bitten by a brown recluse.

- d. Ticks: Ticks, like mosquitoes, seek the blood of mammals. A tick will attach itself to your skin and fill itself with your blood, then drop off. Especially when hiking through areas where tall grass grows, it's a good idea to wear long pants and socks, and to check yourself for ticks during and after a hike. Some ticks are relatively harmless, but others carry Lyme disease. If you find a tick on your body, have a doctor or other expert remove it so that the head will come out. Have the tick analyzed to see if it carries Lyme disease.

10. Why should you avoid feeding or attracting wild animals?

Wild animals aren't used to humans. Unlike domesticated pets, they are unlikely to be friendly toward you. Instead, they will feel threatened and defensive—in attack mode, in other words. Some wild animals may carry diseases like rabies or plague, which make them particularly dangerous to you. (Note: If you have mountain lions or bears in your park, see pages 12-16 to 12-18.)

11. Can you name some plants you should avoid?

Poison oak, stinging nettle, thorny plants, etc. (Show Junior Rangers how to identify dangerous plants in your park by pointing them out or showing pictures).

B. Finding Your Way

1. If you were on a hike, and you didn't have a compass or a map, how would you know what direction you were going?

Demonstrate how to use the sun, landmarks, and the night sky for direction.

2. Find a map of the park. What is the symbol for mine, spring, or ranger station? Who can find one?<sup>1</sup>

3. There are five "D's" of map reading:

- a. Description (found in margins)
- b. Details (map symbols, legend)
- c. Direction
- d. Distances (scales at the bottom margin of the map)
- e. Designations (places and other map features)

4. Draw your own map of the park using the five "D's."

5. Demonstrate basic compass use.

6. Can you use a compass without a map?

- a. Yes, you can use a compass to find your direction (or "bearings") from a location. If you're lost, you can use a compass to head back in the right direction, and to be sure you aren't walking in circles.
- b. Show how to use a compass with a map.
- c. Show how to use a compass to tell time.

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<sup>1</sup> B. Kjellstrom's book *Be an Expert with Map and Compass* contains some games you may want to try.

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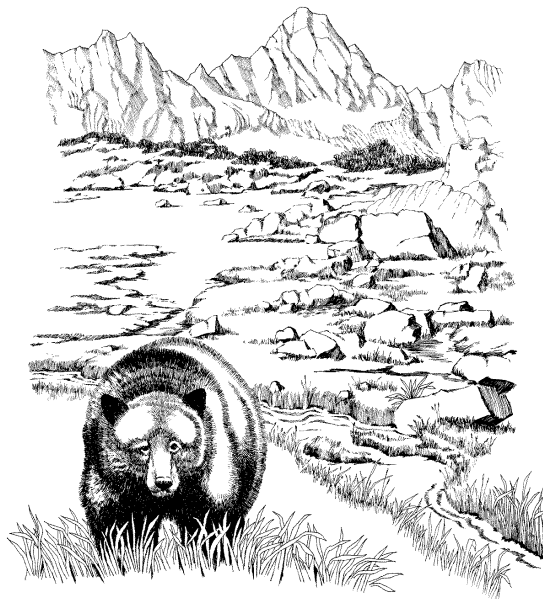
7. Take the group to an area and let them find their way back using only the compass. Determine a safe route to a destination.
- C. Losing Your Way.
1. If you get lost, what should you do?  
Try to stay calm, and stay in one place. Try “hugging” a tree; it may help you feel calmer. Stay by your tree. People will come to find you. Sometimes kids worry that their parents will get mad at them when they are found. Don't worry about that—your parents will be so happy to see you that they won't get mad. Listen for voices, and shout out every few minutes. It's a good idea to bring a whistle with you on hikes, because if you get lost, a whistle can be heard better and takes less energy than shouting.
- D. Fire Safety
1. Where are you allowed to build a fire in the park?
    - a. Only in a designated area, and only with adult supervision.
    - b. Demonstrate safe fire building and extinguishing.
  2. Where should you go if there is a fire in the park?  
Discuss fire evacuation procedures.
  3. What should you do if you're trapped by fire while in the park?  
Select an area clear of vegetation (road, ditch, waterway). Lie down, and cover any exposed skin with a jacket or blanket. Avoid canyons that can concentrate and channel fire.
  4. What should you do if your clothing catches on fire?  
Stop, drop, and roll. If you see someone else's clothes on fire, tell them to drop and roll, and then try to extinguish the fire by covering the person with a blanket, depriving the fire of the oxygen it needs to burn.
- E. Preventing Crime While on Vacation
1. What should you and your family do before leaving home for a vacation?
    - a. Arrange for friends or neighbors to pick up your newspapers, mail, and packages.
    - b. Notify a neighbor.
    - c. Notify your police department (they provide vacation checks of homes).
    - d. Leave some shades up or curtains open so the house doesn't look deserted.
    - e. Arrange to keep your lawn maintained.
    - f. Use timing devices for your lamps.
    - g. Make sure all of your doors (basement, french, porch, balcony) can be securely locked.
    - h. Lock your garage door when you are away from home.
    - i. Leave a radio on.
  2. How do you report a crime?
    - a. Tell an adult.
    - b. Call 9-1-1 or park rangers immediately.
    - c. Get a good description of suspects or vehicles.  
Roleplay calling 9-1-1 and giving appropriate information.

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3. How can you prevent your bike from being stolen?
  - a. Get a strong lock and use it every time you leave your bicycle somewhere. Most bikes that get stolen weren't locked.
  - b. Lock or chain your bicycle to something solid.
  - c. Lock your bike through the frame and both wheels if you can.
4. How can you prevent your favorite things from being stolen?
  - a. Don't leave your things on the seat of the car, or out in the open campsite where someone could easily pick them up.
  - b. Mark your things for identification and keep them safely locked up when not in use.
5. How can you keep yourself safe?
  - a. Always try to play or walk with friends instead of alone.
  - b. Don't take anything from a stranger, including candy, money, or car rides.
  - c. Tell an adult you trust if anyone makes you feel unsafe.
  - d. Know where the nearest telephone is and how to telephone for help.<sup>2</sup>

IV. Application/ Conclusion

- A. Ask the Junior Rangers what they learned today about safety.
- B. Announce next Junior Ranger program and other interpretive programs.
- C. Stamp logbooks.



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<sup>2</sup> These personal safety hints are from the "McGruff safety pledge." For more information on McGruff activities contact: National Crime Prevention Council. [www.ncpc.org](http://www.ncpc.org).

## **Water Safety**

### **I. Introduction**

Introduce yourself.

Introduce the Junior Ranger Program.

### **II. Focus**

Start off by explaining that since it's summertime and the Junior Rangers will be cooling off in the water, there are some important rules for them to follow so that they can have fun at a beach or a pool without getting hurt.

### **III. Inquiry/Discussion**

A. How many of you can swim?

B. What are some important things to remember to be safe while you're swimming?

1. Never swim alone.

2. Swim only in supervised areas.

3. Follow all posted rules.

4. Don't swim during electrical storms.

5. Don't dive into a place where you've never been before until you look it over and make sure it is safe and deep enough for a dive.

6. Never fake calls for help.

C. When you're down on the beach, there are other important things to remember, such as checking with lifeguards to see if the conditions are safe.

1. How many of you have younger brothers and sisters? One important thing to do is to keep an eye on them, even if there are lifeguards.

2. Can you think of any other things you might or might not want to do while on the beach?

a. Don't bring glass or breakable objects onto the beach.

b. Don't throw sand.

c. Obey the lifeguards.

d. Don't swim near rocks, surfers, and rip tides.

D. When you are swimming in the ocean, you should know what to do if you get caught in a rip current. Rip currents are narrow, river-like currents. They take water that the waves have moved onto the beach back out past the surf. Rip currents are usually about 50 feet wide (about as wide as twelve kids laid end to end). You can spot a rip current by looking for the dirty brown water, choppy surface and the foam the currents carry back to sea.

1. Does anyone know what to do if you get caught in a rip current?

Don't panic. Swim parallel to shore, swimming across the current (rip currents are not very wide).

E. How many of you know how to do the survival float?

Explain how to do the survival float, and explain that it can be used to stay afloat if they ever need to.

F. Does anyone know what to do if you get tangled in weeds or kelp while swimming?

Slow, gentle movements will free you, while thrashing around will only get you more tangled up.

- G. What is a lifeguard? What does a lifeguard do?  
A lifeguard is always watching for people in danger. He or she gives first aid when needed, can give out information, and saves lives on the beach!
- H. Keep an eye out for animals on the beach. If you see baby seals on the beach, don't disturb them. They generally rest on the beach when they are tired or cold. Their mothers are usually around, but let the lifeguard know the seal is there.
- I. What should you do if you see someone in trouble in the water?
  - 1. Tell a lifeguard right away. If no lifeguard is nearby, follow the REACH-THROW-ROW-DON'T GO method.
    - a. REACH: Extend anything to a person in the water and assist the person to shore. The rescuer should hold onto a secure object and not enter the water. (Use a stick, branch, belt, rope, jacket, arm, leg, etc.)
    - b. THROW: Toss anything that floats to a person in the water. It should be thrown close enough to be grabbed by the person in the water, but try not to hit him/her in the head. The person can float until you can get a lifeguard to help get him/her out.
    - c. ROW: Propel a small boat, inner tube, log, etc. to a person in distress. Carefully bring the victim to safety.
    - d. DON'T GO: Unless you are a trained lifeguard. You should not swim to a person in distress without this training—you could become a victim also. Get a lifeguard or call 911 as soon as possible.
- J. Activity: Sand animal contest. The Junior Rangers can make any kind of marine animal they like, either alone or in pairs. Give out an award for the most realistic creature!

#### IV. Conclusion

- A. On the way back, ask the Junior Rangers to tell you what they learned today about water safety.
- B. Announce the next Junior Ranger program.
- C. Stamp logbooks.

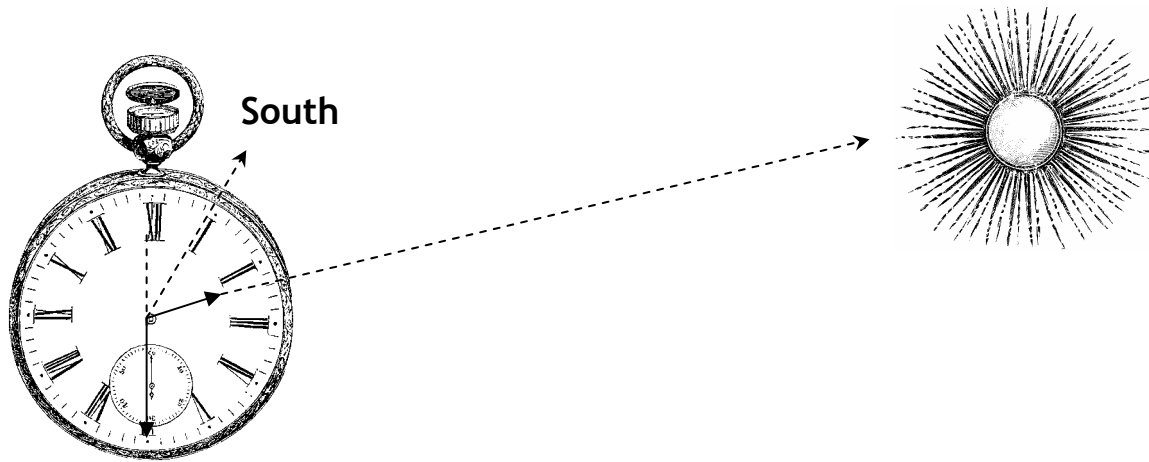
## Activities

### Sun Compass Activity

The birds and the bees use the sun as a compass. You can, too. All you need is an old-fashioned, non-digital watch. Go outside and point the hour hand of your watch at the sun. Imagine drawing a line from the center of your watch halfway between the 12 and the hour hand. This line will always point close to due south. You may encounter one slight complication, however. If it's summer and you're on daylight



saving time, you'll have to set your watch back an hour to make your calculations come out right.



## Background Information: Safety and Survival/Crime Prevention

### Water Safety

Safety in the water begins with learning how to swim. A learn-to-swim program is key to enjoying water recreation. By developing your swimming skills, you open up wonderful opportunities to learn a wide variety of aquatic sports and activities.

Whenever possible, swim or play at a beach or pool that is protected by lifeguards. Most drownings occur at unguarded beaches where there are no lifeguards on duty.

When swimming, if you ever feel like you're in danger of drowning, try to stay calm. If you panic, your body will stiffen and you will not be able to move or breathe easily. Many people who are afraid in water wave their arms wildly. If you do this, you may become tired and swallow water or faint. Staying calm helps you to breathe and stay afloat. Staying calm also gives you a chance to think of what to do to save yourself. You can float for hours as long as you are calm, keep your lungs filled with air, and tread water or use the survival float. Treading water and floating are the best ways to save energy. If you learn both of these, you can change from one to the other in the water while you wait for help to arrive.

#### What to do if someone is in trouble in the water:

- In an emergency—dial 9-1-1
- If you see someone in trouble, get help from a lifeguard. If a lifeguard is not available, have someone call 9-1-1.

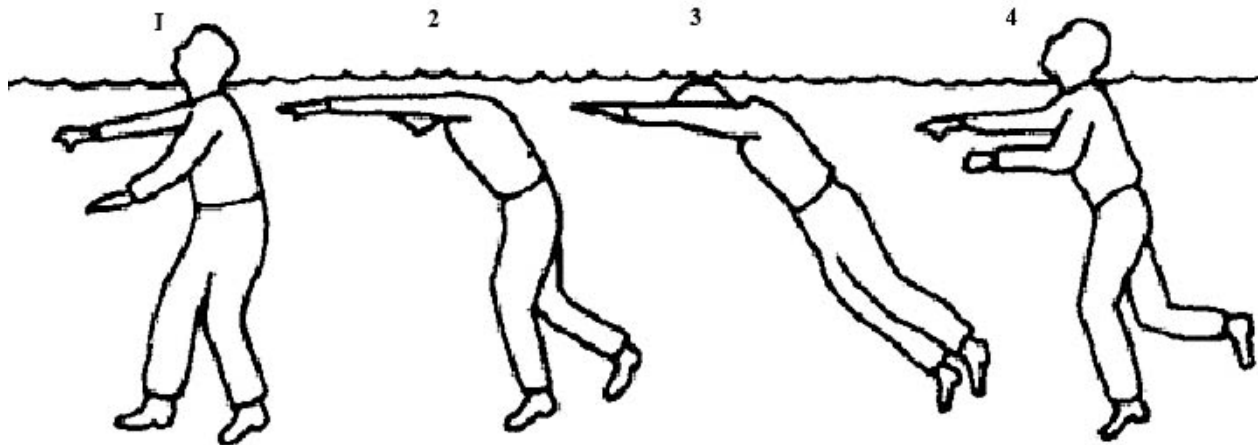
- Try to remain calm. Have someone spot the person in trouble or keep your eyes on the person. Give a clear explanation of your location and stay on the line with the dispatcher until you are told otherwise.
- Throw the rip current victim something that floats and yell instructions on how to escape by having the victim swim out of the rip current, in a direction following the shoreline. When out of the current, direct them to swim toward shore.
- Only professionally trained rescuers should attempt in-water rescues.

## Treading Water

Treading water is a simple way to keep your head above the water while you stay afloat. When you know how to tread water, you can stay in the same place and use only a little energy. Your head stays above the water, so you can see all around you and can do these things if you need to: signal for help by moving your arm back and forth over your head; watch for help; and take off your clothes and shoes if they are weighing you down.

## The Survival Float

Learning to float with very little effort will help you stay alive in the water for a long time in an emergency. To do the survival float:



1. Float upright in the water and take a deep breath.
2. Lower your face into the water (keeping your mouth closed) and bring your arms forward to rest at water level.
3. Relax in this position until you need more air.
4. Using motion from your arms and legs raise your head above the surface, treading water, and exhale. Take another breath and return to the relaxed position.

## **Cramps**

Cramps are painful tightening of muscles. If you swim too soon after eating, you can get stomach cramps. If you swim too long, you can get cramps in your arms or legs because they are tired. With either type of cramps, the pain and tightness will make swimming very hard. If you get cramps:

- Relax as much as you can.
- Call for someone to help you.
- Change your swimming stroke or float to rest the arm or leg with the cramp.
- Stretch and rub the cramped muscle to relax the tightness.

## **Ocean Safety**

- Learn to swim before you go to the ocean—5,000 people drown every year.
- Show fins are easily pulled off in the surf—use only strap type fins.
- Non-swimmers should not use floats.
- Be aware of drop-offs in bays and lakes.
- Do not run in the water. Shuffle your feet when you walk to scare away stingrays. If you do step on a stingray, soak your foot in hot water until the pain is gone, then have the wound cleaned by a doctor to prevent infection.
- Jellyfish in Southern California usually cause only a slight rash with very mild pain that quickly goes away.

## **Inshore Holes and Cusps**

Large winter storms erode the beach and move a lot of sand off shore. The small, even waves of spring and summer create sand bars that slowly move toward the beach. Eventually these sand bars reach shore and their sand is added to the beach. They may add up to 50 feet of sand to a heavily eroded shore line.

This process is not uniform and usually results in uneven bottom contours. The deep areas between the sandbar and shore are called “inshore holes.” They can be long trenches, a series of small depressions, or just a large hole 100 feet or more across with a rip current flowing out of it.

Holes are easy to spot because they do not have waves breaking in on them, and therefore do not have much foam on the surface. When a broken wave moves over a hole it turns back into a swell that will break again when it gets past the hole.

When the beach is building, it will have cusps, which are wide scallops in the shore line. They are usually more than 100 feet across. If you see cusps you know there are holes. Holes are usually easy to swim across, but sometimes the long shore current flowing down the beach will place you in a rip current. You have to swim parallel to shore with the long shore current until you are out of the rip.

Holes are very dangerous for non-swimmers, because they can suddenly find themselves in water over their heads.

### **Undertow**

After waves come onto shore, they cause a current when they return to the ocean. This current is called undertow, because it happens under the next wave coming to shore, and it can have a very strong pull. Most beaches where undertows are common have signs that read, “Unsafe Swimming—Dangerous Undertow.”

Higher waves cause stronger undertows. You should watch the waves so that you are not caught off guard. If you are knocked off your feet by a wave, you could be caught by an undertow.

If you are caught, do not fight the undertow. Let the current carry you away from the beach. It will not carry you very far. When it weakens, do not try to swim back the same way. Swimming against the undertow is very hard—like trying to swim up a river. Instead, swim up or down the beach a little way, until you can swim back into shore.

### **Rip Currents: Rivers in the Sea**

Rip currents are powerful, channeled currents of water flowing away from shore. They typically extend from the shoreline, through the surf zone, and past the line of breaking waves. Rip currents can occur at any beach with breaking waves.

As waves travel from deep to shallow water, they eventually break near the shoreline. When waves break they generate currents that flow in both the offshore (away from the coast) and the alongshore directions. Currents flowing away from the beach are called rip currents.

Rip currents can be found on many surf beaches every day. Under most tide and sea conditions the speeds are relatively slow. However, under certain wave, tide and beach profile conditions the speeds can quickly increase to become dangerous to anyone entering the surf. The strength and speed of a rip current will likely increase as wave height and wave period increase. They are most likely to be dangerous during high surf conditions.

Rip currents most typically form at low spots or breaks in sandbars, and also near structures such as groins, jetties and piers. Rip currents can be very narrow or extend in widths to hundreds of yards. The seaward pull of rip currents varies: sometimes the rip current ends just beyond the line of breaking waves, but sometimes rip currents continue to push hundreds of yards offshore.

Look for any of these clues to identify rip currents:

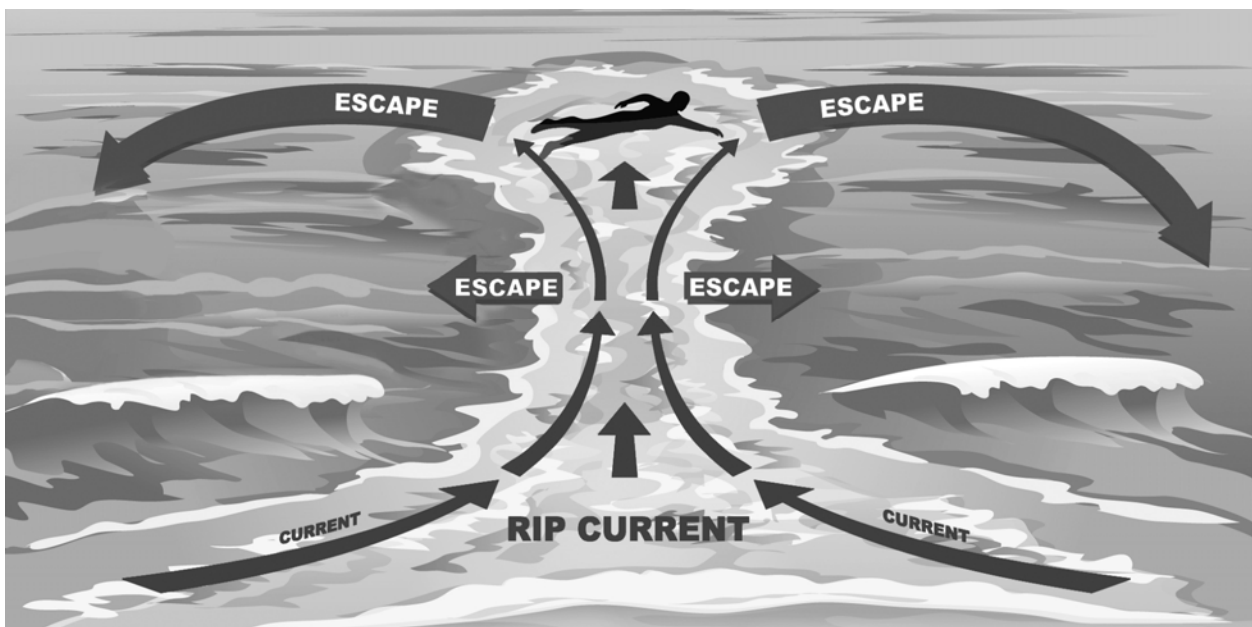
- a channel of churning, choppy water

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- an area having a notable difference in water color
- a line of foam, seaweed, or debris moving steadily seaward
- a break in the incoming wave pattern

None, one, or more of the above clues may indicate the presence of rip currents. Rip currents are often not readily or easily identifiable to the average beachgoer. For your safety, be aware of this major surf zone hazard. Polarized sunglasses make it easier to see the rip current clues provided above.

If you are caught in the seaward rush of a rip current, do not panic or attempt to swim directly to the shore against the strong current. Swim parallel to the shore until you are out of the rip current, then swim to shore angling away from the rip current.



*Illustration courtesy of U.S. Lifeguard Association and National Oceanic and Atmospheric Administration Weather Service*

Even if you are unable to do this, the current usually dissipates just beyond the surf line. At this point, you may swim around the current and back to shore. Remember to swim at an angle away from the area to keep from getting caught up in the rip current again.

- Never swim alone.
- Be cautious at all times, especially when swimming at unguarded beaches. If in doubt, don't go out!
- Whenever possible, swim at a lifeguard-protected beach.
- Obey all instructions and orders from lifeguards.
- If caught in a rip current, remain calm to conserve energy and think clearly.
- Don't fight the current. Swim out of the current in a direction following the shoreline. When out of the current, swim toward shore.

- If you are unable to swim out of the rip current, float or calmly tread water. When out of the current, swim toward shore.
- If you are still unable to reach shore, draw attention to yourself: face the shore, wave your arms, and yell for help.

If you see someone in trouble, get help from a lifeguard. If a lifeguard is not available, have someone call 9-1-1. Throw the rip current victim something that floats and yell instructions on how to escape. Do not go in the water after the person, unless you are a trained lifeguard. Remember, many people drown while trying to save someone else from a rip current.<sup>3</sup>

## **Ocean Waves**

Ocean waves are formed primarily when the wind blows over the surface of the water. The strength of the wind and the distance that the wind blows over open water is called fetch. Waves can be divided into several parts:

- The crest is the highest point on a wave.
- The trough, or the valley between two waves, is the lowest point.
- Wavelength is the horizontal distance between the crests or troughs of two consecutive waves.
- Wave height is the vertical distance between a wave's crest and trough.
- Wave period measures the size of the wave in time. A wave period can be measured by picking a stationary point and counting the seconds it takes for two consecutive crests or troughs to pass it.

Waves breaking on the beach can be categorized into three basic types:

- **Surging Breakers:** These waves happen on beaches where the slope of the beach is very steep. The wave is very powerful and dangerous as it suddenly rolls up onto the steep beach.
- **Plunging Breakers:** This type of wave will curl over and form a “tube” until the wave collapses. Expert surfers love to ride these waves, which can be found on beaches where the slope of the beach is moderately steep.
- **Spilling Breakers:** Usually found on beaches with a gradual slope. These waves gently roll, or spill, as they break over the front of the wave.
- **Rogue Wave:** A common name given to a wave that is larger than the average wave height that has been observed. These can be unpredictable waves, which may occur even on days when most of the surf looks small and unspectacular. These large waves have been the cause of many drownings over the years and can catch those close to the shoreline by surprise, washing them into the cold, turbulent water. Most victims were climbing on rocks and cliffs, playing near or in the surf, or shore fishing.

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<sup>3</sup> This information on water safety is provided by the United States Lifesaving Association and NOAA Weather Service.

## **Boating Safety**

Tragically, every year there are boating related fatalities in California's state parks. Most boating-related fatalities can be prevented by taking a boating safety course, following simple safety precautions, and ensuring that everyone aboard has a suitable and well-fitting lifejacket.

- Carry life preservers—all vessels must carry at least one proper-fitting U.S. Coast Guard approved personal flotation device for each person on board. State law requires children under age 12 to wear a life jacket at all times while the vessel is underway. All boaters should wear a life jacket when on the water.
- Check your safety equipment. Do you have a fire extinguisher? Anchor? Signal devices? Radio/cell phone? Life jackets? Know **BEFORE** you GO!
- Don't drink alcohol and operate a boat. Alcohol and water recreation don't mix. It is against the law and dangerous to operate a boat while intoxicated.
- Inhaling carbon monoxide can be deadly. State law prohibits the dangerous practice of teak surfing. Exposure to carbon monoxide from boat exhaust can cause unconsciousness and lead to drowning.

*For more information on safe boating, visit the Department of Boating and Waterways website at: [www.dbw.ca.gov/Education.asp](http://www.dbw.ca.gov/Education.asp).*



## **River Safety**

The clear rushing appeal of rivers and streams entices many into the swift-running waters flowing through many of California's state parks. Whether recreating from shore or floating the rapids, visitors in these areas need to take safety precautions while on the river.

- Know the flow!—High flows on the rivers can be dangerous and may fluctuate daily. Do not overestimate your skill or underestimate the power of the river. Knowing what the flow is on the day of your trip is one way to determine if the river is boatable for your level of paddling experience.
- Wear it!—Always wear a properly fitted personal flotation device (PFD) at all times when you are in or near the river.
- Survival in cold water—Although it may be hot on shore, the shock from cold water in the river can deplete the strength of even the strongest swimmer and hypothermia can lead to unconsciousness. Wearing a PFD will help keep you afloat.

## Wild Animal Safety

### Mountain Lions

There's been very little research on how to avoid mountain lion attacks. But actual mountain lion attacks are being analyzed in the hope that some crucial questions can be answered: Did the victim do something to inadvertently provoke an attack? What should a person who is approached by a mountain lion do—or not do? The following suggestions are based on studies of mountain lion behavior and analysis of attacks by mountain lions, tigers and leopards.



- When you walk or hike in mountain lion country, go in groups and make plenty of noise to reduce your chances of surprising a lion. A sturdy walking stick is a good idea; it can be used to ward off a lion. Make sure children are close to you and within your sight at all times. Talk with children about lions and teach them what to do if they meet one.
- Do not approach a mountain lion, especially one that is feeding or with kittens. Most lions avoid a confrontation. Give them a way to escape.
- Stay calm when you come upon a lion. Talk calmly yet firmly to it. Move slowly.
- Stop. Back away slowly only if you can do so safely. Running may stimulate a lion's instinct to chase and attack. Face the lion and stand upright.
- Do all you can to appear larger. Raise your arms. Open your jacket if you're wearing one.
- Do not crouch down or bend over. While a person standing up may not seem the right shape for a lion's prey, a person squatting or bending over resembles a four-legged prey animal.
- If the lion behaves aggressively, throw stones, branches, or whatever you can get your hands on without crouching down or turning your back. Wave your arms slowly and speak firmly. What you want to do is convince the lion you are not prey and that you may in fact be a danger to it.



- Fight back if a lion attacks you. Lions have been driven away by prey that fights back. People have fought back with rocks, sticks, caps or jackets, garden tools, and their bare hands successfully. Remain standing or try to get back up.

## **Bears**

Bears are wild animals and can be dangerous and unpredictable. They normally don't attack or threaten people unless they are provoked, but our food attracts their interest.

Bears are active at all hours—day and night. Property damage related to bears and improper food storage occurs every year. Bears recognize food and food containers by sight and smell (including ice chests, grocery sacks, cardboard boxes, canned goods, freeze-dried foods, and garbage). Bears also consider odorous products to be food. Store food securely in your car trunk, cover all food containers with a blanket and roll up windows. Use food lockers when available. Store toothpaste, insect repellent, suntan lotion, etc. as if it were food. Dispose of all refuse. Do not leave refuse in an unattended campsite.

Bears are territorial about food. If food is in your possession and you see a bear, you can scare him away by shouting, banging pots and pans, or throwing bark, sticks or small rocks at his body. But once a bear gets the food, he considers it his and you will not be able to scare him anymore. Never try to take food away from a bear. Respect the bears' wildness and keep a safe distance. Don't tease or crowd the bear. Avoid getting between a bear and her cubs. Bears are clever and resourceful. Acknowledge their intelligence and act "smarter than the average bear."

### **Tips for Bear-Safe Campsites**

- Wash all dishes and utensils after use.
- Never leave food or containers (drinks, ice chests, etc.) unattended on the table.
- Store all food in airtight containers, or wrap it well.
- If you don't have a trunk, cover ice chests and food with a blanket so they are not visible from outside the vehicle.
- Store toothpaste, suntan lotion, and other cosmetics as though they were food.
- Make sure all car windows are rolled up tight and doors are locked.
- If you don't have a car, hang your food from a tree, 15 feet above the ground and 10 feet from the trunk, on/from a branch that won't hold a bear.
- Deposit all garbage in the nearest dumpster.



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- Do not store food in tents or wooden lockers.
- Remember, bears have a sense of smell hundreds of times more acute than that of humans. Bears are especially attracted to sugar and fat, and they know how and where we like to store our food.

## **Suggested Resources: Safety and Survival/Crime Prevention**

Department of Boating and Waterways. [www.dbw.ca.gov/Education.asp](http://www.dbw.ca.gov/Education.asp).

Department of Homeland Security. U.S. Fire Administration. [www.usfa.fema.gov](http://www.usfa.fema.gov).

National Crime Prevention Council. [www.ncpc.org](http://www.ncpc.org).

United States Lifesaving Association. [www.usla.org](http://www.usla.org).

**INSERT *WATER* TAB HERE**



# Water



*“All the rivers run into the sea; yet the sea is not full; unto the place from whence the rivers come, thither they return again.”*  
—Ecclesiastes 1:7

## Introduction

Junior Rangers may be surprised to learn how much water our bodies and our planet contain. The survival of human beings, animals, and plants depends on having an adequate supply of clean water.

Although 75 percent of the earth is covered with water, 97 percent of that water is found in the oceans and is too salty for us to use. Of the three percent that is fresh water, only one-third is accessible. Junior Rangers often don't realize that the supply of water—especially in California—is limited. One of the goals of this section is to teach Junior Rangers how important it is that we conserve water and keep our waters from becoming polluted.

The sample program covers the many ways we use water, the water cycle, the importance of water, pollution issues, and conservation. Depending on the location of your park, you may also want to discuss specifics of water safety, wetlands, oceans, or other relevant topics.

## Interesting Water Facts

- Water makes up 75 percent of our bodies.
- We could live two months without food, but only a week without water.
- Water is the only mineral that can be found in all three states (solid, liquid, gas) on earth.
- A leaky faucet may drip enough water in one day to fill six bathtubs.

- In a normal year, about 247 cubic kilometers of snow and rain fall on our state. This is enough to cover all of California with about 23.6 inches (60 centimeters) of water.
- Due to global warming the sea level along California's coast has risen four to eight inches over the past century. It is likely to rise an additional 13 to 19 inches by 2100.

## Sample Programs: Water

### Water

#### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

#### II. Focus

Did you know that if you were to look at Earth from way up in space you wouldn't be able to see people, cars, or even buildings, but you would see water? That's because 75 percent of the earth's surface is covered with water. Earth's great oceans are one of the features that distinguish Earth from any other planet in the solar system.

#### III. Objectives

By the end of this program, you will have learned how the water cycle works and why we must make sure that we have enough clean water.

#### IV. Inquiry/Discussion

##### A. Water and People

1. How much of your body is made up of water?  
75 percent
2. Have you used water today? If so, how?  
Washed hair, brushed teeth, drank a glass of water, etc.
3. Go to a water source in your park, or a water treatment plant.
4. Can you think of some other things we use water for besides drinking and washing?
  - a. Food: Water is in everything that we eat, and to grow our food requires a lot of water.
  - b. Transportation: Boats have always been used for transporting people and goods over water.
  - c. Energy: We can use water held behind dams and water in steam generators to produce electricity (hydroelectric power).
  - d. Recreation: At beaches, lakes, and rivers we relax, enjoy fishing, swimming, water skiing, boating, and other fun water activities.

## *Junior Ranger Program Handbook: Water*

5. If you have old flumes, wells, or ditches in your park, talk about the historic uses of water.

### B. The Forms of Water

1. Water comes in three different forms, depending on its temperature. Do you know what they are?  
Solid (ice), liquid (tap water), and gas (steam or vapor).
2. Water also appears in nature in many different forms. Can you name some of them?  
Oceans, rivers, snow, glaciers, icicles, clouds, fog, rain, lakes, puddles, ponds, etc.

### C. The Water Cycle

1. Have any of you ever drunk recycled water?
  - a. Pass out copies of the water cycle illustration.
  - b. You all have! Nature recycles water by itself. Here's how: when rain falls, it runs down mountains in rivers and streams and it collects in lakes and oceans. The sun makes the water evaporate from the lakes and oceans. When water evaporates, it turns into an invisible gas or vapor, like the steam from your tea kettle when it's hot. This water vapor rises and cools, and the moisture in the air groups together in water droplets to form clouds. When the clouds get very heavy with water, it begins to rain or snow. Then the water cycle starts all over again! That's how nature recycles water.

## V. Application

### A. Acid Rain and Other Pollutants

1. Looking at your rain cycle diagram, what do you think happens when the sky is filled with pollution? What would happen when it rains?  
The rain pulls the pollution down with it.
2. When the rain brings down pollution, it's called acid rain. What do you think happens to lakes and streams when acid rain falls?  
The water becomes contaminated.
3. What do you think happens to the animals who live in or drink from these contaminated lakes and streams, and to trees that soak up acid rain?  
They get sick, and sometimes die.
4. Besides acid rain, can you think of anything else that might make water polluted?  
Many possible answers: people putting waste into the water, chemicals or oil dumped into the water, etc.
5. Why is it important that we keep people from polluting the water?  
Because people, plants and animals all need clean water to live.
6. Should you drink water from a stream or lake when you're on a hike or nature walk?  
No! Water could have chemicals, bacteria, or other pollutants in it that will make you very sick. Bring plenty of water along when you go on a hike.

## *Junior Ranger Program Handbook: Water*

### B. Conservation

1. How many of you have heard that California doesn't have enough water?
2. If 75 percent of the earth is covered with water, then why doesn't California have enough?

Most of the world's water is salt water. It is expensive to take the salt out of it.

3. What is a drought?

When we don't get as much rain as usual.

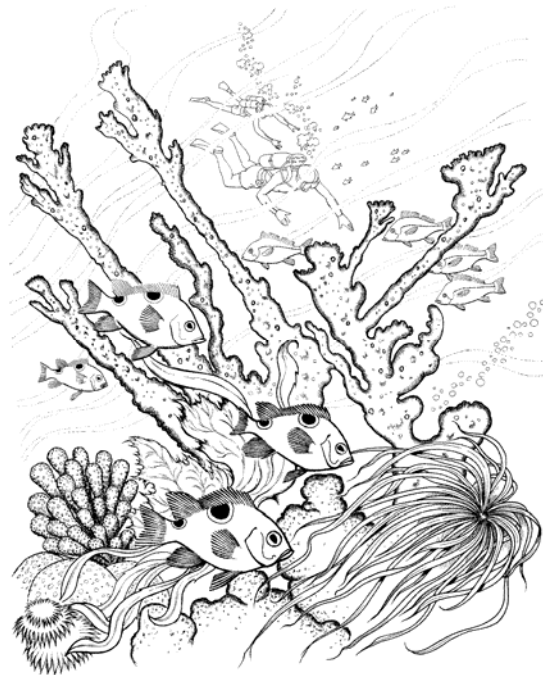
4. When we have a drought, we all need to use less water so that we won't run out and there will be enough for everybody. The more people we have in California, the less water there is to go around. There are now about 35 million<sup>1</sup> people in California who need water. Do you have any ideas about how we can save water so everyone will have enough?

Many possible answers, including:

- a. Turn off the faucet while you're brushing your teeth, soaping up in the shower, or doing dishes.
- b. Water the lawn at night when there is less evaporation.
- c. Have your family install low flush toilets and low flow shower heads, and fix leaky faucets.

### VI. Conclusion

- A. Announce the next Junior Ranger program and other interpretive programs.
- B. Stamp logbooks.



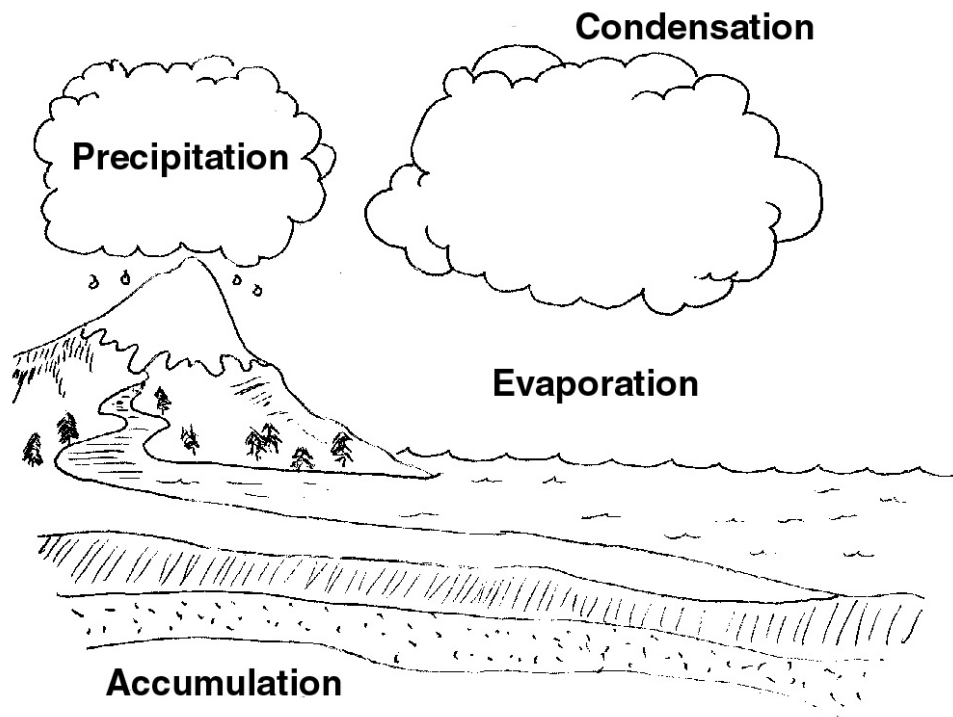
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<sup>1</sup> Approximate population of California, 2004.



## The Water Cycle

This program was developed by Stephanie Price, who suggests that the most important concept to convey with the Water section may be the water cycle and how our actions can affect it. Many children do not realize that their litter can travel through storm drains or channels into the ocean. For example, a sea turtle might think a plastic bag or balloon is a jellyfish and eat it. The turtle would later develop a blockage in its digestive tract . . . not to mention the problems caused by toxins, paper, etc! The water program can be very broad, encompassing ponds, creeks, and the ocean. Here is Stephanie's outline of how she would organize a water program:



- I. Introduce the water cycle  
(Hand out copies of the water cycle diagram).
  - A. Precipitation
  - B. Evaporation
  - C. Water vapor
  - D. Snow/rain
  
- II. Get specific with the park you are in
  - A. Water source or creek
  - B. Where does the water flow?  
To an ocean, river, basin, etc.
  - C. Who are the people or animals that use the area?

### III. Activities

- A. Before the program starts, set up one (or more if you have a large group) transect area along a creek bed or beach. Have the children walk along the ten foot transect and see how many signs of animals they can find (bugs, prints, scat).
- B. If possible, make plaster of paris prints of animal tracks found at the water's edge—deer, raccoon, etc. (This is a hit with kids). We used tin rings 1" high and 5" across (you can also use tin cans with no bottom, or square sections cut from milk cartons). Mix plaster with water in a cup with a coffee stick. Place the ring around a well-defined print and pour the plaster in. The plaster takes 30 to 45 minutes to harden.
- C. Other Activities (see activity section below)
  1. A pond park could use the "Plant Succession Crawl" activity.
  2. The "Penny Hike" activity can be adapted for a creek/beach.
  3. "Fishstick" activity is great for the ocean.

### IV. Conclusion

- A. How can we protect the plants and animals in the park?
- B. How can we protect their water supply while in the park?
- C. At home?

## Activities

### Plant Succession Crawl<sup>2</sup>

Number of Children: One or more

Environment: Pond edge

Equipment Needed: Pencils and paper

Purpose of Activity: To observe plant succession

Activity:

1. Plant succession is the process by which plant composition in an area gradually changes, allowing new species of plants to come in and eventually establish themselves, replacing species that were better suited to the earlier conditions. Available light, soil and water conditions, plant competition, fire, etc. all play a role in the transition of the progressive species.
2. A very good place for observing plant succession is the area close around a pond, especially if there is a gentle slope running up away from the water. As you move farther away from the pond, the soil becomes drier and its composition changes. You will be able to observe several plant types in successive rings around the pond.
3. To see the actual process of plant succession, you would have to watch the changes in and around a pond over a period of many years. This is because

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<sup>2</sup> From *Sharing Nature With Children*, by Joseph Cornell. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998.

plant succession is the result of plants dying and slowly building up and drying out the soil (this is also the result of sedimentation). When the soil becomes drier, the plants that like wet soil are easily forced out by their dry-soil competitors. Over a long period a pond will actually shrink and disappear as the soil level builds up higher and higher in and around it. The rings of plant life move gradually closer to the center of the pond as the wet area becomes smaller. You can see this process of plant migration happening by careful observation at any one of its points; it is rather like looking at one frame of a movie film.

4. Have the children crawl from the outside rings toward the edge of the water. By crawling and closely examining the ground, they will get a feeling for the different types of plants in the rings. Ask the children to share their discoveries as they find them. One discovery might be coming across a new ring with its special kinds of trees, shrubs, plants, and grasses, or wetter and stronger-smelling soil. When they reach the water, have each child draw a map of the pond and its surrounding area, with the successive circles of plant life. Label each ring from wettest to driest, and list the plants that grow there. Ask the children to imagine how big the pond will be in fifty or a hundred years.



### **Penny Hike: An ant's eye view of the world<sup>3</sup>**

Number of Children: Two or more

Environment: The shore of a river, pond, or ocean

Equipment Needed: Container (such as a film canister) filled with enough pennies to accommodate your group, 3-D bug boxes, and a hand lens

Purpose of Activity: To encourage the close observation of the mini-world living around a body of water

Activity:

#### A. Variation 1:

1. "O.K., gang, get down on your hands and knees here in a circle. Pretend you are rabbits . . . your head is six inches off the ground. Look for the smallest plant you can see. What signs are there of other animals having been here? Now sit up on your hind legs and hold your head high . . . sniff the air . . . can you see any enemies?"
2. "This time get down low and pretend you are an ant. Get really close to the ground. How far can an ant see? Do ants need to see the way we do? What can you find in this area that ants might hide behind? Be afraid of? Eat?"

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<sup>3</sup> From *Manure, Meadows, and Milkshakes* by Eric Jorgensen, Trout Black, and Mary Hallesy. 2nd. Ed. Los Altos, CA: The Trust for Hidden Villa, 1986.

3. "O.K., now for the next 5 minutes each of you become an ant or rabbit. Take this penny. See how many treasures you can find to place on your penny. When your penny is full, return to the circle."
- B. Variation 2:
1. As your group is walking along, casually take out your penny container. Shake it once or twice. "What have you got in your hand?" inquires a curious child. "Oh, just a dime," I reply. "There is more than one dime in there!" exclaims the child. "No, just one dime," I calmly reply. By then all the children have circled around and are paying close attention. "Want to see?" I inquire. I open the canister handing one penny to each child until I count ten. "See, one dime."
  2. With interest aroused, I quickly transfer to the next step. "Want to go on a penny hike?" Again curiosity appears on faces as they try to discern what I've got in mind. To replies of "Ya," "O.K.," and "Sure," I explain that each child is to take a penny and find tiny treasures—plant, animal, rock, fungi, and so forth—to carry on a penny. (Caution, do not pick live plants.)
  3. After the hike, we share our finds. After the initial sharing, try the following:
    - a. Create a miniature food chain (pebble, soil, lichen, scat).
    - b. Build a sculpture or miniature garden.
    - c. Use bug boxes for a mini hunt. Be sure to let your captives return home.
  4. Remember, the sharing is only secondary to the seeking, observing, and exploring. Get down on your belly and perceive a new world.

## Schooling Fish<sup>4</sup>

Number of Children: Eight or more

Environment: An open space

Equipment Needed: One 24-inch stick or dowel per student; copies of lanternfish pattern (both sides); cardboard for mounting fish patterns; black indelible marker, scotch tape, glue

Purpose of Activity: By acting as a school of lanternfish, students learn how bioluminescence and schooling behavior help fish survive

Background: Each species of deep sea lanternfish shines with a unique pattern of body lights. Without its lights, a black lanternfish would be hard to see in the darkness of the deep sea. The bioluminescent spots help fish find mates and lure prey. You can discuss lanternfish adaptations with students throughout the activity.

Activity:

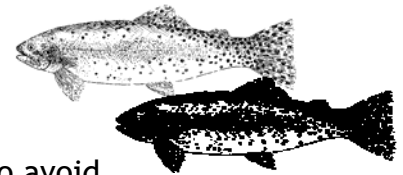
1. Before the program: make a copy of lanternfish pattern in Appendix B (both sides) for each student. For BIG impact, enlarge the fish to double size on an enlarging copy machine. Mount a fish half on both sides of a piece of cardboard to form a sturdy lanternfish.



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<sup>4</sup> From *The Ocean Book*, by the Center for Environmental Education. New York: Dodd, Mead, 1988.

2. Group the paper fish into schools (four or five per school). To give each school a unique pattern of lights, use the marker to darken specific spots on each fish in that school. (The light patterns on both sides of a fish should match. Each school has a different pattern, but fish in the same school have the same pattern). Attach the fish to sticks.
3. Mix up the fishsticks. Give a fishstick to each student. Ask students to guess where lanternfish live. Why are they called lanternfish? Explain that each species of lanternfish has a unique pattern of body lights. Each student holds a fishstick high and looks for other fish with the same light pattern. Look-alikes unite to form a school. Have each school of student-fish list ideas about how bioluminescence helps lanternfish survive.
4. Schooling for survival: Let each school of fish swim a simple course, following these rules:
  - a. The fish swim close together, but without touching.
  - b. All fish in a school maintain the same speed and direction.
  - c. The front fish of the school determines the direction and speed for all.
  - d. Each time the school turns, the front fish becomes the new leader.
  - e. A school that is forced to divide must reunite as soon as possible.
5. How did students feel about being part of a school? Was it easy to move as a group? What cues did they use to stay together? Would it be harder to school in the dark? How does schooling help fish? To show how fish school to survive, you can have many species unite to form a huge school, using the same rules. Have the school swim a fixed course while you play the predator. Attack the school, but only capture those fish who leave the ranks. The school may change direction to avoid you, but it must stick to the course (no running). If a fish turns or changes speed to avoid a predator, the rest of the school must follow. A fish who's caught becomes a predator and may help attack the school. The game ends when the school reaches the end of the course. Was it different being in a large school? Is it better to be at the outer edge or in the middle of the school? If predators joined in a school, would they feed more effectively?



## **Water Density<sup>5</sup>**

Number of Children: One or more

Environment: Any

Equipment Needed: Four glasses (at least 8 inches tall), table salt, three colors of food coloring (red, blue, and yellow), clear plastic drinking straws, measuring spoons

Purpose of Activity: To understand one practical implication of varying water density is that water forms into layers with the most dense water in the bottom layer

Preparation: Mix four solutions of water and table salt, each containing 1/2 gallon of tap water and an amount of salt as follows:

Solution 1: no salt, yellow food color

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<sup>5</sup> From *Water Inspectors*, published by California Aquatic Science Education Consortium, Graduate School of Education, University of California, Santa Barbara, CA 93106.

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Solution 2: 1 tablespoon salt, green food color

Solution 3: 2 tablespoons salt, red food color

Solution 4: 4 tablespoons salt, blue food color

### Activity:

(Either perform the following demonstration yourself or ask a Junior Ranger to do it.)

1. Holding a finger over the top of a drinking straw, insert it into the blue glass so that the bottom of the straw reaches half way to the bottom of the glass. Remove your finger from the top of the straw, allowing air to escape and blue water to flow into the straw. Replace your finger and remove the straw from the water. Blue water will stay in the bottom half of the straw.
2. Using the half-filled straw, repeat the above procedure with the yellow water. Gently remove the straw from the yellow water and hold it so all can observe. Ask the group to describe what they see. (They should notice that, after a while the blue water “moves down” and mixes with the yellow, forming a green mixture).
3. Repeat the above procedure, this time sampling the yellow water first, then the green, then the red, then the blue. Again ask members to describe what they see. (The colors will remain un-mixed, with the yellow on the top, blue on the bottom).
4. Ask for guesses why they mixed one time and not the other. As a hint, ask one person to taste the blue and yellow waters by dipping a fingertip into each and touching it to his or her tongue. (They should note that the blue is salty and the yellow is not.)
5. Explain that the only difference between the different colors is that they contain different levels of salt. The presence of salt, a dissolved mineral, in the water makes the water more dense and denser water is “heavier” and settles toward the bottom, underneath the less dense “lighter” water.

### **High Tide, Low Tide<sup>6</sup>**

Number of Children: Two or more

Environment: Open space

Equipment Needed: Line markers

Purpose of Activity: To understand the effect of the moon on high tide and low tide

#### Activity:

This is a variation of the Red Light, Green Light game. Mark two lines about 100 feet apart. Appoint one person as the moon. This person stands on one line, while the rest of the group lines up on the other. When the moon turns her back and shouts “High Tide,” everybody runs toward the moon. When the moon turns around and says “Low Tide,” everyone must freeze. Those that move when they are supposed to be frozen must go back to the starting point. This continues until one person crosses the line. That person then becomes the moon.

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<sup>6</sup> From *The Ocean Book: Aquarium and Seaside Activities*, by the Center for Environmental Education. New York: Dodd, Mead, 1988.

## Background Information: Water

### California's Water

As a rule, California gets a lot of snow in the mountains during wintertime. When warmer spring weather comes, the snow melts, supplying us with much of the water we need during the hot, dry summer months. In a normal year, about 247 cubic kilometers of snow and rain fall on our state. This is enough to cover all of California with about 23.6 inches (60 centimeters) of water. About two-thirds of this water is used by trees and other plants, soaks into the ground, or evaporates. Only about one-third of all our water runs off into rivers and streams in an average year. Most of the water we do keep winds up in California's natural storage system of lakes, rivers, and streams, or goes into our people-made systems of dams, reservoirs, and aqueducts.

Most of California's streams, rivers, and lakes are in the north. This is because about 75 percent of the water from rain and snow runs off northern mountains. Nearly half of California's water flows into the great Central Valley, mainly through the Sacramento and San Joaquin rivers. Once there were vast lakes and swampy areas in many parts of the Central Valley, but now most have been drained and made into farmlands.

At the point where the rivers join to meet the salt waters of San Francisco Bay, we have what is called the Delta. Years ago, the rivers washed rich soil into the Delta, making islands that are good for farming today. Now the water flows by these islands, through sloughs and channels, on to San Francisco Bay and the ocean.

Most of the rest of California's water—about 40 percent—goes into the North Coast basin, which stretches along the Pacific Ocean from Oregon to San Francisco. The Eel, Trinity, and Klamath rivers are in this basin—they carry over one-fourth of California's water runoff.

Another important part of our natural water supply is groundwater (water which has seeped into the ground). Groundwater collects in underground areas of rocks and sand known as aquifers. Aquifers hold huge amounts of water like giant sponges. About 40 percent of the water we use comes from wells.

Although we rely on rain and snow to keep these surface and groundwater systems flowing, nature needs some help to get all the water from up north to all the people who live down south. Furthermore, while most of the rain falls in the winter and early spring, farmers need water most in the summer.

In order to solve the problem, people have built large systems that store water from the winter and move it to areas of need for use in the drier times of the year. Nearly 200 years ago, the Spanish missionaries dug canals that carried water from streams to nearby fields. In Pueblo de Los Angeles (1770s) the Zanja Madre, or Mother Ditch,

brought water from the Los Angeles River to residences. In the early 1900s, California's big cities had to do the same thing. People needed more water than they had, so they began building water systems to get it.

Los Angeles was first, building a 250-mile (402-kilometer) canal to bring water from the Owens Valley and the southern Sierra. At about the same time, Southern California farmers built canals from the Colorado River to the rich farmlands of the Imperial and Coachella valleys.

Then, in the late 1920s and 1930s, San Francisco and Oakland outgrew their local water supplies. The Hetch Hetchy Reservoir was built to bring water to these growing areas from the western slopes of the Sierra.

By the early 1940s, the Metropolitan Water District of Southern California built a 242-mile (389-kilometer) canal from the Colorado River to the many people of the southland. But even with all these efforts, there was not enough water where it was needed, so the state and federal governments built the two biggest systems of all.

The reservoirs and canals of the state's California Water Project and the federal government's Central Valley Project were built to store water from Northern California rivers. The water is transported southward through the California Aqueduct, the largest people-made water transport system in the nation. These reservoirs do more than store water. Many have power plants that use the force of the flowing water to turn electrical generators. This gives us a clean, cheap source of electricity.

Our people-made systems cannot make water—they can only store and move it. Even with all the reservoirs and pipelines to take care of California's water needs, there is still only so much water to go around. During dry years, when only a little rain and snow fall, some reservoirs may not fill up and water could run short.

We should make good use of water today, so that we'll have enough to go around for a long time to come.<sup>7</sup>

## **Wetland Destruction**

Wetlands are wet environments, including bogs, ponds, marshes, and swamps. Although we may not be aware of it, America's wetlands contribute significantly to our daily well-being. Wetlands are vital ecological resources that nurture fish and wildlife, help purify polluted waters, and protect us against the destructive forces of floods, storms, and erosion. Wetlands provide us with a variety of recreational activities such as hiking, canoeing, hunting, fishing, bird watching, photography, and environmental education. Until recently, wetlands were thought to have little

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<sup>7</sup> Information on California's water is from "The California Water Works and Why It Does." Pamphlet published by the California Department of Water Resources.



economic value. As a result, researchers estimate that more than half of the original 215 million acres of American wetlands have been destroyed since the first settlers arrived. About 90 percent of all original wetlands on the California coast have been drained or filled. Consequently, wetland wildlife populations are at an all-time low.

## **Water Density**

Samples of water may contain different amounts of dissolved minerals. The more dissolved minerals in a sample of water, the higher the density of the water. A practical effect of differing water density is that bodies of water (a lake, pond, or the ocean) will contain different layers of water. Unless unusual conditions exist, the most dense water will be layered on the bottom, and the least dense on the top.

When fresh water flows from a stream into the ocean, the water does not mix equally but is layered, fresh water on top, salty underneath. Animals and plants, which prefer a certain level of salinity, will seek to travel in the layer most comfortable for them. Fishermen who know this are always the most successful because they know how deep or shallow to fish. Scientists who try to encourage the growth of a particular fish population must not depend simply on measurements of salinity at the surface; they must sample at various depths to verify that water of proper salinity exists in some layer in the body of water.

## **Home Pollutants**

We tend to think of water pollution as being caused by industrial waste or sewage treatment plants. Indeed, this is often true, but individuals dumping pollutants around the home and garden contribute greatly to water pollution. Many items around the home can injure the environment if not disposed of properly, e.g. motor oil, paint, cleaning fluids, fertilizers, pet droppings, etc.

This type of pollution from residential areas is called nonpoint source pollution, which means the problem is coming from many sources in tiny amounts and cannot be traced back to one main source. Nonpoint source pollution occurs when rainfall moves over and through the ground. It picks up and carries natural and human-made pollutants, depositing them into lakes, rivers, coastal waters and even our underground sources of drinking water. Any pollutant that leaves our home can travel a long way through our water system. Storm drains, for example, are not connected to the sewer system, but instead drain directly into waterways. Anything toxic that is dumped into a gutter or a storm drain can eventually pollute a stream, river, estuary, bay, or the ocean.

When we think of pollutants we automatically assume it means fertilizers, insecticides, household cleaners, paint, oil and other chemicals we use in our houses, yards and vehicles. However, things such as loose grass clippings and leaves, soil from erosion, and pet droppings are also classified as nonpoint source pollutants.

Soil, grass clippings and leaves in runoff carry contaminants that can smother and kill aquatic life. Fertilizers, car exhaust and detergents cause explosive plant and algae growth, which depletes the water of oxygen, killing fish and animals. Pet droppings and septic tank overflows can cause diseases like dysentery, hepatitis and parasite infections by getting into drinking water and recreation areas. Oil, paint, cleaning materials and other toxic chemicals contaminate drinking water and kill fish, other animals, and plants.

Controlling and preventing nonpoint source pollution is everyone's responsibility. There are many things we can personally do to help reduce nonpoint source pollution, including:

- Plant grass, trees and shrubs in bare areas to reduce erosion and water runoff.
- Properly dispose of motor oil and household chemicals.
- Use fertilizers and pesticides sparingly on lawns and gardens, or substitute them with natural products like compost or ladybugs.
- Put trash in its place.
- Organize neighborhood cleanups.
- Recycle plastic, glass and paper.
- Pick up and properly dispose of pet droppings.
- Keep roadways, street gutters and walkways swept and clear of soil, grass and debris.

## **Drinking Water Safety**

A human being cannot live for more than a few days without water. Our bodies are 75 percent water, and water is needed for every bodily function. In a survival situation, then, finding water, and making sure it is safe to drink, comes near the top of the priority list.

Not all water is safe to drink—never take a chance. The risk of poisoning, parasitic infection, etc. is too great. There are many signs to look for when determining whether a water source is safe to drink. The water should be clear and free of coloration or oil slicks on the surface. Fast-flowing water at high elevations and away from human habitation is usually safest, but don't forget to purify for Giardia. Giardia is a protozoan parasite that can be present in park waters. When ingested, it often causes intestinal problems such as vomiting, diarrhea, and cramps—symptoms that may persist for months.

If you're investigating a small, self-contained water source, make sure it is free of algae and animals. In the case of a large, free-flowing water source, look for a healthy assortment of plants growing in and around the water, as well as signs of fish, frogs, or invertebrate life.

There is no positive proof of drinkability, so only if you are desperate and your survival absolutely depends on finding water should you drink from a questionable

water source. Filter and boil the water before drinking it. A piece of cloth will filter water nicely, but will not filter out Giardia cysts. Boil water for 20 minutes to purify it, either by heating it in a container over a fire or by dropping heated rocks into a container. This will kill all the bacteria, but you can't be sure of chemical pollutants, so pick your source carefully.

## **Finding the Water**

Water flows downhill—find where it collects. Survey the landscape to find where you might discover the troughs, ravines, and depressions that will help the water move downward. Or follow animal tracks, or watch an animal to find where it gets its water. When drinking from a stream, be sure to boil or filter the water first.

Another way to get water is to dig a hole and wait for water to seep into it (it may take awhile). Gather the liquid with a piece of cloth or dried grasses. You may want to dig several holes. Then filter and purify the water.

A solar still is one of the best ways to get drinking water where it is scarce. You have to carry the things you'll need with you, though. You need a six-by-six sheet of clear plastic, six feet of surgical tubing, and a container to catch the water. Dig a hole four feet across and three feet deep. Place a container in the hole. Lay the tube in place so that one end is in the bottom of the container and the other end runs up and out the side of the pit. Cover the hole with the plastic sheet, securing the edges of the material with dirt and weighting the center of the sheet with a rock. The plastic should now form a cone. The low point of the cone must be directly over the container and no more than three inches above it. You can put crushed, edible, herbaceous plants such as cactus in the hole to increase the still's output. You can also get water directly from these plants. Collecting dew is one of the safest drinking sources—use a rag or safe grasses to do it.

If you're in a situation in which water is scarce, follow the following guidelines:

- Don't eat anything if you don't have water to drink with it.
- Travel slowly, during the coolest hours.
- Don't expose your skin to the hot sun if you can help it.
- Drink as much and as often as possible.
- At high altitudes, or in cold or wet weather, force yourself to drink. You may become dehydrated without feeling it.

## **Suggested Resources: Water**

Braun, Ernest and David Cavagnaro. *Living Water*. Palo Alto, CA: American West Publishing Company, 1971. The authors follow a typical Sierra stream along its course from timberline to the sea, freely digressing into storms and snowbanks, soil and seeds.

## *Junior Ranger Program Handbook: Water*

Brickson, Betty, J. K. Hartshorn, and Elizabeth McCarthy. *Layperson's Guide to California Water*. Sacramento, CA: Water Education Foundation, 2000. Combining historical and current information, this booklet gives a brief overview of the development and allocation of water resources in California.

Center for Environmental Education. *The Ocean Book: Aquarium and Seaside Activities and Ideas for All Ages*. New York: Dodd, Mead, 1988.

Pielou, E. C. *Fresh Water*. Chicago: University of Chicago Press, 1998. This source provides useful insights into the remarkable ways of water, such as the behavior of currents in a stream, the movement of pollutants through an aquifer, or the differences between a reservoir and a natural lake.

Reisner, Marc. *Cadillac Desert: the American West and Its Disappearing Water*. New York: Viking Penguin Inc., 1986. The author weaves history, biography, engineering, politics and economics into a fascinating story—a story of the quest to control and allocate the West's precious supply of water.

*Project WET Curriculum and Activity Guide*. Bozeman, MT: Project WET, 1995. Project WET (“Water Education for Teachers”) is a water education program designed to promote awareness, appreciation, knowledge, and stewardship of water resources. This guide is only available through training workshops.

*The No Waste Anthology: A Teacher's Guide to Environmental Activities K-12*. Sacramento: Department of Toxic Substances Control, 2003.

*WOW!: The Wonder of Wetlands*. St. Michaels, MD: Environmental Concern Inc./Bozeman, MT: The watercourse, 1995. Exploring the potential of wetlands as an educational tool, this guidebook combines useful background material with more than forty wetland-related activities for kindergarten-through-twelfth-grade youths. [www.wetland.org/wowteacher.html](http://www.wetland.org/wowteacher.html).

### **Other Sources of Information**

California Coastal Commission. “Public Education Program.” Offers a variety of conservation, education and community involvement programs. [www.coastal.ca.gov/publiced/pendx.html](http://www.coastal.ca.gov/publiced/pendx.html).

Department of Conservation. “Kids & Educators.” This website is full of fun facts and interesting information that students and teachers can use for school projects and learning. [www.consrv.ca.gov/index/qh\\_kidsEducators.htm](http://www.consrv.ca.gov/index/qh_kidsEducators.htm).

Department of Water Resources. A good source of information on a variety of water-related topics. [www.water.ca.gov](http://www.water.ca.gov).

*Junior Ranger Program Handbook: Water*

National Oceanic and Atmospheric Administration, National Ocean Service. "NOS Education Discovery Kits: Nonpoint Source Pollution."  
[www.oceanservice.noaa.gov/education/kits/pollution/03pointsource.html](http://www.oceanservice.noaa.gov/education/kits/pollution/03pointsource.html).

U.S. Environmental Protection Agency. "Educational Resources."  
[www.epa.gov/epahome/educational.htm](http://www.epa.gov/epahome/educational.htm).

U.S. Environmental Protection Agency. "Polluted Runoff (Nonpoint Source Pollution)." [www.epa.gov/owow/nps/qa.html](http://www.epa.gov/owow/nps/qa.html).

Watersheds.org. "Polluted Runoff, Nonpoint Source Pollution: What Can You Do."  
[www.watersheds.org/earth/nps2.htm](http://www.watersheds.org/earth/nps2.htm)

Water Education Foundation. An informative and educational website from the creators of Project WET. [www.water-ed.org](http://www.water-ed.org).

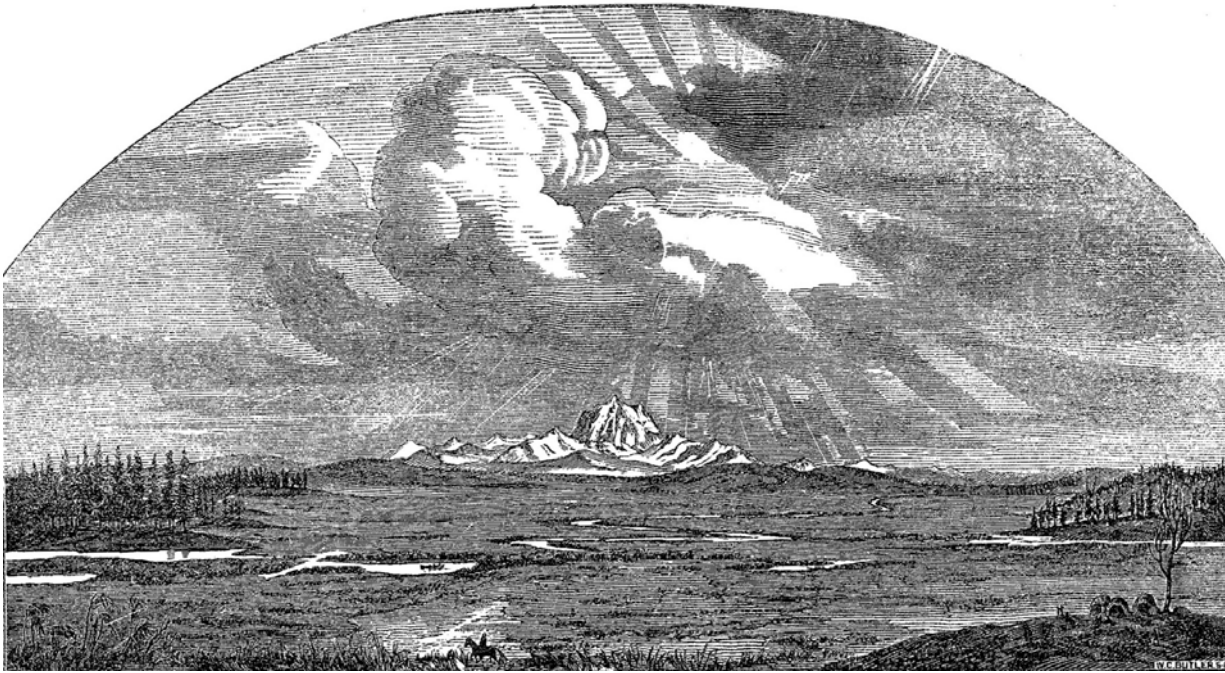


**INSERT *WEATHER* TAB HERE**





# Weather and Climate



*“A sky without clouds is a meadow without flowers, a sea without sails.”*  
—Henry David Thoreau

## Introduction

We talk about the weather every day. “How about this weather?” “Hot enough for you?” “Can you believe this rain?” We listen to weather forecasts to determine what we will and won’t wear and do. Hurricanes, tornadoes, blizzards, droughts, and floods can wreak havoc on our lives and environment. No wonder we’re so interested in the weather!

But what causes the weather? Why does it rain, and what is fog? What happens when people get too hot or too cold? These are questions you can answer in a weather and climate program. Most children don’t realize that we affect the weather. In the conclusion of your program, you can show how deforestation, global warming, and the thinning ozone layer affect the weather around the world, while focusing on what we can do to keep the weather systems intact.

## Interesting Weather Facts

- Insects fly low to the ground before a rainstorm because their wings are heavier than normal with dampness from increased humidity.
- The reason it smells different right before a rainstorm is because there is less air pressure around us. It presses less heavily on the ground. Smells have a chance to rise higher. What you smell is grass, flowers, and decaying vegetation.
- Spiders live on the snow and ice of Mount Everest, the highest mountain in the world. They were blown there by the wind. What do they eat? Live insects also blown there!
- An average thundercloud holds about six trillion raindrops.
- Mighty winds pick up dusty soil from the Sahara Desert in Africa and blow it all the way across the Atlantic Ocean. The soil drops as far away as Florida, the Caribbean, and the Amazon rainforest, and may help fertilize the soil there!
- There are approximately 2000 thunderstorms raging around the world every second of the day.
- In 1937, a tornado lifted a train engine, turned it around, and set it back down on nearby tracks, facing in the other direction!
- Swirling winds can pick up animals and drop them far from home. Cities in California have been showered with crabs, shrimp, and salamanders!
- Racetrack Playa is a place in California where the racing contestants are rocks! Wind makes rocks slide along the smooth surface of a desert “dry lake” bed when the ground is wet or frozen!



## Sample Program: Weather and Climate

### I. Introduction

Introduce yourself to the group.  
Introduce the Junior Ranger Program.

### II. Focus

Ask the Junior Rangers to look at what they are wearing and what the other kids are wearing. Why did they choose to wear that outfit today? (Keep asking for responses until someone says, “because of the weather.”)

### III. Objectives

Today we are going to discuss weather. Weather includes everything from a breeze to a tornado, from a raindrop to a thunderstorm. By the end of this program, you will have learned just how much everything on earth is affected by the weather, and how some kinds of weather phenomena occur.

### IV. Inquiry/Discussion

A. Weather and Safety

## *Junior Ranger Program Handbook: Weather and Climate*

1. We have to pay attention to weather. If animals, including humans, get too cold or too hot, they can get very sick and some can even die.
2. What is it called when people become too cold, either from being exposed to cold water or weather for long periods of time or from not wearing appropriate clothing in cold or windy weather?  
Hypothermia (hypo = low, thermia = temperature)
3. How does your body try to keep itself from getting too cold?  
Your muscles move to create heat (shivering).
4. If people exercise too much or hike without drinking enough water they can overheat and get heat exhaustion, heat cramps, or heat stroke. What is this condition called?  
Hyperthermia (hyper = high, thermia = temperature).
5. How does your body try to keep cool?  
You perspire (sweat).
6. Let's say you look out in the morning before your hike, and it is sunny and warm, but the weatherman says it is going to rain. What should you do?
  - a. Bring several layers of clothing (T-shirt, sweatshirt, windbreaker.)  
Bring a hat, sunscreen, and plenty of water to drink. If it stays warm, you can tie the extra clothing around your waist. If it rains, you will still be comfortable and warm.
7. How do most animals keep cool?
  - a. They pant, shed their coats, reduce their activity, or hide in the shade/shelter.

### B. Nature's Temperature Regulation

As sunlight is not distributed evenly on the earth, the temperature in other places may not be the same as it is here right now. Differences in pressure and temperature cause air masses to circulate.

1. What is this movement of air called?  
Wind
2. Do you feel air moving right now?
3. Where is the air going?
4. How fast is it moving?
5. Have the children close their eyes and "feel" the wind. Have them listen to the grass or trees to find out where the wind is coming from.
6. Compare their "gut" responses to real observations based on the "Determination of Wind Speed" chart in Appendix B.

### C. Clouds

1. Name some types of weather that you can see.  
Sunshine, wind (blowing things), clouds, fog, snow, rain, sleet, hail
2. Are there any clouds in the sky?
3. What are clouds made of?  
Clusters of minute droplets of water or ice crystals
4. Form a circle with the children lying on their backs, heads to the center (without heads touching).
5. What types of clouds are there today?
6. Clouds are forms of condensation. How does condensation occur?

7. If all clouds contain water, why don't all clouds rain?  
(Have the group sit back up, but remain in the circle)
  8. What is a type of cloud with its base at or near the ground?  
Fog  
Fog and clouds are made of the same stuff—fog is just closer to the ground.
- D. Lightning
1. The shock you get on a rainy day when you touch a metal object is very close to what lightning is—only at a different intensity.
  2. Can you remember what type of cloud would create a thunderstorm?  
Cumulonimbus
  3. Let's make our own thunderstorm!  
Activity: The Rain Circle Game (see activity section below)
- E. Climate
1. What is climate?  
Generalized weather patterns
  2. Name a place that has a dry climate.  
Africa, Australia, the desert, Texas, New Mexico
  3. Name a place that has a wet climate.  
Hawaii, tropical rainforest
  4. Within the overall climate there are also smaller climates.  
Activity: The 100-Inch Microclimate (see activity section below)
- V. Application/Conclusion
- A. Discuss the importance of weather in our lives.  
Droughts, floods, etc.
  - B. Do people affect the weather?  
Yes: deforestation, greenhouse effect, ozone depletion (see Ecology Information.)
  - C. What can we do about it?
  - D. Announce time and topic of the next Junior Ranger program.
  - E. Stamp logbooks.

## Activities

### The 100-Inch Microclimate

Number of Children: One or more

Environment: Large natural area

Equipment needed: None

Purpose of Activity: To understand the variety of climates and which animals and plants are adapted for climate

Activity:

## *Junior Ranger Program Handbook: Weather and Climate*

1. Give each student approximately 100 square inches of area to investigate. Try to give each person a different climate (e.g. in the moist shade, by a stream, under a tree, on the trail, etc.).
2. Have the Junior Rangers sit for a minute and feel the way the sun hits them. Is there wind? Is it warm or cool? Have them look for plants and animals. What do they look like? Do the plants look like they want more or less sun (look at leaf structure). Have the children touch the soil. Is it moist? Is the soil warm or cool? Then gather in a circle and discuss the climate types you all have found.

*Adapted from "Tom Thumb's Jungle." Green Box. Office of Environmental Education, Humboldt County Schools, Eureka, CA.*

### **Rain Circle**

Number of Children: Three or more

Environment: Anywhere

Equipment needed: None

Purpose of Activity: To investigate the sounds of a rainstorm

Activity:

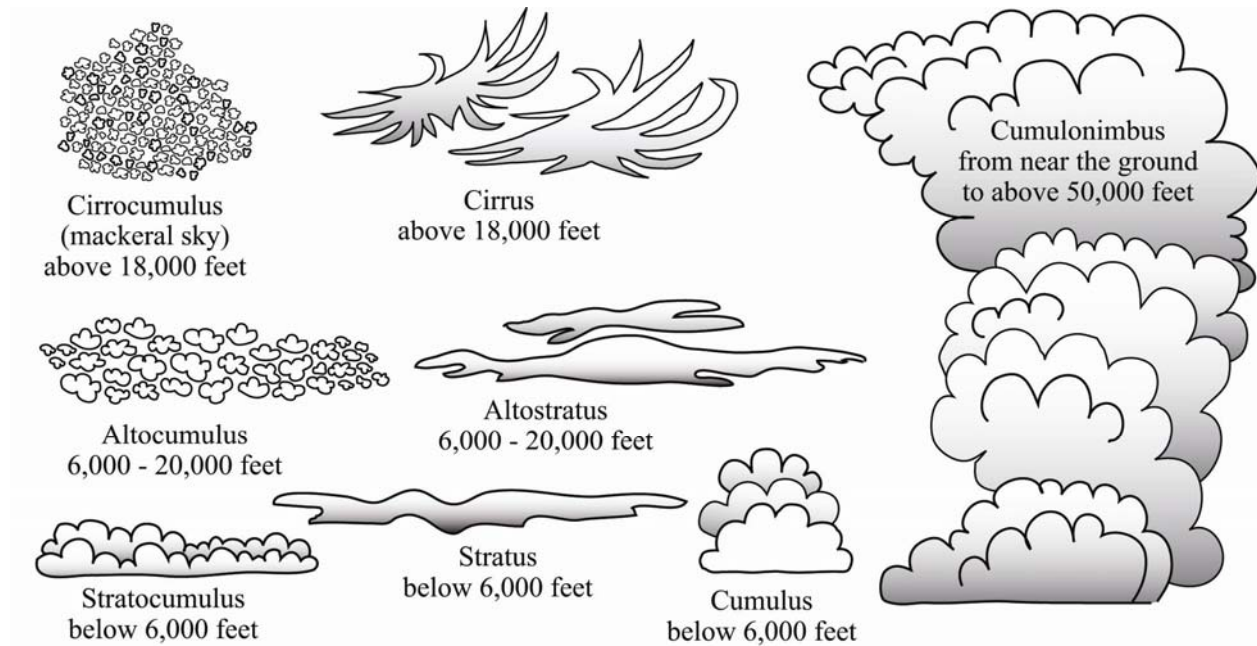
1. While the children are sitting in a circle facing the center, ask them to close their eyes, pausing for a moment or two of quiet while each child gets ready to repeat the sound the person on his or her right will be making.
2. With all eyes closed, the leader begins the rainstorm by rubbing her palms together, back and forth. The person to her left joins in and then the person to his left, and then the next person, and so on around the circle until everyone is rubbing palms and can hear the drizzling rain building in intensity.
3. When the leader hears the drizzle sound being made by the person on her right, she starts snapping her fingers. One by one around the circle, finger snapping replaces palm rubbing and the sprinkling rain turns into a steady patter. When the snapping action has been picked up by everyone, the leader switches to hand clapping, and all follow in turn. A hard rain is falling now.
4. The storm builds into a downpour as the leader begins slapping her thighs. Then the skies open and thunder crashes as the next round has everyone stomping their feet.
5. And then the storm subsides, just as it grew - foot stomping, thigh slapping, hand clapping, finger snapping, and back to palm rubbing. (If someone is having trouble hearing the changes, his neighbor can alert him with a gentle nudge each time he switches from one action to the next.)
6. For the last round, the leader stops rubbing her palms and takes the hand of the person on her left, as each person does in turn around the circle until there's silence once again. When everyone opens his eyes, perhaps the sun will have appeared.

*From The New Games Book. New Games Foundation. The Headlands press Inc., 1976.*

## Background Information: Weather and Climate

### Clouds

Clouds are forms of condensation best described as clusters of minute droplets of water or ice crystals. They are identified and grouped according to three basic classifications: their form and appearance, their composition, and their height above the surface.



Despite their seemingly endless shapes, clouds can come under two very broad classifications with regard to appearance or form. They are either stratus type (stratiform) or cumulus type (cumuliform). The stratus cloud is sheetlike, fibrous, layer-like. Think of the word “straight,” and visualize layers or sheets. Cumulus is a type of cloud that has piled up, or accumulated in appearance. It has a rolled, cottony, or cauliflower appearance.

There are three heights of clouds in the atmosphere: high, middle, and low. The high clouds include cirrus, cirrocumulus, and cirrostratus. Cirrus clouds are often isolated, detached, fibrous filaments of cloud. They are generally delicate, thin, and wispy in appearance, sometimes in feathery plume shapes or tufted streaks. They produce no precipitation.

Cirrocumulus clouds are usually arranged in small ripples, layers, patches, or tiny-appearing globular forms without shading. They produce no precipitation.

Cirrostratus clouds are veil-like, fibrous sheets of cloud, often with a shredded appearance. They usually cover large portions of the sky.

Middle clouds include altocumulus and altostratus. They are usually composed of water droplets, though sometimes upper portions contain ice crystals. Altocumulus clouds may appear as small, isolated, globular patches, parallel bands, or in flattened, slightly rolled masses. Altocumulus clouds sometimes produce light rain or snow. Altostratus clouds appear fibrous, and shredded. They are generally grey in color and can produce fairly steady light rain or snow.

The low clouds include nimbostratus, cumulus, stratocumulus, and stratus. Nimbostratus clouds are low, thick, dark grey masses of clouds, often threatening in appearance. Their bases are usually ragged and wet looking. This cloud produces steady rain or snow.

Stratus clouds often resemble a light fog lifted a few hundred feet off of the ground. Stratus clouds are not very thick and usually dissipate quickly under the sun's heat.

Cumulus clouds, also known as fair weather clouds, are usually flat on the bottom with rounded, cauliflower-like tops. These low puffy clouds are often seen in the late morning or early afternoon.

Cumulonimbus clouds are hugely developed vertically and have a dark, menacing appearance. They are often called thunderheads and generally produce heavy showers of rain and snow, sometimes hail, and frequent thunderstorm activity.

## **Condensation**

Warm air can hold more water than cold air. If air cools to a certain temperature (called the dew point), then water is forced out of the air. In order to condense, each water droplet needs a bit of dust, smoke, or salt to hold on to. It takes about one million of these droplets to form one raindrop. The little droplets stay in the air until enough of them clump together to form a raindrop.

There are two ways these rain droplets bind together:

1. If the cloud is below the freezing temperature, the droplets can freeze together until they are heavy enough to fall out of the cloud. On their way to the earth's surface, the ice may melt and become a raindrop; or,
2. Droplets in the cloud can bump into each other and combine. After they've bumped into enough other droplets to form a raindrop, they will fall from the cloud as rain.

## **Fog**

Fog is defined as a cloud with its base at or near the surface of the earth. Physically, there is no difference between a cloud and fog. Fog can be formed in several ways:

- Under clear skies, rapid cooling of the ground and air at night can cause water vapor to condense into fog. This is radiation, or tule (winter), fog. In the morning, when it gets warm enough to evaporate the water droplets, the fog disappears.
- When warm, moist air blows over a colder surface, it becomes chilled and the moisture/vapor in the air condenses. Moist marine air passing over cold coastal waters gives rise to the persistent fog bank found along the seashore in summer.
- Fog can also be formed when humid air rises up a gradually sloping hill or mountain.
- When cool air moves over warm water, enough water may evaporate from the water surface to produce saturation. As the rising water vapor meets the cold air, it immediately recondenses and rises with the air being warmed from below. Often it has a steaming appearance and is called steam fog. This type of fog is sometimes seen on lake surfaces on chilly mornings.

## **Lightning**

Lightning is caused by the attraction of unlike electrical charges within a thundercloud, or between the cloud and the earth. The earth normally has a negative charge (a surplus of electrons as compared to the atmosphere.) The lower part of the cloud has positive zones surrounded by negative zones. When electrical pressure becomes high enough, charges between parts of cloud or between cloud and Earth are released by lightning. Sixty-five percent of all discharges are within the cloud or between clouds. A single lightning discharge is incredibly powerful—up to 30 million volts. The sudden tremendous heat from lightning causes the compression or shock waves we call thunder.

### **Lightning Safety**

Lightning tends to hit the highest places. Never stand under a lone tree in an open field or fix your television antenna during a lightning storm. Stay away from boats and water during storms. You will always be safe inside your car or a steel-framed building. Airplanes have often been struck by lightning, but occupants are seldom harmed. If you are in a safe place, remain there for 30 minutes after the last observed thunder or lightning.



## Wind

Air flows from areas of high pressure to areas of low pressure. You have experienced this when you open a vacuum-packed can of coffee or tennis balls. The sucking sound you hear is caused by air rushing from the higher pressure outside to the lower pressure inside the can. So wind comes from pressure differences. The greater the pressure difference, the stronger the wind.

Our coastal winds are largely a result of the global circulation pattern (prevailing westerlies).

## Suggested Resources: Weather and Climate

Anderson, Bette R. *Weather in the West*. Palo Alto, CA: American West Publishing Co., 1975. This book explores Western American weather—its curious, distinctive aspects, its shaping of major climatic regimes, and its influence on human life and history.

Bailey, Harry P. *Weather of Southern California*. California Natural History Guides: 17. Berkeley: University of California Press, 1966. This little book does a nice job of introducing readers to the many fascinations of Southern California's climate.

Greenler, Robert. *Rainbows, Halos, and Glories*. Cambridge, NY: Cambridge University Press, 1980. This book explains the physical origins of the many optical effects found in the sky and advises how to look for them.

Keen, Richard A. *Skywatch West: The Complete Weather Guide*. Golden, CO: Fulcrum, Inc., 2004. This source covers much of the same material as Anderson's *Weather in the West* (cited above), but is more current.

Lehr, Paul E., R. Will Burnett, and Herbert S. Zim. *Weather*. New York: Golden Press, 1975. This pocket-sized "Golden Guide" provides a basic overview of meteorological science. Contains many colorful and useful illustrations.

Williams, Jack. *The Weather Book: an Easy-to-Understand Guide to the USA's Weather*. New York: Vintage Books, 1992. An outstanding introduction to meteorology, this book contains many colorful diagrams, maps, and other graphics.

## Other Sources of Information

National Oceanic and Atmospheric Administration. "National Weather Service." [www.nws.noaa.gov](http://www.nws.noaa.gov).

*Junior Ranger Program Handbook: Weather and Climate*

National Aeronautics and Space Administration. "Earth Observatory."  
[earthobservatory.nasa.gov](http://earthobservatory.nasa.gov).

**INSERT *DIRECTED ACTIVITIES* TAB HERE**



# Directed Activities for Junior Rangers



## Introduction

The directed activities included in this section were chosen for their usefulness in the Junior Ranger Program. They require little or no equipment and can be used alone or as part of the regular program presentation. By capturing some of the boundless energy of the children and channeling it toward the educational goal, you can help the children benefit even more from the program.

The activities have been arranged in the following categories: Activities to Start or End With, More than One Topic, California Indians, History, Safety/Survival, Ecology, Geology, Animals, and Plants. The section concludes with instructions for making the tools and equipment required for some of the activities and a list of further references.

## Sources for Activities

The number in front of each source corresponds to the number after the title of each activity. If a source number is not given for the activity, it was contributed by a Department employee. Activities compiled by Eileen Hook, supervised by Douglas R. Bryce.

### *Junior Ranger Program Handbook: Directed Activities*

1. *Cowstails and Cobras*. Karl Rohnke. Project Adventure, 775 Bay Road, Hamilton, Massachusetts, 91936. 1974.
2. *Environmental Concepts Through Questions*. Josh Barkin, Supervising Naturalist, East Bay Regional Park District, 1969.
3. "Games, Rattlesnakes, and Ice Cream." Workshop organized by Bob Flasher and Paul Ferreira. Sponsored by the Bay Area Chapter of the Western Interpreters Association. September 27, 1980: Alexander Lindsay Junior Museum, Walnut Creek, California.
4. *The Green Box*. Humboldt County Office of Education, Environmental Education Program. 901 Myrtle Avenue, Eureka, California, 95501.
5. *A Guide for Conducting Outdoor Field Experiences*. Cortland/Madison BOCES Outdoor Environmental Education Program. Bruce Matthews, Coordinator. New York: February 1978.
6. *Indoor-Outdoor Natural Learning Experiences—A Teacher's Guide*. Sacramento County Office of Education. 9738 Lincoln Village Drive, Sacramento, California 95827: 1978.
7. *My Backyard History Book*. David Weitzman. Boston: Little, Brown and Company, 1975.
8. *The New Games Book*. Andrew Fluegelman, editor. New Games Foundation, The Headlands Press, 1976.
9. *Outdoor Biology Instructional Strategies (OBIS)*. Lawrence Hall of Science, University of California, Berkeley, California 94720. Sets I, II, and III.
10. *Project Learning Tree, Grades K-6*. Western Regional Environmental Education Council and the American Forest Institute. 1619 Massachusetts Avenue NW, Washington, D.C. 20036, 1977.
11. *Sharing Nature With Children*. Joseph B. Cornell. Ananda Publications. 900 Alleghany Star Route, Nevada City, California 95959, 1979.
12. *Spaceship School*. Mollie Rights and Barbara Steinberg. Marin Museum of Natural Science. P.O. Box 957, San Rafael, California 94902, 1978.
13. *Teacher's Guide: The Coast Redwood and Its Ecology*. California Department of Parks and Recreation. P.O. Box 2390, Sacramento, California, 95811, 1974.

## Activities to Start or End With

### Becoming a Plant<sup>3</sup>

**Number of Children:** 1 or more

**Environment:** Outdoors, sunny area

**Equipment Needed:** None

**Purpose of Activity:** A start-up activity for a plant talk, and an exercise in frustration

**Activity:** After talking about the basic elements needed by plants to live (soil, water, air, and sunshine), form a circle and try this.

“Did everyone have something to drink today? Good.”

“Now plant your feet firmly in the ground, take a deep breath, and stretch your hands up toward the sunlight.”

“Do you feel full?”

“Shucks. We aren’t plants then.”

### Gift Box<sup>3</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To stimulate the imagination

**Activity:** (For younger groups, explain the activity first)

With the group seated in a circle, the leader walks in ceremoniously, carrying an imaginary box. He lifts the lid off and takes out an imaginary creature. Acting as if he is holding some small animal, he passes it to any person in the circle. That person reshapes the animal into any other animal and passes it to the next person. When it returns around the circle, put it back in the box and close the lid. Guess what each animal was.

## Sherlock Snout<sup>3</sup>

**Number of Children:** 1 or more

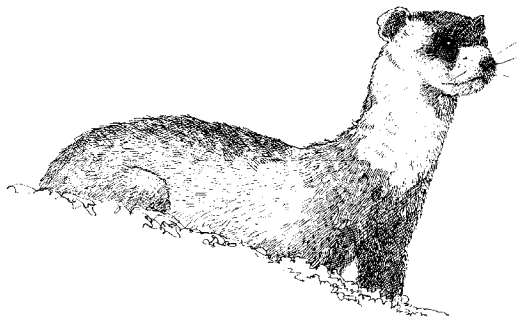
**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To use the sense of smell to locate objects

**Activity:** If you pick up a strong scent while outdoors, challenge the children to locate it using their noses and eyes. The smell of tobacco, flowers, dog scat, freshly cut lawn, skunk, etc., will do. This is a good game to play because it refocuses our attention to senses that are weaker than our eyes.

**Variation:** Bring along bags with different scents and pass them around for players to guess what they are.



## Silent Walk<sup>11</sup>

**Number of Children:** 1 or more

**Environment:** Any natural area

**Equipment Needed:** None

**Purpose of Activity:** To heighten awareness of the world around us

**Activity:** This is a good way to calm down after the more energetic games. Take a hike in total silence for 5-10 minutes. Suggest at the beginning that everyone pay attention to the sounds around them and to the feelings inside them. Sit in a circle in silence for several minutes at the end of the hike. Then share your experiences, feelings, and opinions.

Try to develop appreciation of the diverse experiences the group has had during this hike. (The Silent Walk is often used as a nighttime activity.) Make it a game by seeing who can count the most sounds.



## Hawk and Dove<sup>1</sup>

**Number of Children:** 3 or more

**Environment:** Open area

**Equipment Needed:** None

**Purpose of Activity:** To begin or end a bird walk

**Activity:** Place your hands and feet apart and chase one of your hands with the other (the hawk chasing the dove). Try to fly everywhere your body and arms can reach without moving your feet. After warming up individually, get into a group, form a V-shaped flying pattern of ducks or geese, and fly your hands south for the winter, quacking as you move forward in formation. This is a good activity to use after taking a group on a bird walk.



## Activities for More than One Topic

### Sound Orchestra <sup>3</sup>

**Number of Children:** 6 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To encourage the children to listen to and identify the sounds around them

**Activity:** Talk about the sounds heard in the park area; listen closely and see what can be heard at that time, and identify the things that make the sounds. Pick a particular situation or area (frog pond at sunset, rookery at mating time, forest at night, etc.) and assign each child the sound for a particular animal. One child is the conductor, and points to each person in turn, who continues to make their sound until directed to stop by the conductor. The conductor can motion for the sound to rise and fall, make one sound louder, etc. Have separate groups make up their own symphony and challenge the other groups to guess what they are.

**Variation:** Contrast the natural sounds with man-made sounds. After practicing a natural symphony, pick a man-made environment (kitchen, freeway, downtown area), and make the sounds heard there. Which does the group prefer?

### Role Playing <sup>11</sup>

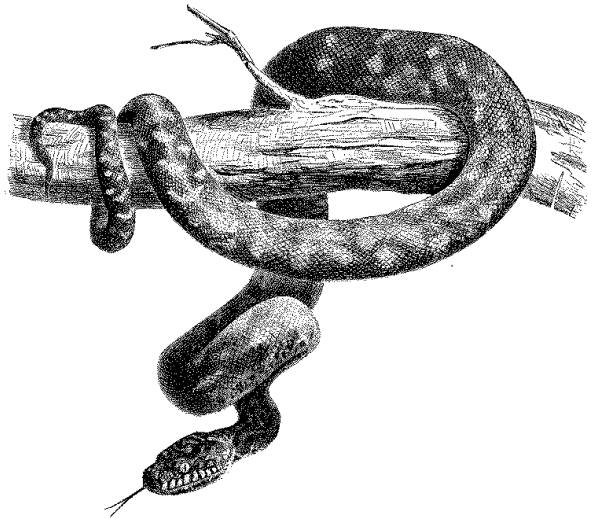
**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To increase observation of plant and animal behavior

**Activity:** Choose an animal, plant, tree, etc., and become it. React as it does to its surroundings. As a tree, how does a thunderstorm feel? How does a fox feel when it trails a mouse? Slither like a snake, be a seed growing into a tree, etc.



## Nature Near and Far <sup>5</sup>

**Number of Children:** 3 or more

**Environment:** Trail

**Equipment Needed:** List of objects on trail and corresponding scores (one copy for each participant), paper and pencil for leader

**Purpose of Activity:** To encourage the children to listen to and identify the sounds around them

**Activity:** List 20-30 items to be found on the trail. Give a score to each item (bird's nest=10 points, butterfly= 5 points, etc.). Give each child a copy of the list and explain its use. The first player to observe an item and report it to the leader gets the score. The total score at the end of the game determines the winner.

This is a good activity to use up excess energy before taking a more serious look at the environment.

## Microdiscovery <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Natural area

**Equipment Needed:** Paper or light cardboard

**Purpose of Activity:** To discover objects and living things close to the ground

**Activity:** Give everyone a piece of paper or cardboard, and have them roll it into a viewing tube. Find a place where everyone can crawl around a little. Using the viewing tubes to look through, have everyone crawl around and search for a micro-discovery, a scene or object that looks really neat to them and is very small. Mark the spots of the micro-discoveries.

Everyone chooses a partner and shows their discovery, trying to figure out what that is and how it relates to the environment.

Be prepared to help the children identify what they have discovered. A variation of this is "Tom Thumb's Jungle," on the next page.

## Tom Thumb's Jungle <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Natural area

**Equipment Needed:** Pieces of string 100 inches long, one for each child

**Purpose of Activity:** To observe the world around our feet

**Activity:** Go on a 100 inch hike. Cut a piece of string into 100 inch-long pieces. Have each child lay out the string in a straight line, or curve it. Follow the string, carefully observing everything along the path. Hunt for little creatures, feel the earth, find evidence of humans.

Discuss how these items are interrelated, and help the children identify their discoveries.

## Waste Not... <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Campground, near garbage cans

**Equipment Needed:** Trash, latex gloves, arts and crafts supplies

**Purpose of Activity:** To demonstrate that things that are thrown away can be used again, and to explain the value of recycling

**Activity:** Wearing latex gloves, go to a garbage can and fish out three items that have been thrown away. Invent something using the garbage and arts and crafts supplies. Discuss how items can be recycled and why it is important to do so. Explain some simple ways recycling can be done around the house—separating aluminum cans, saving newspapers and bottles, and finding a recycling center in your town.

## The Fallen Log <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Forested area

**Equipment Needed:** None

**Purpose of Activity:** To explain interdependence among living things

**Activity:** Locate a rotting log, and observe the plant growth on and around the log. Look for signs of animals in and around the log. Discuss how the log benefits the plants and animals of the surrounding community. Find an area without rotting logs; observe the ground, plants and animals. What differences are apparent between the two areas? Are there more animals in one area than another? Are the plants and animals gaining anything from the log?

## Did You Ever Eat a Pine Cone? <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explain the food chain in relation to the foods people eat, and to explain where the foods come from

**Activity:** Make a list of foods people eat, with the children's help. Explain how these foods are linked to plants, and how they became human food. Relate this to how animals are linked to plants by what they eat, and by what eats them. Is there any food you can think of that is *not* linked to a plant?



## California Indians

### The Native Way: A Natural Lifestyle <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To relate the lives of California Indians to those of children today

**Activity:** Give a brief description of the lives of California Indians in your area, then discuss the children's current lifestyles and correlations with the lives of California Indian children in the area in the past. Have the children imagine how they would live and learn if they were a California Indian 250 or more years ago. What food would they eat, and how would they gather it? What kind of transportation would they use?

**Variation:** This cultural comparison can easily lead to a discussion of "needs" versus "wants." Example: What kinds of communication did the native people use? (Is an I-Pod a "need" or a "want"?)

### Woven History <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Natural area

**Equipment Needed:** Baskets indigenous to the park area

**Purpose of Activity:** To explain how California Indians used the environment

**Activity:** Using baskets indigenous to the area, talk about the plants used to make the baskets. Identify any of these plants growing in your park, and discuss why these plants were used instead of others. Talk about the uses for each basket, and why they were constructed in that manner. Compare these containers to other containers used for the same purposes today. How are they similar?

If possible, have a partially completed "twined" basket ready. Allow the children to try their hand at twining.

**Variation:** Show pictures of California Indian dwellings from your area, and explain the plant materials used. Identify any of these plants growing in your park, and talk about why they were used instead of others.

## Grass or Hand Game <sup>10</sup>

**Number of Children:** Groups of 2-4

**Environment:** Any

**Equipment Needed:** 2 sticks or bones—one marked in some way, one unmarked—for each turn (Several pairs of sticks can be used for scorekeeping)

**Purpose of Activity:** To demonstrate one of the games played by Indians in many parts of California

**Activity:** A player takes two sticks or bones, one marked, and shifts them from hand to hand, hiding them behind his back. The opponent tries to guess which hand the marked stick is in. If the opponent is wrong, he must give the winner a stick from his pile of counters. After he misses, the other player may guess until he loses. The game continues until an agreed number of sticks is won.

California Indians played many other games, according to the tribe they belonged to. These games are still popular among native groups. Reference works on Native Californians in your area may give information on the games played by those people.

## Clothing <sup>10</sup>

**Number of Children:** 3 or more

**Environment:** Any

**Equipment Needed:** Examples or pictures of California Indian clothing indigenous to the area, samples of the materials used to make the clothing (optional)

**Purpose of Activity:** To draw a correlation between the traditional clothing worn by Native Californians and that used by people today

**Activity:** Compare today's clothing with the traditional clothing of California Indians. Where did each type come from? How was it made? How was it decorated? In the past, different areas required more or less clothing, depending on the climate. Is this true today? Draw correlations between the different items of clothing worn by Indians in the past and those worn today. How are they similar? Do they serve the same purpose? Are they made the same way?

## California Indian Supermarket

**Number of Children:** 10 or more

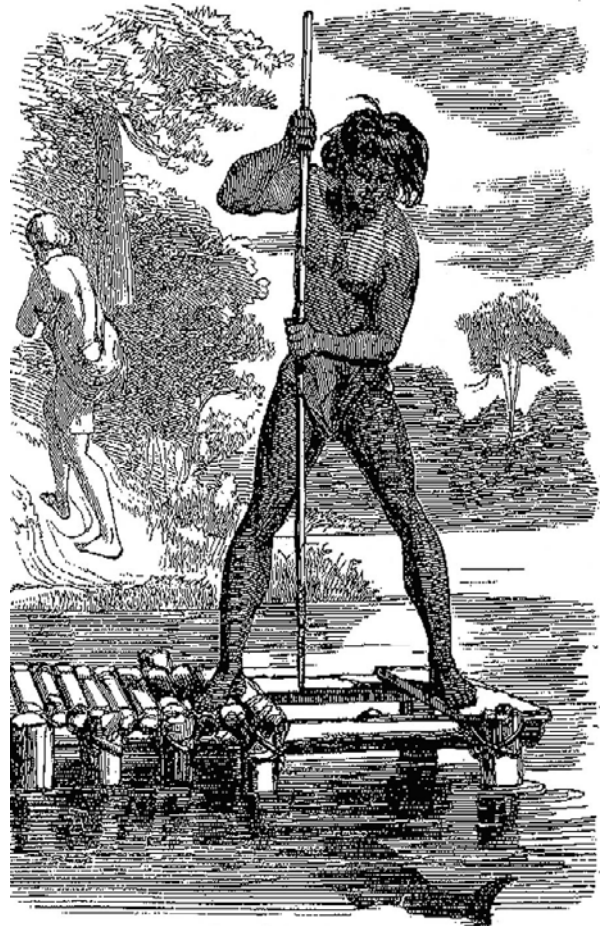
**Environment:** Trail

**Equipment Needed:** None

**Purpose of Activity:** To explain the ways in which native people lived off the land, using many of the plants as food, medicine, and basketry sources

**Activity:** Take the group for a nature walk in a California Indian's "supermarket." Explain the uses of the plants on the trail.

**Reference:** *Early Uses of California Plants*, Edward K. Balls, University of California Press, 1982.





## History

### Rubbings <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Historic area with plaques, tombstones, or other metal or stone markers

**Equipment Needed:** Lightweight paper, charcoal pencils or dark crayons, masking tape

**Purpose of Activity:** To encourage children to take a closer look at the signs, plaques, and other objects that tell the history of the area

**Activity:** Fasten paper over surface and rub firmly with crayon or charcoal until a picture appears. Using the pictures made by the children, discuss the history of the area and how it relates to these signs or markers.

### Did You Notice? <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** Old photographs of the park area

**Purpose of Activity:** To explain the history of a park unit and some of the changes that happen to places through time

**Activity:** Using old photographs, show how the area looked in the past. Ask the children to talk about what has been changed, and the reasons. Which changes are beneficial and which are detrimental? Has opinion changed as to whether the changes are good or bad ones? *Note: Enlarge the photographs as much as possible to make them easier to see. Lamination allows them to be used for other programs.*

## Teach a Historic Skill

**Number of Children:** 4 or more

**Environment:** Any

**Equipment Needed:** Equipment needed for the skill chosen

**Purpose of Activity:** To demonstrate a skill that early Californian settlers used in order to live here

**Activity:** Some skills to teach: candle making, gold panning, splitting shakes, making a corn husk doll, weaving, basket weaving, etc. Some of the older residents in your area may know how to do these crafts, and can help you get started. Reference books are available at your local library to explain many of the crafts. As safety permits, allow hands-on participation for the children in the activity.

## If I Were Going to Cross the Plains...

**Number of Children:** 3 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To demonstrate the self-sufficiency the early settlers needed to reach California

**Activity:** Using the old "If I were going on a trip" game, adapt it to crossing the plains in the 1840-1850 era. In a wagon traveling from St. Joseph, Missouri to California, what kind of things would you need to survive while crossing the plains?

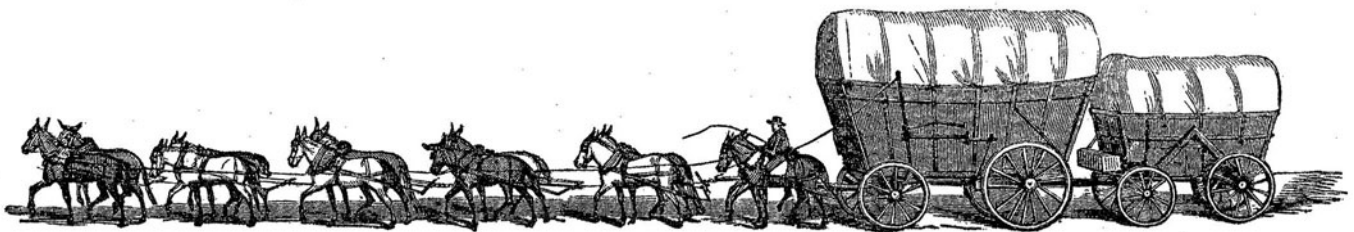
### **Examples:**

If I were going to cross the plains, I would take a barrel of water.

If I were going to cross the plains, I would take a barrel of water and a bedroll.

If I were going to cross the plains, I would take a barrel of water, a bedroll, and a fishing pole.

Etc.



## Hanging Around Old Town <sup>7</sup>

**Number of Children:** 3 or more

**Environment:** A historic area with buildings to be viewed by the children

**Equipment Needed:** None

**Purpose of Activity:** To show the various ways the date of a structure can be determined

**Activity:** Take the group on a tour of the historic area. While walking, tell the children to watch for dates engraved on cornerstones, around doors, on plaques, on the sides of buildings, on old sidewalks, and on metal items—manhole covers, fire hydrants, lampposts, fences, etc. How old is this part of town? What kinds of businesses were located here? From the names on the buildings, can you tell if the town was mostly of one nationality? Encourage the children to do the same in their own town with their parents.



## Safety/Survival

### Planet Strange <sup>4</sup>

**Number of Children:** 2 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explain what things are needed for survival

**Activity:** You are shipwrecked on an island where no other person lives. No other islands are around you. There is no way to send for help. The island is shaped like a horseshoe; it has a cove, a beach, and mountains. It is hot and damp, with storms from the sea. A fresh water stream is available. There are fruit trees, birds, monkeys, and larger animals available. How will you survive? What will you need?

### It *Is* Necessarily So <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Natural area

**Equipment Needed:** None

**Purpose of Activity:** To find out what is necessary for survival

**Activity:** Walk around outside and find 6 things that are alive. Look at them and try to figure out what is necessary for the survival of each. What do people really need to survive on this earth? How do people's needs compare with the needs of the other things you found? Do people, plants and animals ever use the same things in different ways? Do people, plants and animals use something in the same way?

## Ecology

### Resource Recipe <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explain how natural resources are used in everyday life and how their loss affects us

**Activity:** The food you eat, the clothes you wear, and the house you live in are all created from natural resources. Name one natural resource, and have the children name at least 10 products that would not be around without that resource. Continue, using other resources. Which of the resources you identified are renewable, and which are non-renewable? What could be substituted for these resources if they were not available?

### Historical Hap <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explain the interdependence of people and animals in the environment

**Activity:** Preliminary: Explain how birds, bats, and insects affect our world and our lives.

The planet Zarkov in the Alpha Centauri solar system is a great deal like the earth. It has air, water, plants, minerals, animals, and people. There are a couple of differences, however. Zarkov has no birds, bats, or insects. How would these facts affect the Zarkovian development?

**Variation:** Make your own world! Choose a site and pretend that it is your own world. Think about what you would need to survive here. What would you want to bring here and what would you take away? What would be the most important thing to do first?

## The Web of Life <sup>2</sup>

**Number of Children:** 7-15

**Environment:** Any

**Equipment Needed:** 5 x 7 cards with the names or pictures of some part of the environment, ball of string, scissors

**Purpose of Activity:** To explain the interrelatedness of all plants, animals, and other elements of the environment

**Activity:** Players form a circle. Each is given a “name” card (or a card with a picture on it) which identifies them as some part of the environment—sun, air, water, soil, plants, animals, humanity, etc. Sun holds one end of the string and starts the game by handing the ball of string to one thing that is dependent on the sun to survive. That person passes it on to something that needs his or her card to survive, etc. After each player is connected to at least one other player, cut the string between two players to show that their link is broken. Follow the cut string from player to player to show how this affects the entire web of life. *Note: select local examples of plants and animals.*

## Food Chain Game <sup>6</sup>

**Number of Children:** 6 or more

**Environment:** Any

**Equipment Needed:** 3 x 5 cards with pictures of some living things in the park area

**Purpose of Activity:** To explain the food chain and how animals and plants interact

**Activity:** On small file cards, make pictures of the living things in your area. Have all players sit in a circle, then distribute the cards, one to a person. Explain how a food chain works, who is on top, who is on bottom, etc. The remaining cards go to the reserve pile. Choose someone to start the game by challenging another player to a showdown. The two players lay down their cards; if one preys upon the other in some way, that player takes the card from the eaten opponent. The turn lasts as long as the person can find other cards to eat. If the person challenges and loses, the card and the turn are lost. Whenever a player is eaten, that person draws a replacement card from the reserve pile. In the case of a challenge where neither organism eats the other, it's a standoff, and the game continues as the player next to the challenger takes a turn. Continue until everyone has had a turn and the survivors are all at standoffs. Each counts their cards; the one with the most cards wins.

## Un-nature Trail <sup>11</sup>

**Number of Children:** No more than 10

**Environment:** Trail

**Equipment Needed:** 10-15 man-made objects (clothes pins, pencils, combs, mirrors, toys, etc.)

**Purpose of Activity:** To sharpen observation skills

**Activity:** Place the man-made objects just off a 20- to 30-foot-long section of trail. Use some bright objects and some well hidden ones. People walk the trail one at a time, silently, trying to see as many objects as possible. At the end, they whisper to you how many they have seen. If not all were spotted, tell them “there’s still more,” and let them start over. Finish up by walking the trail as a group, pointing out and then removing each object in order. Make a point about keeping unnatural objects where they belong while hiking, then practice your new observation skills on a nature hike. *Note: Make sure all park staff is notified that this is an interpretive activity—not litter!*



## Knots <sup>8</sup>

**Number of Children:** 6 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To try and untangle the complex web of relationships between animals and plants

**Activity:** Explain that every animal and plant is connected in many ways to the other plants and animals around it. The soil, the amount of water, exposure to the wind, and many other factors affect all living things as well.

The object of the game is to try and untangle a complex web of relationships to see the cycle involved. Give each player an animal or plant name before the knot begins. Tell them to remember their name. Stand in a circle, shoulder to shoulder. Everybody reaches across and grabs two other hands (not the same person’s or the person next to you). Now that you are all interconnected, try to untangle the knot without letting go of any hands. Do you end up in a circle? Two circles?

After the knot is untangled, ask the players about their names, and talk about the relationships between their neighbors on each side of them in the circle. Would they be eaten or eat their neighbors? How is this going to affect the food chain they are a part of?

## Geology

### The Missing River <sup>4</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** Aquarium or wooden box lined with foil, various soil elements from the park area, watering can, water

**Purpose of Activity:** To demonstrate and explain a water table and how it affects human lifestyles

**Activity:** Using an aquarium or a wooden box lined with aluminum foil, make a gently sloping hillside of the soil elements. Use the kind of subsoil, topsoil, duff, and ground cover you find in your area. Gently sprinkle the top of the hill with rain (very slowly, so it will sink in—not a cloudburst), using a watering can. Observe where the water eventually becomes visible. When you have a pond about an inch deep, let your hillside stand until the upper hillside dries out. Dig down to find out whether all the water has drained into the pond. You may find a water table buried down there. Explain what a water table is. How is the water table important to people, wherever they live? How is it affected by human patterns of living?

**Note:** to speed up the process, prepare a “hillside” earlier, and let it dry out. (Use it for the latter half of the experiment, preparing another hillside while the children watch.)

### Water Holding Capacities <sup>13</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** Two (or more) funnels or similar containers with different types of soil from the park area in them, equal-size clear glass jars for the funnels to drain into, stopwatch or wristwatch with second hand, water in equal amounts

**Purpose of Activity:** To explain soil’s water-holding capacities and how this capacity affects the plants that live in it

**Activity:** Pour equal volumes of water through several different soil samples (clay, sand, loam) from different parts of the park. Let the water drain through the soil into separate containers for each sample. Compare the water holding capacities of each soil by comparing the rates at which the water pours through each sample, and the amount of water collected in the containers. Explain how soil holds water. Discuss why the holding rates of the soil samples are different, and relate this to the park’s geology and the plants that grow in different parts of the park.

**Variation:** Examine the runoff water and the particulate matter in each jar. Discuss which soils might be more susceptible to erosion.



## Holding Power <sup>10</sup>

**Number of Children:** 1 or more

**Environment:** Hilly area, partially eroded

**Equipment Needed:** Water

**Purpose of Activity:** To explain the waterholding benefits of plants on hillsides and how they prevent erosion

**Activity:** Select two equally sloping sites; one with bare soil only, one with plants. Pour an equal amount of water on each slope. Which slope has the most water runoff? Why? Were any mini-check dams created? Talk about erosion and how plants prevent it.

## Sand, Silt and Clay <sup>10</sup>

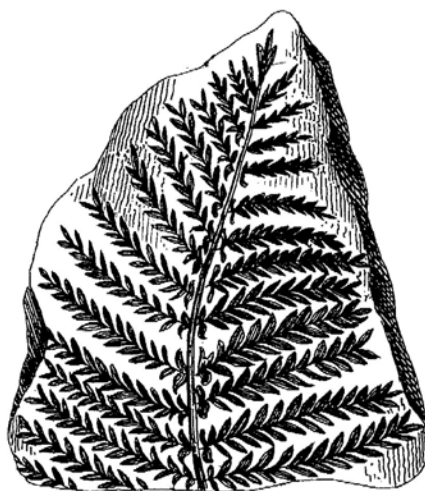
**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** Tall jars with lids, soil samples, water softener, wristwatch

**Purpose of Activity:** To demonstrate the varieties of soils in a given area

**Activity:** Have children collect soil from different areas. Fill tall jars  $\frac{1}{4}$  full of soil, add water to  $\frac{2}{3}$  full, and add a small amount of water softener. Shake each jar vigorously for 2 minutes, then let settle for 15 to 20 minutes. Observe the variety of soil textures in each jar—silt, sand, and clay.



## Rock Classification <sup>3</sup>

**Number of Children:** 4 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explore how things, especially rocks, are classified

**Activity:** Players each find a rock. Sitting in a circle, share what attracted you to that rock. Then line up according to who has the biggest rock at one end and who has the smallest rock at the other end. Brainstorm other ways to divide the rocks into other categories (like color, texture, shape, sparkles, type, etc.), and form those groups. Discuss how animals, plants and rocks have been classified in a similar way by scientists.

## Volcanic Eruption

**Number of Children:** 10 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To explain the workings of a volcano

**Activity:** Before beginning the game, introduce the terms: magma, cinder cone, cinders, ash, lava, and caldera, and explain how they relate to a volcano. Four people, the magma, crouch down in a tight circle. They are surrounded by the others, the cinder cone, who stand around the magma with their hands in the air to form a sloping cone. The magma starts bubbling, sending out cinders and ash (pieces of grass). The magma rises higher and higher, hissing and bubbling. The cinder cone begins shaking and rumbling. Part of the cone breaks away, and the magma (now lava) explodes out and quickly solidifies. As the lava leaves, the cone crumbles, leaving a caldera in the center.

## Animals

### Sticklers<sup>9</sup>

**Number of Children:** 1 or more

**Environment:** Any natural area

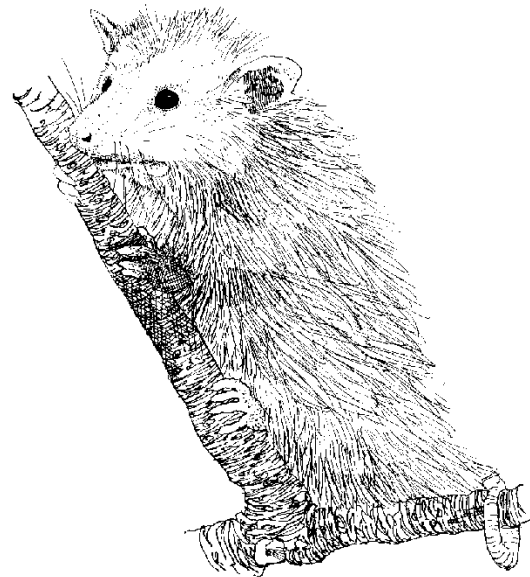
**Equipment Needed:** 100 sticklers  
(colored toothpicks work well)

**Purpose of Activity:** To introduce the terms “habitat” and “distribution,” and to explain them

**Activity:** Use a simulated lawn (or forest, field, etc.) animal—a stickler—to demonstrate habitat and distribution. A stickler can be a toothpick, or other material that will not contaminate the area if left behind. Select a habitat and a distribution manner, place the sticklers on the ground and study them as if they were actual animals.

Use one of three kinds of distribution: uniform, random or clumped. Uniform is evenly spread out, random is scattered here and there with no pattern, and clumped is a number of organisms bunched together in several places in the habitat. Distribute the sticklers before the group arrives; use the habitats available to give the stickler its own habitat (under certain plants, in the shade, sun, etc.). Use at least 100 sticklers.

Show the group the stickler, and tell them they must search for this “animal” and find out where it likes to live. Give them time to find the sticklers and observe them. Call the group back, and ask where the sticklers live and how they are spread out. Introduce the terms *habitat* and *distribution* as they pertain to the sticklers. Which type of distribution and habitat does the stickler prefer? Use this discussion to talk about the actual plants and animals in the area.



## Centipede Race (Bug Tag) <sup>8</sup>

**Number of Children:** 6 or more

**Environment:** Open area

**Equipment Needed:** None

**Purpose of Activity:** To find out how well an animal with several legs moves

**Activity:** What animals have only one foot, and how fast do they move (snails, clams)? Do our two feet help us move faster than one-footed animals? Can four-legged animals move faster than we do? Does having more legs always mean the animal will move faster? How about birds and insects?

How fast do centipedes move with all their feet? Let's become a centipede and find out. Line up in two lines, back to back. One line then takes a small step to the right, so the people in the line behind them are just over their right and left shoulders instead of directly behind. Then everyone bends down, crosses their arms between their legs, and reaches behind them for the wrists of the two people behind them on both sides. Decide which end will be the head, and start to walk. Race another centipede. Is a centipede faster with all its legs?

## Survival of the Fittest (Smaug's Jewels) <sup>8</sup>

**Number of Children:** 4 or more

**Environment:** Any

**Equipment Needed:** Handkerchief or Frisbee

**Purpose of this Activity:** To demonstrate the effect of scarcity of food on animals

**Activity:** When food gets scarce, animals may be forced to fight over it or steal it from each other. Wolverines may steal a kill from a coyote. Birds and squirrels may steal acorns a woodpecker has stored in holes in a tree.

In this game, a coyote tries to keep a kill for itself. The other hungry coyotes try to steal it away. With the coyote standing over its kill (handkerchief or Frisbee), the others try to sneak up and steal it. If the coyote tags the others, they are dead or have to step back until the food is stolen, or all the others are tagged too. The successful thief is the next coyote. Did the pack cooperate, or was it every coyote for itself?

## People Roll <sup>8</sup>

**Number of Children:** 6 or more

**Environment:** Grassy area

**Equipment Needed:** None

**Purpose of Activity:** To imitate the movement of a caterpillar

**Activity:** After observing how a caterpillar moves by sending a ripple moving along its body, all participants lie face down in the grass, arms at their sides, shoulder to shoulder. The player on the end rolls up onto the next player, keeping arms at sides and head in the same direction as the rest of the players. The player keeps rolling over the other bodies, then drops off the end. The other players follow, and drop off at the end of the line after the leader. Keep rolling, but don't bump heads!



## Support to Survive (The Lap Game) <sup>8</sup>

**Number of Children:** 12 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To demonstrate how survival depends on cooperation, not just individual effort.

**Activity:** Think of the different ways that animals support and cooperate with each other (kangaroo babies in pouches; monkey, opossum, and scorpion mothers carrying their babies on their backs; dolphins pushing their newborn to the surface for their first breath; ambulance crews carrying injured people in stretchers).

Here is a new way we can support each other and relax at the same time. Form a close circle standing shoulder to shoulder. Turn 90 degrees to the right. At the same time, everyone should sit down on the knees of the person behind them. Now, try waving your hands and walking forward in a circle.

## Ants on a Twig<sup>3</sup>

**Number of Children:** 6 or more

**Environment:** A fallen log sturdy enough to hold all the children

**Equipment Needed:** None

**Purpose of Activity:** To demonstrate cooperation between animals

**Activity:** Observe ants on a twig or other narrow space. What do they do when they meet? They touch feelers and pass each other. All the players become ants, and line up on a fallen log. Half the group turns around and faces the other half. One line is returning from the food source, the other is going out from the anthill to find food. Both lines must pass each other on the log without falling off. Touching and holding on is totally permissible. Use skinny (one-foot diameter) logs for skillful players, and bigger diameter logs for beginners.

If players get too hurried, you'll lose some ants, so use ant techniques: touch any player coming toward you, and after secure contact is made, proceed cautiously.

## Amoeba Tag (The Blob)<sup>8</sup>

**Number of Children:** 6 or more

**Environment:** Large, open space

**Equipment Needed:** None

**Purpose of Activity:** Explain how an amoeba feeds, and what it is (amoebas are tiny one-celled animals that grow by surrounding their food and soaking it up through their "skin;" they reproduce by dividing in half)

**Activity:** Agree on boundaries for a game of tag. "It" is the amoeba, which chases its food. When its food is tagged, this becomes part of the amoeba. Holding hands, they pursue the next meal. Everyone tagged joins the amoeba and continues to chase its prey, which it can tag with outside hands only, or by surrounding it completely. If the amoeba gets too big to catch all the food, it can divide in half and continue to chase. The last morsel eaten becomes the amoeba for the next game.

**Variation:** Allow the amoeba to grow to only four people; then each amoeba must divide into two-person amoebas. This solves the crack-the-whip problem at the end of the line.

At the end of the game, talk about the best way the amoebas found to tag their food. Did they try to corner it? How did the last food morsel left manage to survive for so long?

## Burrows<sup>3</sup>

**Number of Children:** 6 or more

**Environment:** Open space

**Equipment Needed:** 3-4 frisbees or similar objects

**Purpose of Activity:** To explain the predator-prey relationship

**Activity:** Three or four frisbees are thrown out on the ground, about 10-15 feet apart. The “ground squirrels” are safe when they have one foot on their “burrow.” One or two predators chase the squirrels when they are out looking for food or visiting neighbors. Every squirrel that is eaten becomes a predator, and joins the hunt. The last squirrel alive is the first predator in the next game. Or, if your group is timid about leaving the safety of their burrows, the squirrel with the most points (one for each burrow visited) wins.

Preface this game with observation and discussion of the squirrels in the park area, how they move about, what they eat, where they live, what their predators are, etc. This can also be a good opportunity to touch on problems with feeding the squirrels—concentration, overpopulation, dependence on people for food, etc.

## Call of the Wild (Cows and Ducks)<sup>3</sup>

**Minimum Number of Children:** 4

**Environment:** Large room or outdoor space

**Equipment Needed:** Enough blindfolds for the group

**Purpose of Activity:** To heighten perception of the sounds of a forest or other natural area

**Activity:** Discuss the animals found in the park area and the sounds they make. Select 2 or 3 animals to use. Blindfold participants. The leader whispers the name of one of the animals to each participant or the child draws a folded name/picture out of a hat. At a signal, everyone moves around making their sound until they find others making the same sound. Watch to make sure that no one gets hurt. Note: use native species, not those exotics we don't want to find in a park.



## Patterns and Vision <sup>3</sup>

**Number of Children:** 1 or more

**Environment:** Various

**Equipment Needed:** Red, transparent plastic or cellophane masks for each participant, paper animal cutouts of two types: 1) realistic and 2) marked with disruptive coloring like bars, dots, and other patterns

**Purpose of Activity:** To explain the purpose of disruptive coloring in animals

**Activity:** Give participants masks, so they become color-blind predators who see everything in shades of red. Place paper animal cutouts in a varied environment, so they are visible but not obvious. Participants then search for the animals. Talk about how the animals had to be recognized by their shapes. Now, place the other batch of paper animals—the ones with disruptive patterns on them—in the same area, and hunt for them. Talk about the difference in the hunts, and about animals the players know that have disruptive patterns, like fawns, birds, and butterflies.

## Hug Tag <sup>8</sup>

**Number of Children:** 7 or more

**Environment:** Open space

**Equipment Needed:** None

**Purpose of Activity:** To demonstrate how safety and comfort are important to animals

**Activity:** Boundaries are determined, and an “it” is chosen. Have a short discussion of how baby animals run to their mothers for protection and comfort when pursued by a predator. The person who is it tries to tag the other players, who are only safe when they are hugging in pairs. Everyone who gets tagged becomes it, too. See if it is harder for a mother to protect more babies by requiring three or four players to hug each other at the same time. Have a time limit for hugging to prevent the players from staying in hug groups; counting to three is good. After hugging one person, you must hug someone else before returning to the first person you hugged.



## Noah's Ark <sup>11</sup>

**Number of Children:** 8 or more

**Environment:** Open area

**Equipment Needed:** 3 x 5 cards, pictures of animals in your park area

**Purpose of Activity:** To explain to the children the types of animals in the park area and how they live

**Activity:** Preface the game with a discussion of the kinds of animals in the park area and their activities.

Write the names of animals in your area on 3x5 cards (or use pictures). Make 2 cards of each animal (if there is an odd number of children, make three cards of one animal). Pass the cards out, one to a person. Each child reads the card to himself and becomes that animal, keeping his/her identity a secret. Collect the cards. On a signal, everyone begins acting out their animals' sounds, shapes, and movements, trying to attract their mates. No human talking is allowed.

## Animal Parts <sup>11</sup>

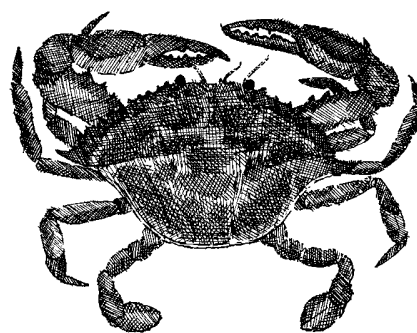
**Number of Children:** 8-10

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To examine the characteristics, behavior, and body movements of animals in a park area

**Activity:** Divide into groups of 4 or 5 children. Each group selects an animal common to the area. They then imitate the body of the animal for a panel of experts—the rest of the group. Each child is allowed to be a part of the animal. No noise is allowed. The panel of experts tries to guess what animal they are, and what they are doing. Try a scorpion—one person for the head, two for the body, and one for the long curving tail, with a stinger on the end. Or a crab, with enough arms and legs to make up all eight legs and the claws in the front.



## Wild Animal Scramble <sup>11</sup>

**Number of Children:** 4 or more

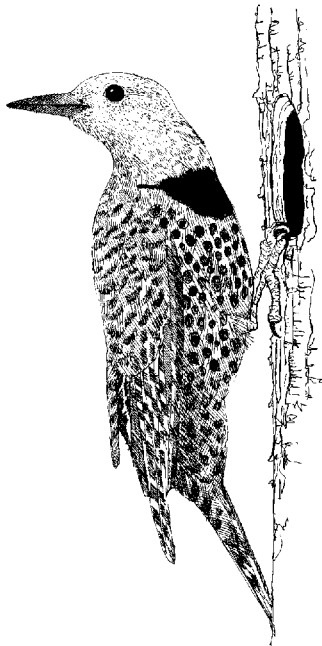
**Environment:** Any

**Equipment Needed:** Cards on loops of string, with animal pictures on them

**Purpose of Activity:** To study animal characteristics

**Activity:** Hang or pin a picture of an animal on the back of each child, but don't let them see the picture. Then they ask each other questions to discover their identities. The questions can be answered only by a yes, no, or maybe.

Preface the activity by giving examples of the kinds of questions to ask. "Do I live in the (forest, ocean, desert...)? "Can I fly" "Am I brightly colored?"



## Nature's Kaleidoscope <sup>2</sup>

**Number of Children:** 6 or more

**Environment:** Any open area with a variety of ground covers (grass and soil, leaves on the forest floor, etc.)

**Equipment Needed:** 100-200 colored toothpicks, an equal number of each color

**Purpose of Activity:** To demonstrate camouflage

**Activity:** Spread the toothpicks over the ground. Players have 30 seconds to collect as many as they can. Divide toothpicks found into groups, according to the colors. Which color was found least? Use this to discuss camouflage in animals.

**Variation:** A variation of this game is called "Birds n' Worms." Instead of toothpicks, it uses pieces of colored pipe-cleaners. The children form the pieces into "worms," and the leader scatters them around the area. The children, as birds, "fly" out over the area and pick up worms until the leader calls out the name of a predator that eats birds—fox, coyote, owl, etc.

## Silent Stalking<sup>9</sup>

**Number of Children:** 5 or more

**Environment:** A clear area with a noisy walking surface—gravel, twigs, brush, etc.

**Equipment Needed:** Blindfold

**Purpose of Activity:** To explain how a predator stalks its prey, and what it must do to keep the prey from being aware of it

**Activity:** Choose a fairly level, open site with a noisy walking surface. Mark off a stalking circle at least 10 meters in diameter for the group. Introduce the terms predator and prey. One member of the group is the prey; the rest are predators.

The prey stands in the center of the circle, and puts on a blindfold. The predators walk out to the edge of the circle, while the prey spins around in place. After spinning 4 times, the prey yells “stop,” and all the predators freeze. The predators stalk the prey by trying to tag him before he hears them. Each predator must pause between steps to see if the prey has heard him. If the prey hears a predator, he points at him. The leader should determine if the prey is pointing at the predator in case of close calls.

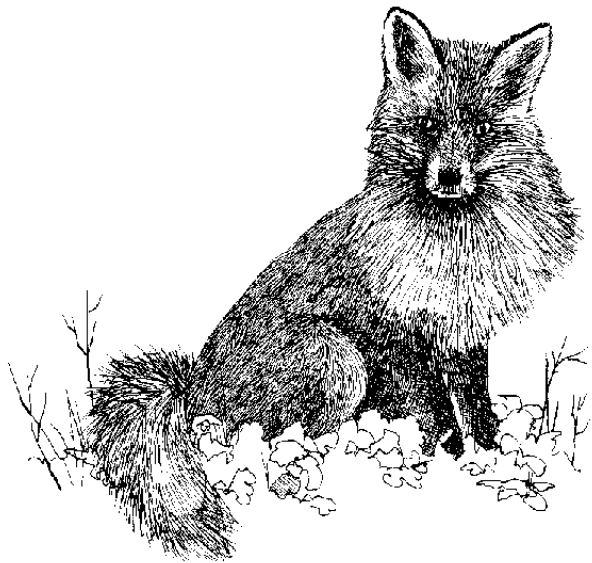
If a predator is caught, he is out of the game. The game ends when all the predators have tagged the prey, or the prey has used up all the available decision attempts (2 for each predator).

### Questions for the group:

Ask participants how they would change their bodies to be more effective as predators or prey.

Ask the most successful stalkers to demonstrate their stalking skills to the rest of the group.

What kinds of adaptations help animals be predators, or to prevent being caught as prey?



## Shake It <sup>9</sup>

**Number of Children:** 3 or more

**Environment:** Trail in brushy area

**Equipment Needed:** Shake-it container (see “Tools and Equipment” section)

**Purpose of Activity:** To examine the insect life in a brushy area

**Activity:** During a pause along the trail, introduce the shake-it game. Tell the children that lots of interesting animals are within arms’ reach of either side of the trail. Challenge them to find some of these animals. Demonstrate the shake-it container, and offer it as a tool to help them get a closer look (see “How to Make Tools” section). When everyone has practiced the technique, challenge the youngsters with some of the following:

Pick one kind of plant to shake at different places along the trail. Which animals appear again and again on that kind of plant?

Show an animal to the group, and challenge them to find as many kinds of plants as possible that harbor that animal.

### Questions for the group:

What kinds of animals were the most common?

Were many of the animals camouflaged?

Were there animals found on only one kind of plant? Why?

## Sound Off <sup>5</sup>

**Number of Children:** 10 or more

**Environment:** Open area

**Equipment Needed:** Strips of paper, a box to hold them, blindfolds

**Purpose of Activity:** To find out how predators and prey find each other

**Activity:** Determine ahead of time the noises you wish to signify prey. The predator will be silent. Write the noises (or names of the prey) on the pieces of paper and distribute them. There will be two of each kind of prey and one predator. Blindfold everyone, and spread the group out in a defined area. Have everyone make their noises only while standing still or moving (determine which ahead of time). The prey must find each other, and stay together and away from the predator until the game is over. If they are caught, they must move to the capture area.

### **Variations:**

Predators can only eat certain animals.

Predators must make noise when moving.

Increase the number of predators.

After the game, talk about how the predators and prey found each other.

Listen to the sounds in your area.

## Rattlers <sup>3</sup>

**Number of Children:** 10 or more

**Environment:** Open space

**Equipment Needed:** Two blindfolds and two noisemakers (cans with rocks in them and plastic tops work well)

**Purpose of Activity:** To demonstrate how predators find their prey

**Activity:** Two players, a predator and a prey, go to the center of the circle formed by the other players. Each is blindfolded and is given a noisemaker of some kind. The predator tries to catch the prey. Each time the predator uses his/her noisemaker, the prey must respond immediately by returning the noise. Limits can be placed on how many times the predator can make a noise before he/she starves to death.

### **Variations:**

Both players must stay silent and try to find each other by using only their hearing.

Either the predator or the prey makes the noise, but not both; or

Instead of noisemakers, have the children make a noise like an animal found in the area (coyote and squirrel, hawk and rabbit).

## Animal Diversity <sup>9</sup>

**Number of Children:** 4 or more

**Environment:** Adjacent areas with different vegetation

**Equipment Needed:** Sweepnets (see “Tools and Equipment” section), plastic bags, rubber bands or twist ties

**Purpose of Activity:** To examine the diversity of insects in adjacent areas

**Activity:** Choose two nearby areas with different types of vegetation, such as a managed area (lawn, landscaped area) and an un-managed area (field, roadside area). Have the group use the sweepnets on each area, and then compare the number of different insects in each area and the total number of insects. The sweepnets should be swept over each area an equal number of times to make the comparisons valid.

Compare the numbers and varieties of insects in the two areas. Explain the term “diversity,” and discuss the reasons behind the results of the sweepnet hunt. What are some of the differences between insects? How do humans affect the diversity? What are the advantages and disadvantages of each area to the insects?

## Mystery Marauders <sup>9</sup>

**Number of Children:** 3 or more

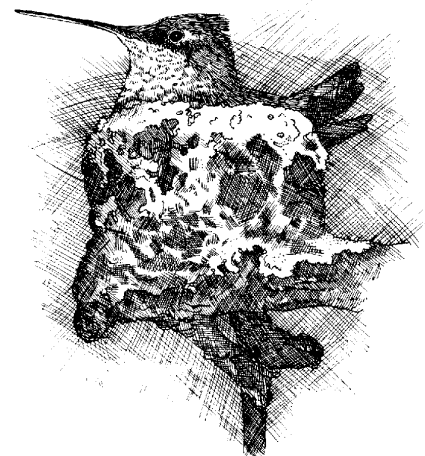
**Environment:** An environment with “holey” plants

**Equipment Needed:** Sweepnets or shake-it containers (see “Tools and Equipment” section), plastic bags, magnifying glasses

**Purpose of Activity:** To observe insects’ feeding habits

**Activity:** Select a site with “holey” plants (ones with a lot of holes in their leaves). Introduce the activity as a detective assignment. First, have the children gather samples of chewed leaves. Examine the leaves for similarities in the type of holes. Send the children back to “the scene of the crime” to look for suspects in the act of chewing. Organize a shakedown of the site with sweepnets or shake-it containers, gathering suspects (see “How to Make Tools” section). Put some of the types of leaves chewed into bags with the bugs. Observe and discuss the types of insects (predators and herbivores). Identify the culprits. If no culprit can be identified, why not?

Too hot?  
Too cool?  
Too light?  
Too early?  
They’ve moved on?



## Plants

### Plants that Hitchhike <sup>6</sup>

**Number of Children:** 3 or more

**Environment:** An area where plants or grasses are going to seed

**Equipment Needed:** Burlap bag or other loosely woven cloth, hand lens

**Purpose of Activity:** To discover how seeds transport themselves

**Activity:** Drag a burlap bag or other piece of loosely woven cloth over an area that has not been mowed, and where plants and grasses are going to seed. How many different kinds of seeds do you find on the cloth? Are there more of some kinds? How did the seeds hitchhike on the cloth? Use a hand lens to discover the fasteners if they are too small to be seen unaided. What do you think these seeds hitchhike on besides the bag? Match the seeds to their plants.

This is a variation of checking your socks for seeds after a hike.

### Plant Hunt <sup>12</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To increase observation skills

**Activity:** Describe a plant so completely that someone else can find it. Give a careful description of a plant—size, color, type of leaves, smell, feel, etc. Can the children find it from your description? Let them try to describe a plant to each other, then find it.



## Green People <sup>12</sup>

**Number of Children:** 1 or more

**Environment:** Any

**Equipment Needed:** None

**Purpose of Activity:** To examine the relationship between plants and humanity

**Activity:** Find plants that help people and animals survive.

Find a plant that burns well (fuel), is good to eat (food), or has lots of leaves (air supplier).

Find a plant that creates products people use. For example, a plant that can be made into paper, clothing (belts, shoes), houses (shelter), or that has water in it (water supply).

## Meet a Tree <sup>11</sup>

**Number of Children:** 2 or more

**Environment:** Forest

**Equipment Needed:** Blindfolds

**Purpose of Activity:** To gain a sensory awareness of forest trees

**Activity:** Blindfold half of the children. The other half of the group finds a partner and leads him or her to a tree (each guide should choose a different tree). Tell the blindfolded kids to feel the tree all over, learning about its bark, size, smell, texture, etc. Then return to the starting point, using an indirect route. Take off the blindfolds and try to find your tree.



## Heartbeat of a Tree <sup>11</sup>

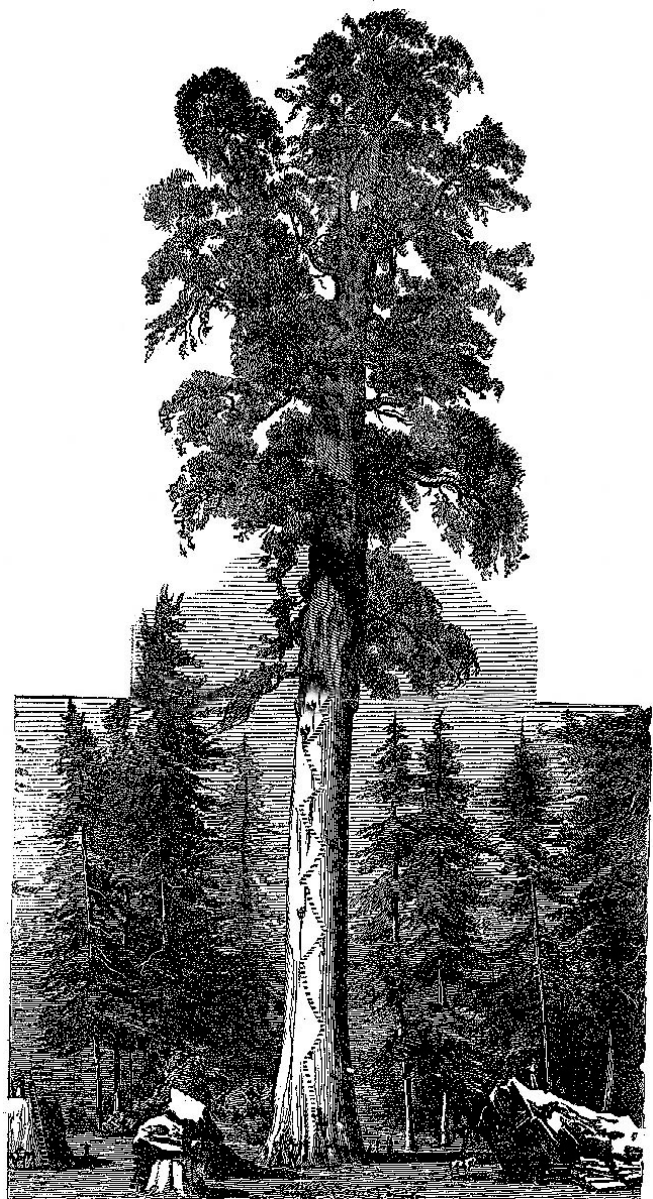
**Number of Children:** 1 or more

**Environment:** Forest

**Equipment Needed:** Stethoscope

**Purpose of Activity:** To become more aware of the life within a tree

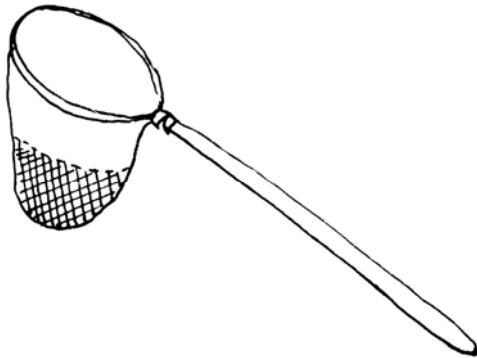
**Activity:** Using a stethoscope, listen to the sap in a tree. Deciduous trees are the best, and trees with thin bark which are at least six inches in diameter work well. Spring is the best time of year to hear the sap flow. From this activity, lead the discussion to the “circulatory system” of trees and other plants.



## How to Make Tools and Equipment

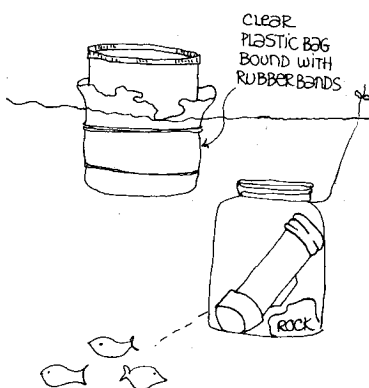
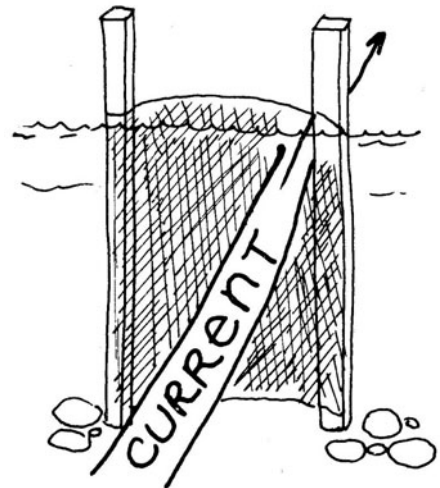
### Collecting Net <sup>4</sup>

Wire hoop on the end of a broom handle. Make net from an old nylon stocking top sewn to a piece of muslin.



### Stream Sampling Screen <sup>4</sup>

Tack window screen to two long wooden handles. Hold in a stream to catch floating organisms.



### Water Scopes <sup>4</sup>

Cut both ends out of a can. Cover the sharp ends with waterproof tape. Place clear plastic over one end, and secure with rubber bands. During the night, place a flashlight in a weighted and sealed jar.

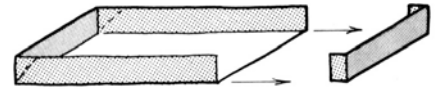
## Shake-it Container

### Materials for one container:

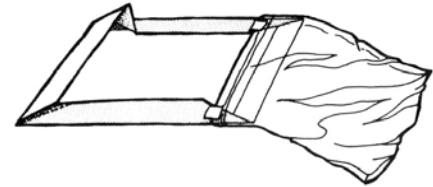
- 1 small, flat box
- 1 piece white paper (optional)
- 1 plastic bag
- Tape

### Construction:

Get some small, flat boxes and cut one end out. One-ream standard 8 ½" x 11" paper boxes are perfect.



If the bottom is smooth and light colored, fine. If not, tape some white paper in the bottom. Now put the open end of the box a short distance into a plastic bag. Supermarket produce bags work well. Tape the bag in place on the bottom and sides of the box.



That's it!

### To use the Shake-it Container:

Simply hold open part of the box under some foliage and shake the foliage vigorously.

Things that fall into the box can be tipped immediately into the bag. Critters that hold on can be tapped or gently scraped into the bag with a 3 x 5 card.



Returning the box to the level position puts a bend in the bag, preventing any captured critters from escaping. In this way, you can make many "shakes" and transfer the catches to the bag.

To empty the bag, take it off and dump the contents. To reuse, re-tape the bag to the box.

## Sweepnet

### Materials:

- 1 or 2 wire coat hangers (strong wire)
- 1 stick (approximately one meter long) for your net handle
- 1 piece of cheese cloth or netting for the net bag (about 60cm by 90cm)
- 1 needle and thread for sewing (or a sewing machine) or 1 stapler
- Strong tape to attach net to handle

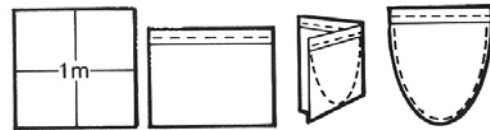
### 1. Preparing the hoop

Take a strong wire coat hanger, straighten the hook, and pull the hanger into a square. (Use two hangers for added strength.)



### 2. Preparing the bag

Your net should be almost one meter in circumference at the top, tapering down to a point. A sewing machine speeds up construction, but older kids can sew the nets if sufficient time is provided. Sew like this:



Fold one edge down 10 cm and sew.

Fold in half and sew or staple.

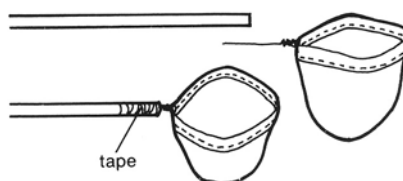
Cut off excess.

### 3. Assembling the net

Open the wire square and thread on the net.



Attach wire hoop to stick.



#### 4. Using a sweepnet

While a sweepnet can be used to pursue and capture an animal that has caught your eye, this is not the most efficient method of use. A sweepnet is best used as a random sampling tool. You walk at moderate speed across the grassy area, sweeping the net back and forth, keeping it close enough to the ground to brush the weeds or grass. The net should just brush across the top of the grass. The idea is to sweep any animals that are buzzing around or resting on plants into the nets, so you must turn the net in your hand to capture animals on both right and left swings of the net. After you have made fifteen to thirty swings of the net, flip the end of the bag over the wire frame to keep the catch from escaping.

#### How to transfer animals from net to observation bag:

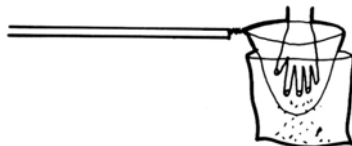
1. Pinch the net closed, keeping the animals on the bottom of the net.



2. Turn the net inside out while holding animals



3. Place the net in a plastic bag. Release and shake animals into the bag



4. Grab the top of the bag.



5. Twist the top a couple of times and tuck the top under your belt or into an open pocket while you continue to sweep.

## Suggested Resources: Directed Activities

Armstrong, Pam, Judith Connor, Chris Parsons, Judy Rand, and Jenny Vuturo-Brady. *Sea Searcher's Handbook: Activities from the Monterey Bay Aquarium*. Monterey, CA: Monterey Bay Aquarium, in cooperation with Roberts Rinehart Publishers, 1996.

Caduto, Michael J., and Joseph Bruchac. *Keepers of the Earth: Native American Stories and Environmental Activities for Children*. Golden, CO: Fulcrum, Inc., 1989.

*Child Ecology*. Los Altos, CA: Child Ecology Press, 1974.

Clark, Janet, Mary Collins, and Gary Collins. *Nature Walk*. Minneapolis: Burgess Publishing, 1975.

Clymire, Olga N. *A Child's Place in the Environment*. 6 volumes. Sacramento: California Department of Education, 1996.

Cornell, Joseph. *Sharing Nature with Children: the Classic Parents' and Teachers' Nature Awareness Guidebook*. 2<sup>nd</sup> Ed. Nevada City, CA: DAWN Publications, 1998. Written by a leading environmental educator, *Sharing Nature with Children* shares some of the environmental games Joseph Cornell uses in his interpretive programs for children.

Grater, Russell K. *The Interpreter's Handbook: Methods, Skills, and Techniques*. Globe, Arizona: Southwest Parks and Monuments Association, 1976. A veteran interpreter shares interpretive techniques that have proved themselves through the years.

Gross, Phyllis and Esther P. Railton. *Teaching Science in an Outdoor Environment*. Berkeley: University of California Press, 1972.

Hill, Katherine E. *Exploring the Natural World With Young Children*. New York: Harcourt, 1976.

Houts, Mary D. *Lesson Plans for Using the Outdoors in Teaching (Grades K-3)*. Danville, Illinois: The Interstate Printers and Publishers, 1976.

Krumbein, William J. and Linda Levya. *The Interpreter's Guide*. Sacramento, CA: Department of Parks and Recreation, 1977. This booklet addresses general interpretive techniques for campfire programs, leading hikes and tours, interpreting to children, and interpreting to people with disabilities. Although this guide is out of print, it is available in most park libraries.

Mortensen, Charles O. *Interpretive Reflections - A Naturalist's Guide to Enhancing Audience Awareness*. Muncie, Indiana: Ball State University, 1976.

*Junior Ranger Program Handbook: Directed Activities*

Musselman, Virginia W. *Learning About Nature Through Games*. Harrisburg: Stackpole Books, 1967.

Nickelsburg, Janet. *Nature Activities for Early Childhood*. Menlo Park, California: Addison-Wesley Publishing, 1976.

*Outdoor Education on Your School Grounds*. State of California Resources Agency, Office of Conservation Education, Sacramento, 1968.

Project Learning Tree. *Environmental Education Activity Guide: Pre K-8*. Washington, D.C.: Project Learning Tree, 1993. [www.plt.org](http://www.plt.org).

*Project WET Curriculum and Activity Guide*. Bozeman, MT: Project WET, 1995. Project WET (“Water Education for Teachers”) is a water education program designed to promote awareness, appreciation, knowledge, and stewardship of water resources. This guide is only available through training workshops.

*Project Wild K-12 Activity Guide*. Bethesda, MD: Western Regional Environmental Education Council, Inc., 1992. [www.projectwild.org](http://www.projectwild.org).

Russell, Helen R. *A Teacher's Guide: Ten-Minute Field Trips: Using the School Grounds for Environmental Studies*. Chicago: J.G. Ferguson Publishing, 1973.

Silbert, Linda and Al Silbert. *Little Twirps Creative Thinking Workbooks*. Mahopac, NY: Silbert and Bress Publications, 1977.

*Sky Challenger: Games for Star Gazers*. Berkeley, CA: Lawrence Hall of Science, University of California, 1978.

Van Matre, Steven. *Acclimatization*. Martinsville, IN: American Camping Association, 1972.

West, James E. and William Hillcourt. *Scout Field Book*. Boy Scouts of America, 1944.

*Wow!: The Wonder of Wetlands*. St. Michaels, MD: Environmental Concern Inc./Bozeman, MT: The Watercourse, 1995. Exploring the potential of wetlands as an educational tool, this guidebook combines useful background material with more than forty wetland-related activities for kindergarten-through-twelfth grade youths. [www.wetland.org/wowteacher.html](http://www.wetland.org/wowteacher.html).

## **Other Sources of Information**

California Coastal Commission. “Public Education Program.” Offers a variety of conservation, education and community involvement programs. [www.coastal.ca.gov/publiced/pendx.html](http://www.coastal.ca.gov/publiced/pendx.html).

California Environmental Protection Agency. [www.calepa.ca.gov](http://www.calepa.ca.gov).

California Institute for Biodiversity. *CalAlive!* Produces educational materials for grades 4<sup>th</sup> through 8<sup>th</sup>. [www.calalive.org](http://www.calalive.org).

California Regional Environmental Education Community Network. An educational project whose mission is to develop a communication network that provides educators with access to high quality environmental education resources to enhance the environmental literacy of California students. [www.creec.org](http://www.creec.org).

Department of Conservation. “Kids & Educators.” This website is full of fun facts and interesting information that students and teachers can use for school projects and learning. [www.consrv.ca.gov/index/qh\\_kidsEducators.htm](http://www.consrv.ca.gov/index/qh_kidsEducators.htm).

North American Association for Environmental Education. [www.naaee.org](http://www.naaee.org).

The EnviroLink Network. Clearinghouse for all environmental education information, materials and ideas. [www.envirolink.org](http://www.envirolink.org).

U.S. Environmental Protection Agency. “Educational Resources.” [www.epa.gov/epahome/educational.htm](http://www.epa.gov/epahome/educational.htm).



**INSERT *SOURCES* TAB HERE**



## Suggested Sources for Additional Information

The following list of resources is a compilation of all the Suggested Resources sections from each chapter of the Junior Ranger Handbook.

Abbott, R. Tucker. *Seashells of North America*. New York: Golden Press, Western Publishing Company, Inc., 1968. A “Golden Field Guide” designed for identifying North American shells.

Abrams, LeRoy, and Roxana Stinchfield Ferris. *Illustrated Flora of the Pacific States: Washington, Oregon, and California*. Stanford, CA: Stanford University Press, 1940. A classic reference.

Ackerman, Diane. *A Natural History of the Senses*. New York: Random House, 1990. Scientific facts, cultural lore, and personal insights come together in this rich contemplation of the senses.

Aginsky, Burt W. and Ethel G. *Deep Valley*. New York: Stein and Day, 1967.

Alden, Peter, Fred Heath, Richard Keen, Amy Leventer, and Wendy B. Zomlefer. *National Audubon Society Field Guide to California*. New York: Alfred A. Knopf, Inc., 1998. A compact, detailed statewide natural history field guide.

Alderson, William T. and Shirley P. Low. *Interpretation of Historic Sites*. Nashville: American Association for State and Local History, 1976. The authors travelled around the U.S. and Canada, and present in this book the best of the interpretation they saw.

Alexander, Taylor R. and R. Will Burnett. *Botany*. Herbert Zim, 1970. A handy guide.

Allen, Elsie. *Pomo Basketmaking: A Supreme Art for the Weaver*. Naturegraph Publishers, 1972.

Alt, David D. and Donald W. Hyndman. *Roadside Geology of Northern and Central California*. Missoula, MT: Mountain Press Publishing, 2000. A very useful and readable geologic guide to regions and roadsides in the northern and central part of the state.

Anderson, Bette R. *Weather in the West*. Palo Alto, CA: American West Publishing Co., 1975. This book explores Western American weather—its curious, distinctive aspects, its shaping of major climatic regimes, and its influence on human life and history.

### *Junior Ranger Handbook: Suggested Sources for Additional Information*

*Audubon Field Guide Series*. New York: Alfred Knopf, 1977. This series includes photographs for identification of numerous topics: birds, mammals, reptiles, trees, flowers, rocks, fossils, weather, etc. Series describes the ecological components of the various habitats described. Identification is based on photographs depicting plants, animals, and geology of the biotic regions.

Austin, Mary Hunter. *The Basket Woman: A Book of Indian Tales*. Western Literature Series, 1999.

Bachert, Russell E., Jr. *Outdoor Education Equipment*. Danville, IL: Interstate Printers and Publishers, 1974. This is a valuable collection of instructional aids that can be easily and inexpensively assembled for use in field investigations.

Bailey, Harry P. *Weather of Southern California*. California Natural History Guides: 17. Berkeley: University of California Press, 1966. This little book does a nice job of introducing readers to the many fascinations of Southern California's climate.

Bakker, Elna S. *An Island Called California: an Ecological Introduction to its Natural Communities*. 2<sup>nd</sup> Ed. Berkeley: University of California Press, 1984. First published in 1971, this overview of the state's ecology remains a standard reference.

Balls, Edward K. *Early Uses of California Plants*. Berkeley: University of California Press, 1972. This small book identifies and describes those plants that were used by California Indians and explains how they were used.

Barbour, Michael G., Bruce Pavlik, Frank Drysdale, and Susan Lindstrom. *California's Changing Landscapes: Diversity and Conservation of California Vegetation*. Sacramento, CA: California Native Plant Society, 1993. This book presents an excellent overview of California's wild vegetation.

Barbour, Michael G. and Jack Major. *Terrestrial Vegetation of California*. Davis, CA: California Native Plant Society, 1988. A more in-depth and technical publication on the terrestrial communities in California. An excellent reference for background knowledge on California floristic provinces.

Barrett, S.A., Ed. *Pomo Myths*. Bulletin of the Public Museum of the City of Milwaukee, WI. Vol. 15: 6 November 1933.

Bates, Robert L. and Julia A. Jackson, Eds. *Dictionary of Geological Terms*. 3<sup>rd</sup> ed. New York: Anchor Books, Doubleday, 1984. Geological dictionary that defines terms used in the field of geology.

*Bats*. Quarterly publication by Bat Conservation International, P.O. Box 162603, Austin, Texas 78716. Bat Conservation International is a nonprofit organization used for public education, research, and conservation of threatened and endangered bats.

*Junior Ranger Handbook: Suggested Sources for Additional Information*

Bean, Lowell J. *Mukat's People: The Cahuilla Indians of Southern California*. Berkeley, CA: University of California Press, 1972.

Beck, Larry and Ted Cable. *Interpretation for the 21st Century*. Champaign, IL: Sagamore Publishing, 1998. The authors update and build upon the interpretive philosophies of Freeman Tilden and Enos Mills, and present fundamental principles in a modern context.

Becking, Rudolph W. *Pocket Flora of the Redwood Forest*. Covelo, CA: Island Press, 1982. Identifies the plants associated with redwood forests and briefly describes the plants.

Benyus, Janine M. *The Field Guide to Wildlife Habitats of the Western United States*. New York: Simon & Schuster Inc., 1989. A guidebook to eighteen distinctive habitat types, most of which occur in California.

Berenbaum, May R. *Bugs in the System: Insects and Their Impact on Human Affairs*. Reading, MA: Addison-Wesley Publishing Company, Inc., 1995. A fascinating, entertaining mix of entomology and history, statistics and stories.

Bibby, Brian, ed. *The Fine Art of California Indian Basketry*. Sacramento, CA: Crocker Art Museum in association with Heyday Books, 2000.

*The Biosphere*. San Francisco: W.H. Freeman and Company, 1970.

Bloch, Louis M., Jr. *Overland to California in 1859: A Guide for Wagon Train Travelers*. Cleveland, OH: Bloch & Company, 1990. How to prepare for wagon train travel, based on 19th century guide books and newspapers. Integrates geography and technology with other disciplines.

Braun, Ernest. *Tideline*. New York: The Viking Press, 1975. In a rather unusual approach to the subject of shores, this insightful narrative describes a single day of exploration in the intertidal zone.

Braun, Ernest and David Cavagnaro. *Living Water*. Palo Alto, CA: American West Publishing Company, 1971. The authors follow a typical Sierra stream along its course from timberline to the sea, freely digressing into storms and snowbanks, soil and seeds.

Breschini, Gary S. *Indians of Monterey County*. Carmel, CA: Monterey County Archeological Society, 1972.

Brickson, Betty, J. K. Hartshorn, and Elizabeth McCarthy. *Layperson's Guide to California Water*. Sacramento, CA: Water Education Foundation, 2000. Combining historical and current information, this booklet gives a brief overview of the development and allocation of water resources in California.

## *Junior Ranger Handbook: Suggested Sources for Additional Information*

Bright, William. *1500 California Place Names: Their Origin and Meaning*. Berkeley: University of California Press, 1998. This little volume gives name explanations for well-known geographic features of the state—and some lesser-known ones, too.

Brown, Tom, Jr., and Brandt Morgan. *Tom Brown's Field Guide to Nature Observation and Tracking*. New York: Berkley Books, 1983. A philosophical and practical approach to observing things in nature.

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Pelz, Ruth. *Black Heroes of the Wild West*. Seattle, WA: Open Hand Publishing, 1990. Biographies of nine heroic men and women in the West between the 16th and 20th centuries: explorers, settlers, businesspeople, a journalist, a rodeo rider, and Stagecoach Mary.

“Peterson Field Guide Series.” The first major field guide series, Peterson's has been updated somewhat over the years, particularly the *Field Guide to Western Birds*. All identification plates are drawn (no photographs) with written descriptions of each plant or animal.

Pielou, E. C. *Fresh Water*. Chicago: University of Chicago Press, 1998. This source provides useful insights into the remarkable ways of water, such as the behavior of currents in a stream, the movement of pollutants through an aquifer, or the differences between a reservoir and a natural lake.

Porter, Erika R. *All Visitors Welcome: Accessibility in State Park Interpretive Programs and Facilities*. 3<sup>rd</sup> ed. Sacramento: Department of Parks and Recreation, 2003. This handbook has three purposes: to inform park staff about access requirements, to explain common disabilities, and to provide guidelines for making interpretive services more accessible to everyone.

Powell, Jerry A., and Charles L. Hogue. *California Insects*. California Natural History Guides: 44. Berkeley: University of California Press, 1979. Although less than ideal as an identification tool, this is still a handy, state-specific insect reference.

Powers, Stephen. *Tribes of California*. Berkeley, CA: University of California Press, 1976.

Purdy, Carl. *Pomo Indian Baskets and Their Makers*. Ukiah, CA: Mendocino County Historical Society, 1975.

Quinn, Kaye. *Planet Earth*. Los Angeles, Enrich, 1986. Contains games, activities and puzzles about earth science.

Quontamatteo, Nancy. *The Gold Rush Era*. Conceptual Productions, 1981. Learn and have fun with crossword puzzles, reading sheets, vocabulary lessons, money tables, outlaw handouts, transportation worksheets, map skills, word finds, and more. Clear writing, simple drawings, comprehension tests.

## *Junior Ranger Handbook: Suggested Sources for Additional Information*

Rawls, James J. *Indians of California: the Changing Image*. Norman: University of Oklahoma Press, 1986.

Rawls, James J. and Walton Bean. *California: an Interpretive History*. New York: McGraw-Hill Book Company, 1998. Good concise basic history with excellent references at each chapter's conclusion.

Raymo, Chet. *The Crust of Our Earth: an Armchair Traveler's Guide to the New Geology*. Englewood Cliffs, NJ: Phalarope Books, Prentice-Hall, Inc., 1983. Modern geology presented by a master storyteller.

Raymond, L. and Ann Rice. *Marin Indians*. Sausalito, CA: Pages of History, 1957.

Reader's Digest. *Joy of Nature*. 1977. A wonderful publication covering all subjects of natural history and how interconnected all elements are in natural systems.

Regnier, Kathleen, Michael Gross, and Ron Zimmerman. *The Interpreter's Guidebook: Techniques for Programs and Presentations*. Stevens Point, WI: UW-SP Foundation Press, 1992. An excellent, easy to read interpreter's guide. Filled with pictures and useful ideas for all kinds of interpretation.

Reisner, Marc. *Cadillac Desert: the American West and its Disappearing Water*. New York: Viking Penguin Inc., 1986. The author weaves history, biography, engineering, politics and economics into a fascinating story—a story of the quest to control and allocate the West's precious supply of water.

Rezendes, Paul. *Tracking and the Art of Seeing: How to Read Animal Tracks & Sign*. Charlotte, VT: Camden House Publishing, Inc., 1992. With high-quality photographs and detailed descriptions of animal signs, this publication is a valuable identification tool.

Rice, Richard B., William Bullough, and Richard Orsi. *The Elusive Eden: a New History of California*. New York: McGraw-Hill Companies, Inc., 1996.

Rickett, Harold W. *Wildflowers of the United States*. McGraw-Hill.

Rockwell, David. *The Nature of North America: a Handbook to the Continent: Rocks, Plants, and Animals*. New York: Berkley Books, 1998. This source is ideal for interpreters who want to consider California's natural history in a broader context.

Rolle, Andrew F. *California: a History*. (fourth edition). Harlan Davidson, 1987. Considered the standard history of California, this book begins with California's early inhabitants and covers Spanish rule, Mexican control, American exploration and settlement, the gold rush, immigration and statehood.

*Junior Ranger Handbook: Suggested Sources for Additional Information*

Roth, Charles E. *The Wildlife Observer's Guidebook*. Englewood Cliffs, New Jersey: Phalarope Books, Prentice-Hall, Inc., 1982. A practical manual for wildlife watching.

Russo, Ronald A. *Plant Galls of the California Region*. Pacific Grove, CA: The Boxwood Press, 1979. Galls are common to many plants. This book identifies many of these galls, their host plants, and the insects that cause them.

Russo, Ron, and Pam Olhausen. *Pacific Intertidal Life: a Guide to Organisms of Rocky Reefs and Tide Pools of the Pacific Coast*. Berkeley, CA: Nature Study Guild Publishers, 1981. Easy to use and compact in size, this guide to seashore life is a good choice for beginners.

Sargent, Charles S. *Manual of the Trees of North America*. New York: Dover Publications, 1961.

Scarry, Rick. *Things that Go: From the Wheel to Modern Engines*. New York: Derrydale Books, 1986. Almost every form of transportation, well-illustrated and explained.

Schoenherr, Allan A. *A Natural History of California*. California Natural History Guides: 56. Berkeley: University of California Press, 1992. A comprehensive and abundantly illustrated book which fosters an appreciation for California's natural diversity and unique beauty. Describes the climate, rocks, soil, plants, and animals in each distinctive region of the state.

Sharp, Robert P. *Geology: Field Guide to Southern California*. Dubuque, IA: W.C. Brown Co., 1976. Contains detailed road guides to the geologic provinces of Southern California.

Sharp, Robert P. and Allen F. Glazner. *Geology Underfoot in Southern California*. Missoula, MT: Mountain Press Publishing Company, 1993. The authors present twenty "vignettes"—each a story focused on some geological subject of particular interest and significance. Several involve California state park units.

Sharpe, Grant W. *Interpreting the Environment*. New York: John Wiley & Sons, Inc., 1976. Addresses the need to make plain how interpretation is applied on a day-to-day working basis. Over twenty nationally recognized experts contributed to this fine book.

Shaw, Charles E. and Sheldon Campbell. *Snakes of the American West*. New York: Knopf, 1974. This book describes the natural history, location, and identification of snakes found throughout the Western United States.

Shelton, John S. *Geology Illustrated*. San Francisco: W.H. Freeman, 1966. Well-illustrated with aerial photos; emphasizes Western U.S. geology, with many topics specific to California.

## *Junior Ranger Handbook: Suggested Sources for Additional Information*

Short History Series: *Los Angeles*, Gordon de Marco, 1988; *Sacramento*, Dorothy Leland, 1989; *San Diego*, Michael McKeever; *San Francisco*, Tom Cole, 1986. From native cultures to modern times, these four city histories tell the story of each place, the people who defined them and their roles in California. Clear writing, photographs, and drawings provide a solid foundation for visitors or students.

Sibley, David Allen. National Audubon Society. *The Sibley Guide to Birds*. New York: Alfred A. Knopf, Inc., 2000. An up-to-date field guide to more than 800 North American birds.

Silbert, Linda and Al Silbert. *Little Twirps Creative Thinking Workbooks*. Mahopac, NY: Silbert and Bress Publications, 1977.

Simpson, Richard. *Ooti: A Maidu Legacy*. Millbrae, CA: Celestial Arts, 1977.

*Sky Challenger: Games for Star Gazers*. Berkeley, CA: Lawrence Hall of Science, University of California, 1978.

Smith, Alexander H. *A Field Guide to Western Mushrooms*. Ann Arbor: University of Michigan Press, 1975.

Smith, Elinor S. *Po-ho-no and Other Yosemite Legends*. Monterey, CA: Peninsula Print Co., 1927.

Smith, Robert Leo. *Ecology and Field Biology*. 5<sup>th</sup> Ed. New York: HarperCollins College Publishers, 1996. A standard ecology textbook.

Snedigar, Robert. *Our Small Native Animals: Their Habits and Care*. New York: Dover Publications, 1939.

Snyderman, Marty. *California Marine Life: a Guide to Common Marine Species*. Niwot, CO: Roberts Rinehart Publishers, in cooperation with Monterey Bay Aquarium, 1998. An excellent survey text of marine habitats.

Stebbins, Robert C. *A Field Guide to Western Reptiles and Amphibians*. 2<sup>nd</sup> Ed. Boston: Houghton Mifflin Company, 1985. A more specific reference than Shaw (above).

Steinhart, Peter. *California's Wild Heritage: Threatened and Endangered Animals in the Golden State*. Sacramento, CA: California Department of Fish and Game, 1990. Catalogues threatened/endangered animals of the state and tells their ecological stories.

Stienstra, Tom. *California Wildlife: A Practical Guide*. Emeryville, CA: Foghorn Outdoors, Avalon Travel Publishing, Inc., 2000. A general reference on the natural

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history of more than a hundred types of California wildlife. Identifies excellent observation places throughout California.

*Still More Science Activities: Twenty Exciting Experiments to Do.* The Smithsonian Institution. New York: GMG Publishing, 1989.

Stokes, Donald W. *A Guide to Observing Insect Lives.* Boston: Little, Brown and Company, 1983. Diverging from the focus of most field guides, this publication investigates the life cycles and behavior of common insects.

Storer, John H. *The Web of Life: a First Book of Ecology.* New York: The Devin-Adair Company, 1953. A time-honored book that clearly explains basic concepts of ecology and conservation, with a number of examples chosen from California and the West.

Storer, Tracy I. and Lloyd P. Tevis, Jr. *California Grizzly.* Berkeley: University of California Press, 1955. Details the natural history and extermination of the single animal most closely identified with California (appearing on the state flag, park ranger patch, etc).

*Story of the American West.* Pleasantville, NY: The Reader's Digest Association, Inc., 1977. Excellent use of historic graphics, maps, and explanatory illustrations, from prairie schooners to mining techniques to railroad construction technology.

Sugden, Andrew. *Longman Illustrated Dictionary of Botany.* Harlow, England: Longman, 1992. Botanical dictionary with numerous illustrations.

Sussman, Art. *Dr. Art's Guide to Planet Earth: for Earthlings ages 12 to 120.* White River Junction, VT: Chelsea Green Publishing Company, 2000. This book explores how our planet works and how our actions can affect the environment.

Swan, Lester and Charles S. Papp. *The Common Insects of North America.* New York: Harper and Row, 1972.

Tilden, Freeman. *Interpreting Our Heritage.* 3rd Edition. Chapel Hill: University of North Carolina Press, 1977. A classic, written by the pioneer of interpretive philosophy and the recognized father of modern park interpretation. Although it was first published in 1957, this book is still relevant today, since it is not about the methodology of interpretation, but rather the guiding principles and underlying philosophy of the interpreter's art and craft.

Time-Life Ed. "Life Nature Library." A number of books in the series may prove helpful, including *The Plants*, 1963; *The Forest*, 1963; *The Desert*, 1962; *The Mountains*, 1962.

Tuttle, Merlin D. *America's Neighborhood Bats.* Austin: University of Texas Press, 1988. Well-written book on some of the world's least understood animals, providing



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helpful information about bat behavior and biology, a key to the identification of common North American species, range maps, a glossary, color photographs, and an extensive list of sources for additional information.

Van Matre, Steven. *Acclimatization*. Martinsville, IN: American Camping Association, 1972.

Van Matre, Steve. *Earth Education: A New Beginning*. Warrenville, IL: The Institute for Earth Education, 1990. This book proposes a new direction for environmental education called the “earth education path,” which aims to accomplish what environmental education set out to do, but didn’t: to help people improve upon their cognitive and affective relationship with the earth’s natural communities and life support systems, and begin crafting lifestyles that will lessen their impact upon those places and processes on behalf of all the planet’s inhabitants.

Van Matre, Steve and Bill Weiler. *The Earth Speaks*. Warrenville, IL: Acclimatization Experiences Institute, 1983. Collection of essays, poems, and quotations which provoke thought about the natural world.

Vieira, Linda. *The Ever-living Tree: The Life and Times of a Coast Redwood*. New York: Walker and Company, 1994. This book for younger readers tells the story of a 2,000-year-old redwood tree, charting its development against a backdrop of world history.

Walker, Alfred L. *The Book of Owls*. New York: Alfred A. Knopf.

Ward, Carolyn J. and Alan E. Wilkinson. *Basic Interpretation Learning System: Making Connections: the Essence of Interpretation*. Sacramento: Department of Parks and Recreation, 2003. An important resource for all state park interpreters.

Watts, May T. *Master Flower Finder*. New York: Warner Books, 1986. A layperson’s guide.

Watts, May T. *Reading the Landscape of America*. New York: Macmillan Publishing Co., Inc., 1975. These essays about selected American habitats are well-crafted pieces of interpretation, blending personal experience with natural (and human) history.

Watts, Tom. *Pacific Coast Tree Finder*. Rochester, NY: Nature Study Guild Publishers, 2004. A layperson’s guide.

Weitzman, David. *My Backyard History Book*. Boston: Little, Brown and Company, 1975. Packed with fun, inexpensive, and easy-to-accomplish projects and activities, from making time capsules and family oral histories to rubbing details. “How-to” history book for children to discover personal, family, and local history.

### *Junior Ranger Handbook: Suggested Sources for Additional Information*

Weitzman, David. *Underfoot: An Everyday Guide to Exploring the American Past*. New York: Charles Scribners & Sons, 1976. A how-to primer on methods for discovering historical records of your family and/or community.

Werminski, John. *Science, Poetry, and Parks: A Sourcebook for Interpreters of California's Natural History*. Sacramento: California State Parks, 2002. An excellent bibliographic source.

West, James E. and William Hillcourt. *Scout Field Book*. Boy Scouts of America, 1944.

Wexs, John B. *Zoo Books*. A series of publications by the San Diego Zoo educational association. Each publication deals with a specific group of animals, i.e. wild dogs, snakes, cats, sharks, etc. These books are written with children in mind and are an excellent reference for animal natural history.

Whitney, Stephen. *A Sierra Club Naturalist's Guide: The Sierra Nevada*. San Francisco, CA: Sierra Club Books, 1979. Describes the natural history of the Sierra Nevada by communities found within the Sierra Nevada biotic zone.

Wilcox, Del. *Voyagers to California*. Elk, CA: Sea Rock Press, 1991. Good brief sketches of California history with short biographies on historic people.

Williams, Jack. *The Weather Book: an Easy-to-Understand Guide to the USA's Weather*. New York: Vintage Books, 1992. An outstanding introduction to meteorology, this book contains many colorful diagrams, maps, and other graphics.

Wilson, Edward O. *The Diversity of Life*. Cambridge, MA: Harvard University Press, 1991.

*World Watch*. Bimonthly magazine of the Worldwatch Institute, 1776. Massachusetts Avenue, N.W., Washington, D.C. 20036. Worldwatch monitors evolving environmental trends such as deforestation, soil loss, species extinction, and climate change. The magazine attempts to make clear connections between the world's economic systems and environmental systems, highlights effective efforts to reverse damaging trends, and points out the problems that have yet to be addressed.

Yep, Lawrence. *Rainbow People*. New York: HarperTrophy, 1989. Traditional tales told among Chinese in California: of love, tricksters, fools, vice, virtue and life in Chinese America.

Zimmer, Kevin J. *The Western Birdwatcher*. Englewood Cliffs, NJ: Prentice-Hall, 1985. Zimmer details biotic zones and identifies birds expected to be found in those areas.

## *Junior Ranger Handbook: Suggested Sources for Additional Information*

### Teacher Guides and other Educational Materials

Armstrong, Pam, Judith Connor, Chris Parsons, Judy Rand, and Jenny Vuturo-Brady. *Sea Searcher's Handbook: Activities from the Monterey Bay Aquarium*. Monterey, CA: Monterey Bay Aquarium, in cooperation with Roberts Rinehart Publishers, 1996.

California Institute for Biodiversity. *CalAlive!* Produces educational materials for grades 4<sup>th</sup> through 8<sup>th</sup>. [www.calalive.org](http://www.calalive.org).

Catalog of Biology/Science Materials. Carolina Biological Supply Company. (800) 547-1733. Hundreds of fascinating visual aids useful for interpretation are available through this catalog, including: preserved animals (spiders, insects, sharks, shellfish, some mammals); animal skeletons; biomounts, exomounts, and other displays (mushroom life cycle, flower anatomy); charts; shells; "biocast" reproductions (acrylic reproductions of animals in exact detail); horns and antlers; "biorama" preparations (demonstrates lifecycles and ecological relationships); taxidermy mounts; botanical mounts; plasto mounts (including igneous, metamorphic, and sedimentary rock samples), among many other interesting and useful supplies.

Eargle, Jr., Dolan H. *Native California Guide: Weaving the Past & Present*. San Francisco, CA: Trees Company Press, 2000.

*Energy Education Resources: Kindergarten Through 12<sup>th</sup> Grade*. Washington D.C.: National Energy Information Center, Energy Information Administration. Published and updated yearly, this publication provides students, educators, and other information users a list of generally available free or low-cost energy-related educational materials.

Faber, Gail and Michele Lasagne. *Whispers from the First Californians*. Alamo, CA: Magpie Publications, 1980. Highly recommended—excellent teacher's guide. Includes illustrations, maps, games, stories, and plenty of well-researched information.

History-Social Science Curriculum Framework and Criteria Committee. *History-Social Science Framework for California Public Schools, Kindergarten Through Grade Twelve*. Sacramento: California State Department of Education, 1988. This is the basic guidebook used by teachers and curriculum specialists for presenting history and social science to California grade schools. Anyone preparing a history program for a park should adopt the thematic approaches suggested.

North American Association of Environmental Education. *Excellence in Environmental Education: Guidelines for Learning (Pre K-12)*. Washington, D.C.: North American Association for Environmental Education, 2004. [www.naaee.org](http://www.naaee.org).

Project Learning Tree. *Environmental Education Activity Guide: Pre K-8*. Washington, D.C.: Project Learning Tree, 1993. Project Learning Tree is an education program designed to promote awareness, appreciation, knowledge, and stewardship

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of forest resources. This guide is only available through training workshops.  
[www.plt.org](http://www.plt.org).

*Project WET Curriculum and Activity Guide*. Bozeman, MT: Project WET, 1995. Project WET (“Water Education for Teachers”) is a water education program designed to promote awareness, appreciation, knowledge, and stewardship of water resources. This guide is only available through training workshops.

*Project Wild K-12 Activity Guide*. Bethesda, MD: Western Regional Environmental Education Council, Inc., 1992. Project Wild is an animal ecology education program. This guide is only available through training workshops. [www.projectwild.org](http://www.projectwild.org).

Roa, Michael. *A Guide to the Side of the Sea: A Teacher’s Guide for Field Trips to Rocky Intertidal Areas*. Sacramento, CA: California State Parks, 2005.

*Rocks* is an activity guide available from British Columbia Teachers Federation. For a catalog, write, B.C. Teachers' Federation, Lesson Aids Service, 2235 Burrard St., Vancouver, BC V6H 3H9. [www.bctf.bc.ca](http://www.bctf.bc.ca).

Russell, Helen R. *A Teacher’s Guide: Ten-Minute Field Trips: Using the School Grounds for Environmental Studies*. Chicago: J.G. Ferguson Publishing, 1973.

Science Curriculum Framework and Criteria Committee. *Science Framework for California Public Schools: Kindergarten through Grade Twelve*. Sacramento: California Department of Education, 1990. This document sets forth the policies and principles that guide public school science teachers statewide. It also outlines, by subject and age group, the basic concepts to be taught.

The EnviroLink Network. Clearinghouse for all environmental education information, materials and ideas. [www.envirolink.org](http://www.envirolink.org)

*The No Waste Anthology: A Teacher’s Guide to Environmental Activities K-12*. Sacramento, CA: Department of Toxic Substances Control, 2003.

Tourtillott, Leeann and Ginney Allen. *Conserve & Renew: An Energy Educational Activity Package for Grades 4-6*. Sacramento, CA: California Energy Extension Service, 1990. This manual is a collection of energy education activities.

*Wow!: The Wonder of Wetlands*. St. Michaels, MD: Environmental Concern Inc./Bozeman, MT: The Watercourse, 1995. Exploring the potential of wetlands as an educational tool, this guidebook combines useful background material with more than forty wetland-related activities for kindergarten-through-twelfth grade youths. [www.wetland.org/wowteacher.html](http://www.wetland.org/wowteacher.html).

### **Other Sources of Information/Organizations**

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Acorn Naturalists. An excellent resource for books and supplies for environmental education programs. [www.acornnaturalists.com/store](http://www.acornnaturalists.com/store).

American Geological Institute has books and pamphlets on many geology topics, including *The Making of a Continent*, a companion volume to the PBS series of the same title. *Earth Science*, a quarterly geology magazine for the general public and “A Study in Time,” a poster on geologic time periods, are also available. For more information write American Geological Institute, 4220 King St., Alexandria, VA 22302. [www.agiweb.org/geoeducation.html](http://www.agiweb.org/geoeducation.html).

Animal and Plant Health Inspection Service, Department of Agriculture, Washington D.C. 20250. Provides information about importing and exporting pets and federally regulated plant species. [www.aphis.usda.gov](http://www.aphis.usda.gov).

California Coastal Commission. “Public Education Program.” Offers a variety of conservation, education and community involvement programs. [www.coastal.ca.gov/publiced/pendx.html](http://www.coastal.ca.gov/publiced/pendx.html).

California Department of Conservation, Division of Recycling. [www.consrv.ca.gov/DOR/index.htm](http://www.consrv.ca.gov/DOR/index.htm).

California Department of Conservation. “Kids & Educators.” This website is full of fun facts and interesting information that students and teachers can use for school projects and learning. [www.consrv.ca.gov/index/qh\\_kidsEducators.htm](http://www.consrv.ca.gov/index/qh_kidsEducators.htm).

California Department of Forestry. “Just for Kids.” [www.fire.ca.gov/php/education\\_kids.php](http://www.fire.ca.gov/php/education_kids.php).

California Energy Commission. “Energy Quest.” [www.energyquest.ca.gov/index.html](http://www.energyquest.ca.gov/index.html).

California Environmental Protection Agency. [www.calepa.ca.gov](http://www.calepa.ca.gov).

California Historical Society. “California History Online.” [www.californiahistory.net](http://www.californiahistory.net).

California Indian Basketweavers Association. [www.ciba.org](http://www.ciba.org).

California Indian Museum and Cultural Center. [cimcc.indian.com](http://cimcc.indian.com).

California Integrated Waste Management Board. [www.ciwmb.ca.gov](http://www.ciwmb.ca.gov).

California Native American Heritage Commission. “California Native Americans.” [ceres.ca.gov/nahc/cna.html](http://ceres.ca.gov/nahc/cna.html).

California Regional Environmental Education Community Network. An educational project whose mission is to develop a communication network which provides

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educators with access to high quality environmental education resources to enhance the environmental literacy of California students. [www.creec.org](http://www.creec.org).

Department of Boating and Waterways. [www.dbw.ca.gov/Education.asp](http://www.dbw.ca.gov/Education.asp).

Department of Fish and Game. [www.dfg.ca.gov](http://www.dfg.ca.gov).

Department of Homeland Security. U.S. Fire Administration. [www.usfa.fema.gov](http://www.usfa.fema.gov)

Four Directions Institute. A good source of information on California Indians. [www.fourdir.com](http://www.fourdir.com).

IUCN: World Conservation Union. [www.iucn.org](http://www.iucn.org).

Massachusetts Audubon Society has reprints from the *Curious Naturalist* on geology topics including “Snow Geology,” “Pangaea—Drifting Continents,” and “Energy from the Earth.” “The Rock Cycle” and “Geologic Time” are charts that are also available. [www.massaudubon.org](http://www.massaudubon.org).

National Center for Learning Disabilities. [www.nclld.org](http://www.nclld.org).

National Crime Prevention Council. [www.ncpc.org](http://www.ncpc.org)

National Marine Fisheries Service, Department of Commerce, Washington, D.C. 20235. Good source of information about endangered whales, seals and other marine species. [www.nmfs.noaa.gov](http://www.nmfs.noaa.gov).

National Oceanic and Atmospheric Administration. “National Weather Service.” [www.nws.noaa.gov](http://www.nws.noaa.gov).

National Renewable Energy Laboratory. [www.nrel.gov/learning](http://www.nrel.gov/learning).

National Wildlife Federation. “The Conservation Directory.” [www.nwf.org/conservationdirectory](http://www.nwf.org/conservationdirectory).

North American Association for Environmental Education. [www.naaee.org](http://www.naaee.org).

*The Alliance for Environmental Education* is the largest advocate for environmental education in North America, representing more than 50 million members through its 275 affiliate organizations representing business, labor, government agencies and other nonprofit organizations. 10751 Ambassador Drive, Suite 201, Manassas, VA 22110.

U.S. Environmental Protection Agency. “Educational Resources.” [www.epa.gov/epahome/educational.htm](http://www.epa.gov/epahome/educational.htm).

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U.S. Environmental Protection Agency. "Polluted Runoff (Nonpoint Source Pollution)." [www.epa.gov/owow/nps/qa.html](http://www.epa.gov/owow/nps/qa.html).

U.S. Geological Survey has many pamphlets, books, maps, lists of resources, and a "Selected Pack of Geologic Teaching Aids" among other items. Many of these materials are free. For more information, write U.S. Geological Survey, Geologic Inquiries Group, 907 National Center, Reston, VA 22092.  
[earthquake.usgs.gov/learning/kids.php](http://earthquake.usgs.gov/learning/kids.php).

United States Department of Energy. "Energy Efficiency and Renewable Energy." [www.eren.doe.gov](http://www.eren.doe.gov).

United States Fish and Wildlife Service. [www.fws.gov](http://www.fws.gov).

United States Lifesaving Association. [www.usla.org](http://www.usla.org).

USDA Forest Service. "Just for Kids." [www.fs.fed.us/kids](http://www.fs.fed.us/kids).

National Oceanic and Atmospheric Administration, National Ocean Service. "NOS Education Discovery Kits: Nonpoint Source Pollution." [www.oceanservice.noaa.gov/education/kits/pollution/03pointsource.html](http://www.oceanservice.noaa.gov/education/kits/pollution/03pointsource.html).

Watersheds.org. "Polluted Runoff, Nonpoint Source Pollution: What Can You Do." [www.watersheds.org/earth/nps2.htm](http://www.watersheds.org/earth/nps2.htm)





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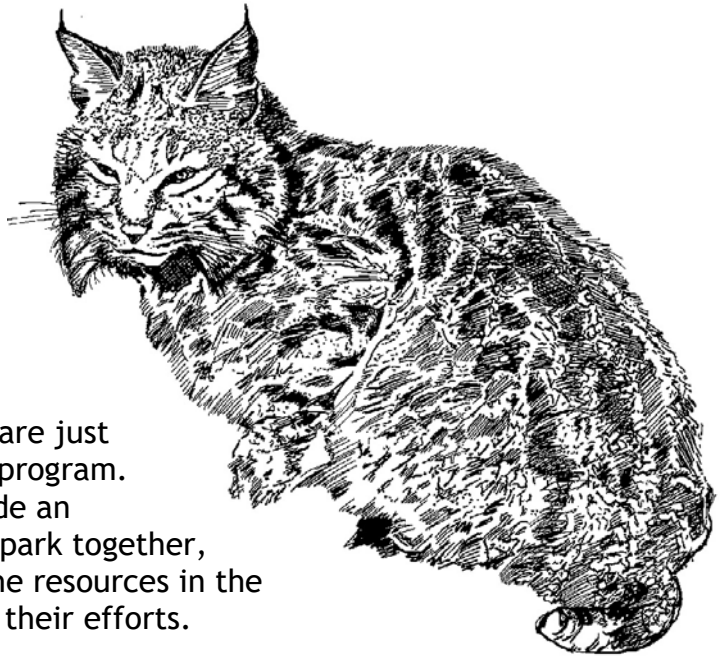


# Appendix A: Self-Guided Activities for Junior Rangers

## Introduction

What can you do when you have kids who want to participate in the Junior Ranger Program, but your unit currently does not have staff available to lead a program or does not currently offer any Junior Ranger programs?

Self-guided activities provide a great alternative to presented programs and are just as valuable as any other Junior Ranger program. In addition, self-guided activities provide an opportunity for families to explore the park together, become inspired and educated about the resources in the park, and receive a positive reward for their efforts.



There is no one “right way” to approach the implementation of a self-guided program. The self-guided activities can be a stand-alone Junior Ranger program for a park unit or incorporated into presented programs. Completion of the Adventure Guide, unit specific self-guided program book, or several of the worksheets included in this section should earn the participant the first level award: the Junior Ranger badge.

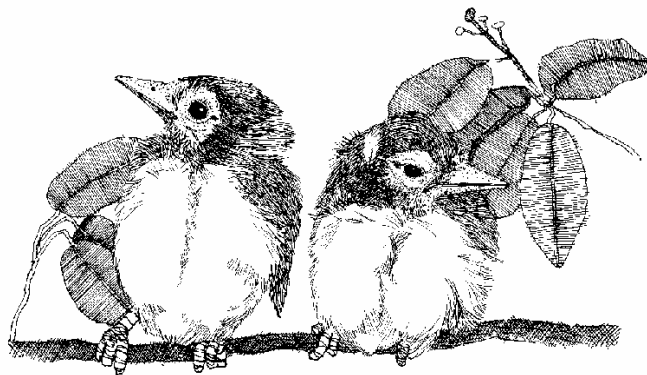
The activities should be designed to be fun and educational. When a Junior Ranger completes the activity book, have clearly identified places for the participant to receive recognition and his/her award. This can be a visitor center, kiosk, or other suitable place. In addition, park staff can carry awards with them during patrols to give the awards out during campground checks and other patrols. Park staff should look over the responses, and if you see an answer that indicates that a child misunderstands a question, inform him/her verbally, in a non-judgmental way. Remember this is a learning tool, not a test. It would be inappropriate, for example, to correct the activity with a red pen. Instead, if you see an answer that needs correcting, you might try to give the Junior Ranger some clues, and guide him or her toward the right answer. Or, you can simply (and gently) let him/her know what the expected answer is.

If the Junior Ranger has made a good attempt at the activity, and has filled in all the answers he or she could, the child has earned their badge. If you are in a visitor center or other public area, make a public announcement recognizing the Junior Ranger. For example, in a visitor center, announce out loud: "Attention everyone. I'd like all of you to stop what you're doing for a moment and recognize our park's newest Junior Ranger. Jim Smith has completed all of the requirements to become a Junior Ranger and is now presented with his Junior Ranger badge." You can officially hand the child his/her badge and shake his/her hand and begin a round of applause among the other visitors. This has the added benefit of including other visitors in seeing the positive efforts of interpretation in the park as well as providing positive feedback for the program participants.

Like the sample programs in this handbook, the self-guided activities are somewhat "generic." Self-guided activities are even more effective if designed with your unit in mind. You could take these samples and adapt them, including your park's interesting features. A specific activity could guide a Junior Ranger to a particular type of plant found on the park grounds, to the place in the museum where the cannons can be found, or to an area where a particular type of animal can often be seen. No matter how it is designed, a specific activity is preferable since it will encourage the child to notice and learn more about the special features of your unit.

Cooperating associations can be approached to help with printing the activity books. Additionally, the California State Parks Foundation will frequently help with funding for printing. Alternatively, you can request a number of copies to be printed through the regular DARC printing process.

Good luck in designing your own self-guided activities!



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## A Habitat is a Home

“Ecology” is a Greek word meaning “study of the home.” Our home is the planet Earth. When we study our home, one of the important things to notice is that plants, animals, people, trees, water, air, and all other parts of nature work together and need each other. Get a pencil or pen and let’s find out how!

1. A habitat is a location where a plant or animal lives. There must be food, shelter, and conditions that help the plant or animal survive. Describe your habitat.
  
2. This park may have several different habitats, each home to a variety of animals. Circle the animals below that you have seen in this park.



Vulture



Fish



Snake



Quail



Gull



Skunk



Butterfly



Shorebird



Beaver



Frog



Raccoon



Insect

3. Choose one animal you circled. Describe what that animal's habitat is like. Where does it live? What does it eat and drink? Observe the animal to find out, look in the nature center if the park has one, or ask a park employee.
  
4. Do the animals you circled above need plants to survive? (yes/no)  
If so, what for?
  
5. Do plants need animals? (yes/no)  
If so, for what reasons?
  
6. Do plants need other plants? (yes/no)  
If so, for what reasons?
  
7. What about animals? Do animals need other animals to survive?  
If so, for what reasons?
  
8. Do people need plants and animals to survive? Why or why not?
  
9. Can you think of any reasons why plants and animals might need humans to survive?

**You have completed this worksheet!**



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## A Habitat is a Home—Part Two

Did you think of some of the reasons why plants, animals, and humans need each other to survive? If humans remove plants, or destroy habitats, we could change the lives of everything that depends on that plant or habitat to survive.

1. Why is it important to have places like this park, in which animal habitats are protected?
2. What does it mean when a species is endangered? Are there any endangered species at this park? (yes/no). If so, what are they?
3. What does it mean when an animal becomes extinct?
4. What do humans do that endangers the lives of plants and animals?
5. What can you do to help protect the homes of plants and animals?
6. Do you, or does your family, recycle:  
aluminum? (yes/no)                      newspaper? (yes/no)  
cardboard? (yes/no)                      motor oil? (yes/no)  
glass? (yes/no)                      other recyclable items? (yes/no)
7. How do you think recycling makes our home, the earth, a healthier place to live?
8. What else can we do to keep this world that we share with plants and animals healthy and beautiful?

**You have completed this activity!**



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Endangered Species Who Me?

California has over 290 different species on the list of threatened and endangered species. As the population of California continues to grow, humans are taking over the former homes of these plants and animals. California's state parks provide safe habitats for many of these endangered species. Unscramble the following names of endangered species and uncover the hidden message.

R	D	O	N	C	O		D	B	L	A		G	E	E	L	A				
—	—	9	—	—	—		—	8	—	—		—	12	—	—	—				
R	H	O	T	N	E	R	H		T	D	O	T	E	S	P		L	O	W	
—	—	—	5	6	—	—	—		—	—	—	—	—	—	—		—	—	—	
O	N	R	W	B		N	C	P	L	E	I	A								
—	—	—	—	—		—	4	—	10	—	—	—								
N	A	I	T	G		R	R	T	E	A	G		N	K	E	A	S			
—	—	2	—	—		—	—	—	—	—	—		14	—	—	—	—			
S	E	E	D	R	T		E	O	S	T	R	T	I	O						
—	—	1	—	—	—		—	—	—	—	—	—	—	7						
K	B	M	U	C	H	P	A		L	W	E	A	H							
—	—	11	—	—	—	—	—		—	—	—	13	—							
W	S	Y	N	O		R	E	P	L	V	O									
—	—	—	—	—		—	—	—	3	—	—									

1 2 3 4 5 6 7 8 9 10 11 12 13 14 !

Good work—you are finished!



# Endangered Species Who Me?—Answer Key

California has over 290 different species on the list of threatened and endangered species. As the population of California continues to grow, humans are taking over many of the former homes of these plants and animals. California's state parks provide safe habitats for many of these endangered species. Unscramble the following names of endangered animals and uncover the hidden message.

<u>R</u>	<u>D</u>	<u>O</u>	<u>N</u>	<u>C</u>	<u>O</u>		<u>D</u>	<u>B</u>	<u>L</u>	<u>A</u>		<u>G</u>	<u>E</u>	<u>E</u>	<u>L</u>	<u>A</u>		
<u>C</u>	<u>O</u>	<u>N</u>	<u>D</u>	<u>O</u>	<u>R</u>		<u>B</u>	<u>A</u>	<u>L</u>	<u>D</u>		<u>E</u>	<u>A</u>	<u>G</u>	<u>L</u>	<u>E</u>		
		9						8				12						
<u>R</u>	<u>H</u>	<u>O</u>	<u>T</u>	<u>N</u>	<u>E</u>	<u>R</u>	<u>H</u>		<u>T</u>	<u>D</u>	<u>O</u>	<u>T</u>	<u>E</u>	<u>S</u>	<u>P</u>	<u>L</u>	<u>O</u>	<u>W</u>
<u>N</u>	<u>O</u>	<u>R</u>	<u>T</u>	<u>H</u>	<u>E</u>	<u>R</u>	<u>N</u>		<u>S</u>	<u>P</u>	<u>O</u>	<u>T</u>	<u>T</u>	<u>E</u>	<u>D</u>	<u>O</u>	<u>W</u>	<u>L</u>
			5	6														
<u>O</u>	<u>N</u>	<u>R</u>	<u>W</u>	<u>B</u>		<u>N</u>	<u>C</u>	<u>P</u>	<u>L</u>	<u>E</u>	<u>I</u>	<u>A</u>						
<u>B</u>	<u>R</u>	<u>O</u>	<u>W</u>	<u>N</u>		<u>P</u>	<u>E</u>	<u>L</u>	<u>I</u>	<u>C</u>	<u>A</u>	<u>N</u>						
							4		10									
<u>N</u>	<u>A</u>	<u>I</u>	<u>T</u>	<u>G</u>		<u>R</u>	<u>R</u>	<u>T</u>	<u>E</u>	<u>A</u>	<u>G</u>		<u>N</u>	<u>K</u>	<u>E</u>	<u>A</u>	<u>S</u>	
<u>G</u>	<u>I</u>	<u>A</u>	<u>N</u>	<u>T</u>		<u>G</u>	<u>A</u>	<u>R</u>	<u>T</u>	<u>E</u>	<u>R</u>		<u>S</u>	<u>N</u>	<u>A</u>	<u>K</u>	<u>E</u>	
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<u>S</u>	<u>E</u>	<u>E</u>	<u>D</u>	<u>R</u>	<u>T</u>		<u>E</u>	<u>O</u>	<u>S</u>	<u>T</u>	<u>R</u>	<u>T</u>	<u>I</u>	<u>O</u>				
<u>D</u>	<u>E</u>	<u>S</u>	<u>E</u>	<u>R</u>	<u>T</u>		<u>T</u>	<u>O</u>	<u>R</u>	<u>T</u>	<u>O</u>	<u>I</u>	<u>S</u>	<u>E</u>				
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<u>K</u>	<u>B</u>	<u>M</u>	<u>U</u>	<u>C</u>	<u>H</u>	<u>P</u>	<u>A</u>		<u>L</u>	<u>W</u>	<u>E</u>	<u>A</u>	<u>H</u>					
<u>H</u>	<u>U</u>	<u>M</u>	<u>P</u>	<u>B</u>	<u>A</u>	<u>C</u>	<u>K</u>		<u>W</u>	<u>H</u>	<u>A</u>	<u>L</u>	<u>E</u>					
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<u>W</u>	<u>S</u>	<u>Y</u>	<u>N</u>	<u>O</u>		<u>R</u>	<u>E</u>	<u>P</u>	<u>L</u>	<u>V</u>	<u>O</u>							
<u>S</u>	<u>N</u>	<u>O</u>	<u>W</u>	<u>Y</u>		<u>P</u>	<u>L</u>	<u>O</u>	<u>V</u>	<u>E</u>	<u>R</u>							
									3									
	<u>S</u>	<u>A</u>	<u>V</u>	<u>E</u>		<u>T</u>	<u>H</u>	<u>E</u>		<u>A</u>	<u>N</u>	<u>I</u>	<u>M</u>	<u>A</u>	<u>L</u>	<u>S</u>	!	
	1	2	3	4		5	6	7		8	9	10	11	12	13	14		





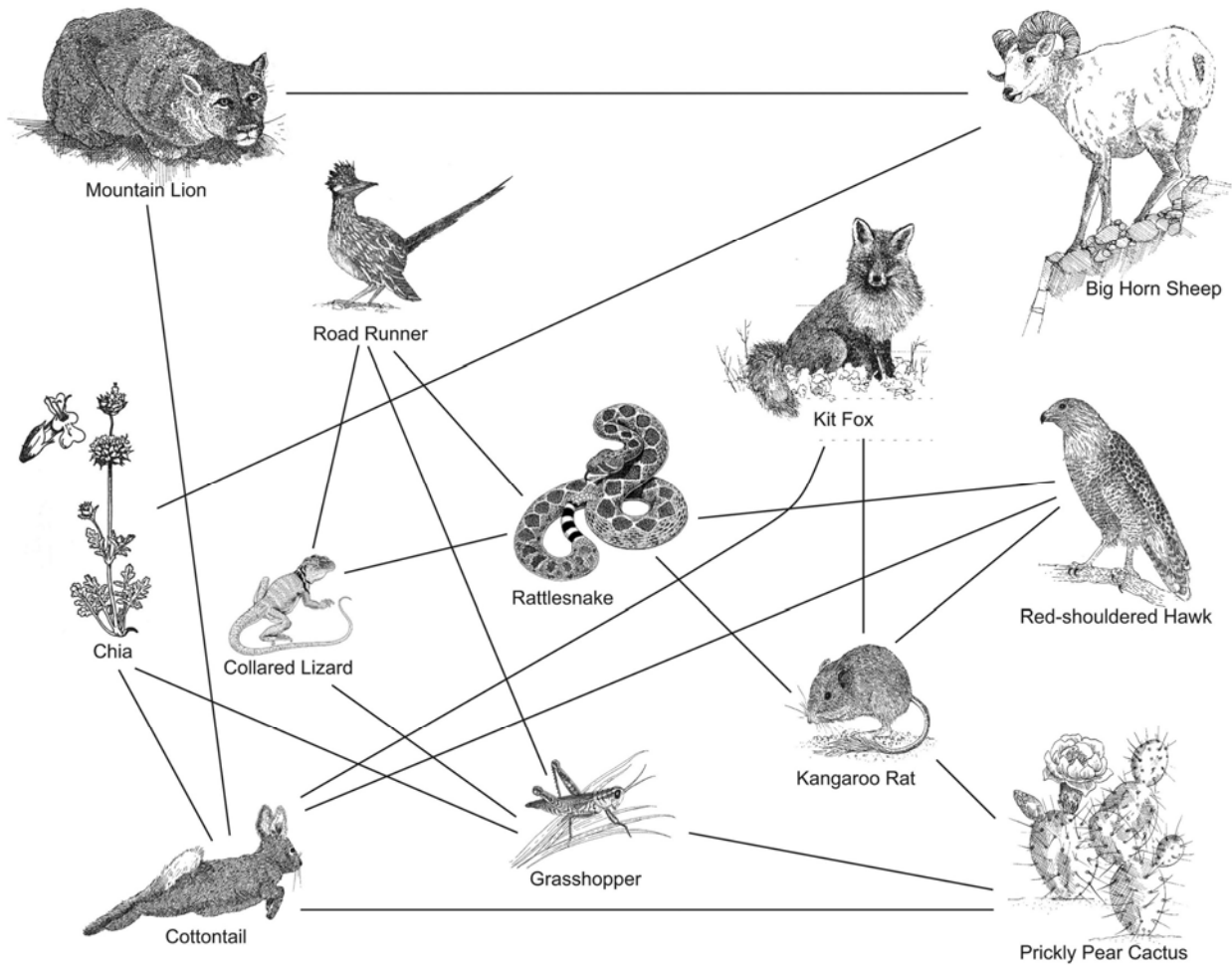
Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Energy=Life

Everything on Earth needs energy to live. Without energy, cars would not run, television sets would not turn on, plants could not grow, and animals could not move or even breathe! In this activity, you will have a chance to explore what energy really is, and how it affects everything around you.

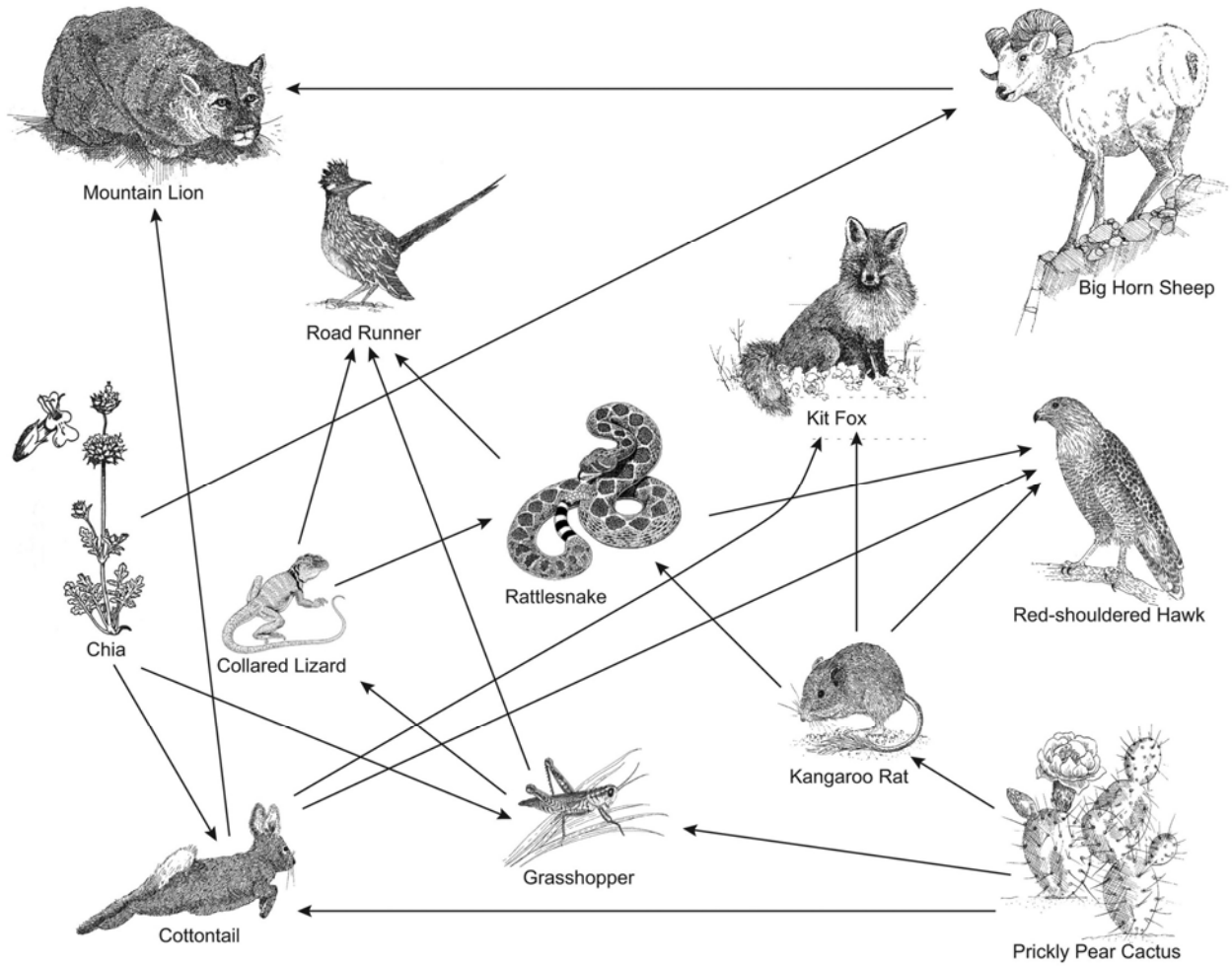
1. How do humans get energy to walk, talk, read, and think?
2. How do animals get their energy to move, grow, and reproduce?
3. Some animals eat plants to get energy to live. They are called herbivores. Other animals eat animals to get their energy. What is this type of animal called?
4. What are some examples of herbivores in the park?
5. What are some examples of carnivores found in the park?
6. What is the difference between predator and prey?
7. Humans eat both plants and animals. What are we called?
8. Arrange these animals and plants into a food chain. A food chain is a simple way to show the transfer of energy between organisms. Hint: where does each thing get their food from?  
Frog Grass Hawk Grasshopper Sun
9. Why do you think there are more herbivores than carnivores (think about the transfer of energy)?

10. Plants and animals are temporary energy “vessels”—but very “leaky” ones. As plants and animals move, digest food, grow, reproduce, and maintain body heat, energy is used and lost. Animals depend on more than one species of plants and/or animals to get the energy they need to survive. A food web shows this interdependency between organisms. Complete the desert food web by drawing in the arrows. The arrows should point from a plant or animal to the animal that eats it. (For example: prickly pear → kangaroo rat → kit fox)



Good work—you are finished!

# Energy=Life—Answer Key







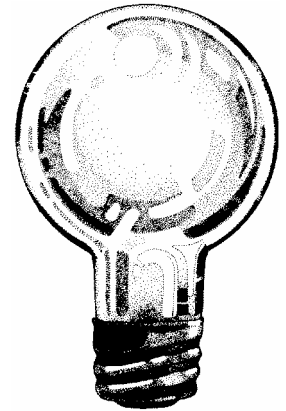
Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Energy, Energy, Everywhere

Energy is an important resource needed by everything on earth to function. Fill in the blanks on the energy crossword puzzle by reading the clues and using the words from the list below the puzzle.

### ACROSS

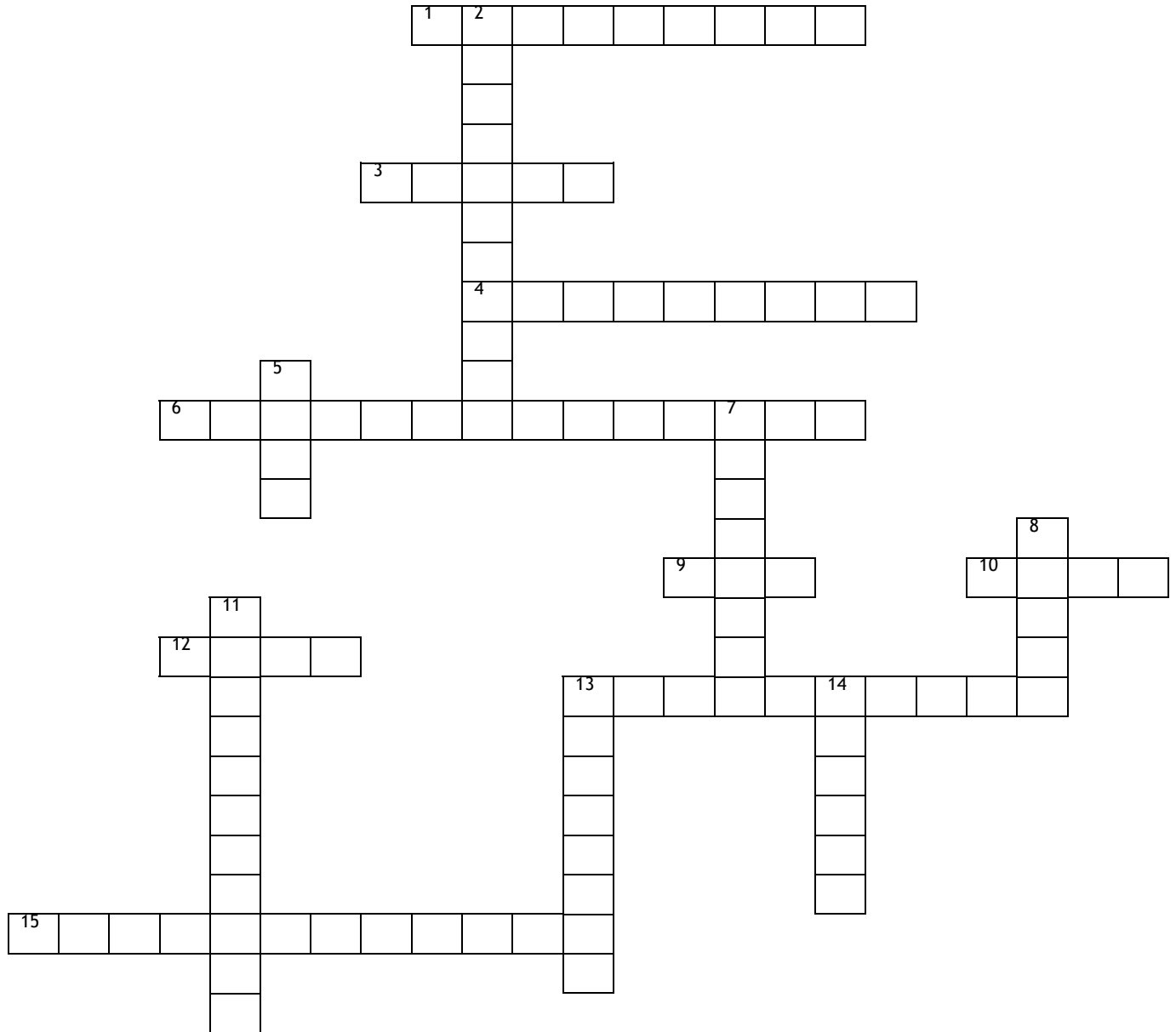
1. The type of animal that eats plants to get energy.
3. This is what is used to make “hydropower.”
4. The type of animal that eats other animals to get energy.
6. The process plants use to get energy.
9. A fossil fuel. Hint: motor \_\_\_\_.
10. The type of energy that sailboats use to move.
12. Burning this (in your fireplace) creates energy.
13. The type of energy created from heat within the earth.
15. Taking care to preserve natural resources is called \_\_\_\_\_.  
Hint: energy \_\_\_\_\_, water \_\_\_\_\_.



### DOWN

2. The type of energy used to turn on a hairdryer.
5. This type of fuel is black and sooty, and produces dust when it is mined.
7. One of the things plants need to photosynthesize (make energy).
8. The type of energy created by the ocean.
11. Materials from prehistoric animals and plants created, over millions of years, many types of fuel. These fuels, like coal, oil, and natural gas, are called \_\_\_\_\_.
13. The fuel used in automobiles.
14. The subject of this program.

# Energy Crossword



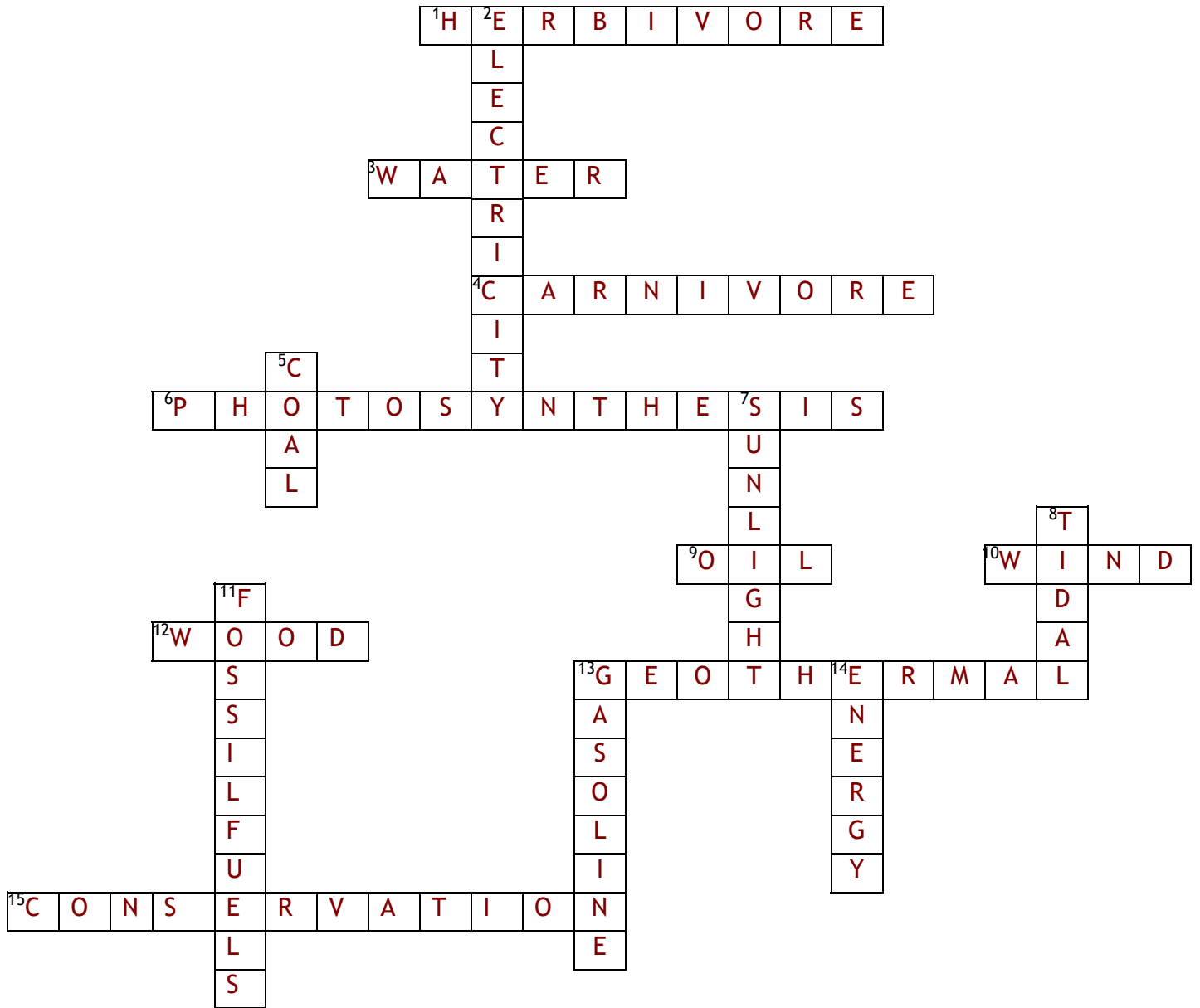
Hint: Below are the words used in this crossword puzzle.

- |                |              |          |              |
|----------------|--------------|----------|--------------|
| gasoline       | conservation | oil      | geothermal   |
| photosynthesis | herbivore    | sunlight | fossil fuels |
| tidal          | wind         | coal     | carnivore    |
| electricity    | wood         | energy   | water        |

**Good work—you are finished!**



# Energy Crossword—Answer Key



The crossword puzzle grid contains the following words:

- 1** H E R B I V O R E
- 2** L
- 3** E
- 4** C
- 5** W A T E R
- 6** R
- 7** I
- 8** C A R N I V O R E
- 9** I
- 10** T
- 11** P H O T O S Y N T H E S I S
- 12** A
- 13** L
- 14** U
- 15** N
- 16** L
- 17** O I L
- 18** G
- 19** H
- 20** W I N D
- 21** D
- 22** A
- 23** F
- 24** W O O D
- 25** S
- 26** S
- 27** I
- 28** L
- 29** F
- 30** U
- 31** G E O T H E R M A L
- 32** A
- 33** S
- 34** O
- 35** L
- 36** I
- 37** N
- 38** E
- 39** R
- 40** G
- 41** Y
- 42** C O N S E R V A T I O N
- 43** L
- 44** S





Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## More Than Just Rocks

Geology involves much more than just the study of rocks. It can include the study of the history of life on earth; earthquakes, volcanos, and tsunamis, and the formation of mountains, rivers, and valleys. The study of rocks and land formations can be fun and exciting. To complete this activity, you will need a pencil or pen and your imagination. Let's begin!

1. There are three kinds of rocks on Earth: metamorphic, sedimentary, and igneous.

One type of rock is formed from melted rock material (called magma). Which one is it?

One type is formed by layers and layers of sand and clay. Which one is it?

The last type has been changed by heat and pressure deep inside the earth. Which type is it?

2. Find a rock, and draw it here.

What does the rock feel like? Is it smooth and rounded? (yes/no)  
Smooth, rounded rocks usually have been shaped by water. Maybe your rock rolled down a stream.

Does your rock have any hard edges? Has it been cracked or broken?  
(yes/no)

Rocks with cracks, breaks, or sharp edges may have fallen. Look around. Maybe your rock came from a nearby mountain.

Does your rock have layers that you can see? (yes/no)  
Maybe your rock has fossils in it. Fossils are impressions or remains of animals that have been preserved in rocks.

3. Have you ever felt an earthquake? (yes/no)
4. Do you know what causes earthquakes? (yes/no)
5. Giant plates of land are under our feet. These plates are arranged like a jigsaw puzzle. If one piece moves out of position, it causes others to move. This is how earthquakes happen. Are there any earthquake faults in this park? (yes/no) If you don't know, ask a park employee.

The words below are scrambled. Can you figure out the geology words all mixed up below?

silsof \_\_\_\_\_

theruqkeaa \_\_\_\_\_

vcoolna \_\_\_\_\_

ckor \_\_\_\_\_

ylvlae \_\_\_\_\_

ounmiatn \_\_\_\_\_

gmaam \_\_\_\_\_

neousig \_\_\_\_\_

Hint: All of these words appear in this worksheet.

**You have finished! Good job!**

## More Than Just Rocks—Answer Key

The words below are scrambled. Can you figure out the geology words all mixed up below?

silsof= **Fossil**

theruqkeaa = **Earthquake**

vcoolna= **Volcano**

ckor = **Rock**

ylvlae= **Valley**

ounmiatn = **Mountain**

gmaam= **Magma**

neousig = **Igneous**





Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Museum Scavenger Hunt

As you walk throughout the museum, fill in the blanks and answer the questions to complete your scavenger hunt.

1. People through the years have used many different forms of transportation to travel. Draw a picture or write the name of your favorite form of transportation.

2. In this museum I saw pictures of people who lived in a \_\_\_\_\_ home.
3. Names of places and towns often mean something (example: Point Mugu is from the Chumash Indian word "muwu" which means beach). What is a place name you learned today? \_\_\_\_\_
4. Draw a picture of your favorite outfit you saw worn in the museum. Why was it important for the person to wear this style of clothing?

5. What was the main industry in this area? \_\_\_\_\_

Is this industry still in California? \_\_\_\_\_

6.  the box below if you saw an example of an animal that was over-hunted. Put two ✓'s in the box if that animal is no longer found in California.

7. Can you give an example that you found in the museum where people were not good stewards of the environment? (Good stewards are people who take responsibility for caring for something and using it wisely).

**You have finished!**





Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Park Animals

There are a million different types of animals in the world. Animals are exciting to study! You'll need a pencil or a pen to begin. When you have finished, bring this worksheet back to the entrance station or visitor center to receive a stamp in your logbook.

1. Have you seen any animals in the park today? (yes/no)  
If so, can you name them?

If you can't name them, look them up in the park's visitor center or in a guide book.

2. There are five senses: hearing, seeing, smelling, feeling, and tasting. Which sense do you think is sharpest in:  
Humans?  
  
Snakes?  
  
Bats?



3. Predators are animals that kill and eat other animals. Can you name a predator that lives in this park?
4. Predators usually kill the sick and weak animals of other species. Why is this important?
5. The biggest threat by humans to animals' survival is when we destroy their habitats (homes). Why does habitat destruction hurt animals?

6. Can you think of any reason why you have been asked not to touch or feed park animals?

7. What does it mean when we say a species is endangered?

8. Are there endangered species at this park? (yes/no)  
If so, what are they? And why are they endangered?

What can you do to help?

9. What does it mean when a species becomes extinct?

10. Why are places like this park important to animals?

11. Name your favorite animal that lives at this park.

12. Draw a picture of that animal below.



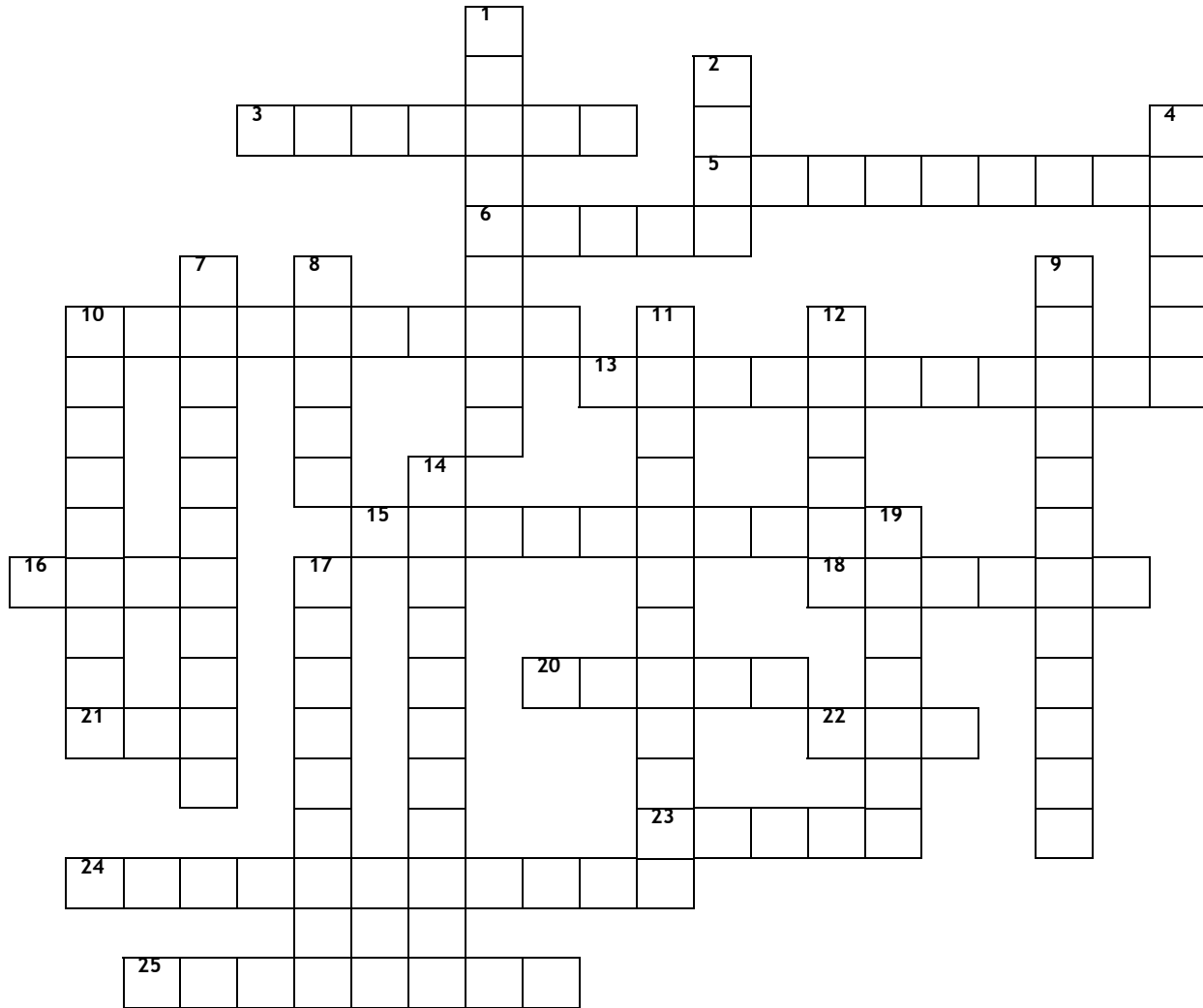
**You have finished!**



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Park Animals Crossword Puzzle

This crossword puzzle is all about animals! Look at the clues on the next page, and then look at the list of words under the puzzle to figure out the answers. Each word is used only one time. Good luck!



bald eagle  
wild burro  
hummingbird  
beaver  
mountain lion  
bullsnake  
raven

raccoon  
swallow  
elk  
porcupine  
hawk  
bats  
pocket mouse

rattlesnake  
mule deer  
golden eagle  
skunk  
woodpecker  
coyote

skink  
horned lizard  
black bear  
fox  
swift  
rabbit

## Park Animals Crossword Puzzle Clues

### ACROSS

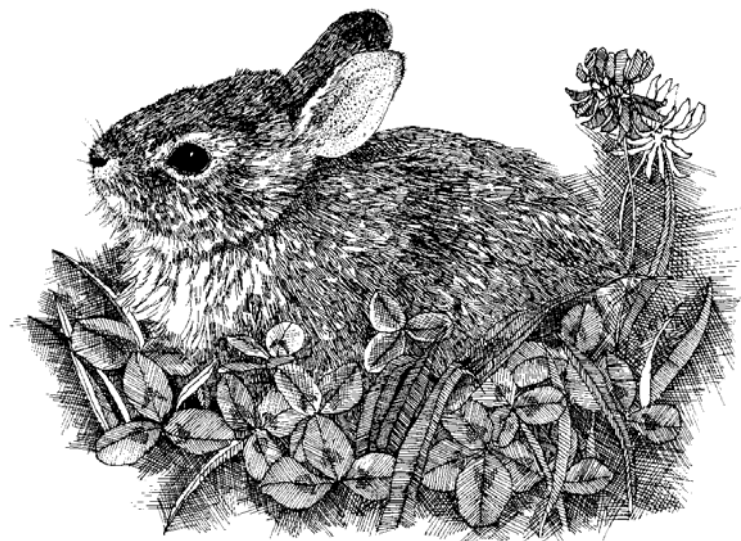
3. This is a slim, graceful bird and eats insects caught in flight. Clue: when you \_\_\_\_\_ your food, it goes to your stomach.
5. When the \_\_\_\_\_ was brought here by the Spanish, it was a tame animal. Today, it is no longer tame. It is a relative to the mule and the horse and can be found as a non-native exotic animal in some parks.
6. You know this animal by its not-so-pleasant smell and its black and white striped coat. The \_\_\_\_\_ eats mice, insects, eggs, and berries.
10. A relative of the grizzly bear, this is a smaller bear and not often seen. Though his coat is typically a brown color, his name is the opposite of "white." The \_\_\_\_\_ eats berries, nuts, insects, eggs, honey, and (unfortunately) garbage.
13. This is a small rodent that looks a little like a long-tailed hamster. Its first name rhymes with "rocket."
15. This colorful bird drills holes in trees with its bill.
16. \_\_\_\_\_ are the only truly flying mammals. They have very poor vision and catch insects by using a sort of built-in radar system.
18. Two examples of these small, soft-furred animals are the jack \_\_\_\_\_ and the cottontail \_\_\_\_\_.
20. This is a small bird, swallow-like in appearance. Flight is very quick, so its name is the \_\_\_\_\_.
21. The \_\_\_\_\_ is a hoofed mammal, and it is larger than mule deer. Usually seen in large herds, these animals can often be found in the mornings and evenings around watering holes.
22. This small, dog-like creature has a reputation for being clever and sly. It eats small animals, berries and fruits.
23. Often confused with a crow, this black bird is larger. Its call is a very distinctive "caw, caw."
24. The \_\_\_\_\_ is a very tiny bird with a long bill that it uses for getting nectar from flowers. Its wings are very difficult to see because they move so quickly when the bird is flying.
25. This deer is found in forests and meadows browsing on shrubs and twigs. It has a whitish rump and large ears.

### DOWN

1. Another name for this reptile is "gopher snake." Clue: could we call the female a "cow" snake?
2. The \_\_\_\_\_ is a hunting bird, usually smaller than an eagle. Two varieties of this bird are the Cooper's \_\_\_\_\_ and the red-tailed \_\_\_\_\_.

4. This creature looks like a small wolf. It is often heard at night howling at the moon.
7. This poisonous reptile is famous for the noisemaker at the end of its tail.
8. This slick-scaled lizard likes moist areas such as damp soil or a spring or stream. It lives under stones, logs, and boards.
9. A member of the cat family, this creature is not often seen. It preys on deer, rabbits, and mice. It is also called a cougar, puma, or panther.
10. This creature is the United States' national bird. Its white head keeps it from being confused with #14 down.
11. Although it looks like a toad, this creature is a lizard and usually lives in desert places. His nickname is "horny toad," and this reptile eats mostly ants.
12. This large rodent builds its house in ponds in the form of a dam. Because of this animal's hard work, we have the saying, "busy as a \_\_\_\_\_."
14. This dark bird's name comes from the flash of gold you can see on the back of its neck when this bird turns its head. This eagle eats mostly rabbits, rodents, and other small animals.
17. The \_\_\_\_\_ is the only North American mammal with long, sharp quills. This heavy-bodied, short-legged, clumsy creature may be seen in forests, sometimes high in a tree.
19. This animal is known for washing its dinner with its "hands" before eating. It has a black mask around its eyes, and a ringed tail.

**You have finished!**













Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Redwoods!

Large forests of redwoods once covered portions of Europe, Asia, and North America. Today only small areas of these forests remain. One region is in China where the smaller Dawn redwood lives. The other two areas are in California.

The world's tallest tree is located in Redwood National Park. It stands at 378 feet tall and is called the Hyperion.

California is also the home of the world's largest tree overall. Located in Sequoia National Park, the General Sherman Tree is 272 feet tall with a 36-foot diameter. That trunk is wider than a city street!

Fill in the blanks with the correct answers:

\_\_\_ \_ R \_\_\_ \_ \_\_\_ \_ V \_\_\_ \_ A

The mountainous area along California's eastern border where you can find the giant sequoia, *Sequoiadendron giganteum*, the world's largest tree. Sequoias can live to be 3,200 years old!

\_\_\_ \_ S \_\_\_ \_

Area of land near water where redwood trees can grow taller than a 25-story building. These trees are called *Sequoia sempervirens*.

\_\_\_ \_ L \_\_\_ \_ \_\_\_ \_ N \_\_\_ \_ \_\_\_ \_ W \_\_\_ \_ \_\_\_ \_

The official state tree, found in many Northern California state parks.

J \_\_\_ \_ \_\_\_ \_ D \_\_\_ \_ \_\_\_ \_ \_\_\_ \_ M \_\_\_ \_ \_\_\_ \_

This famous mountain man was one of the first Americans to cross the Sierra in 1827. One of our redwood state parks is named in honor of him.

\_\_\_ \_ G \_\_\_ \_ \_\_\_ \_ S \_\_\_ \_ \_\_\_ \_ \_\_\_ \_ D \_\_\_ \_ \_\_\_ \_ D \_\_\_ \_

Originally founded in 1902 as California Redwood Park, this is the oldest California state park.

Good work—you are finished!



## Redwoods!—Answer Key

Large forests of redwoods once covered portions of Europe, Asia, and North America. Today only small areas of these forests remain. One area is in China where the smaller Dawn redwood lives. The other two areas are in California.

The world's tallest tree is located in Redwood National Park. It stands at 378 feet tall and is called the Hyperion.

California is also the home of the world's largest tree overall. Located in Sequoia National Park, the General Sherman Tree is 272 feet tall with a 36-foot diameter. That trunk is wider than a city street!

Fill in the blanks with the correct answer:

### SIERRA NEVADA

The mountainous area along California's eastern border where you can find the giant sequoia, *Sequoiadendron giganteum*, the world's largest tree. Sequoias can live to be 3,200 years old!

### COAST

Area of land near water, where redwood trees can grow taller than a 25-story building. These trees are called *Sequoia sempervirens*.

### CALIFORNIA REDWOOD

The official state tree, found in many Northern California state parks.

### JEDEDIAH SMITH

This famous mountain man was one of the first Americans to cross the Sierra in 1827. One of our redwood state parks is named in honor of him.

### BIG BASIN REDWOODS

Originally founded in 1902 as California Redwood Park, this is the oldest California state park.





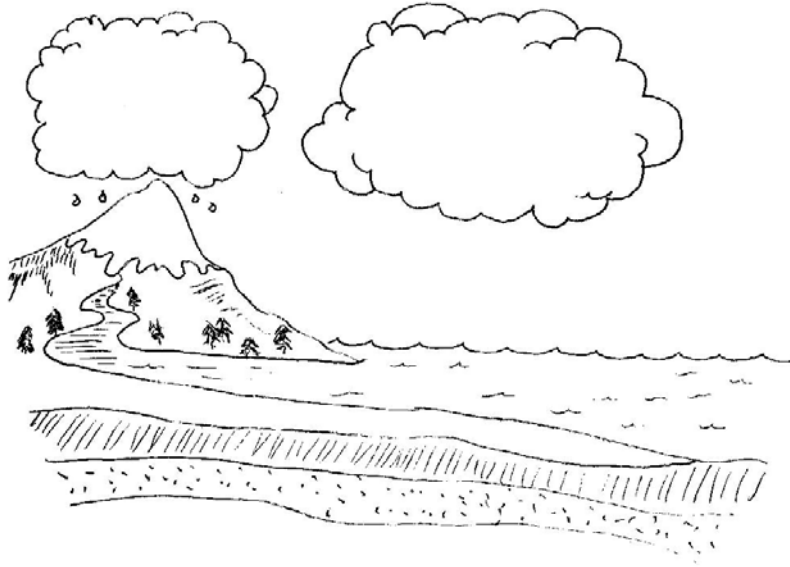
Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Water, Water Everywhere—Or Is It?

Water is all around. It is in oceans, lakes, and streams. It falls from the skies, and comes from faucets. Why is water important to us? You'll find out in this activity. When you have a pencil or a pen, you're ready to start!

1. What have you had to drink today?
2. Do those drinks contain water? (yes/no)
3. We should all try to drink 6-8 cups of liquid per day to keep our bodies functioning regularly. After all, our bodies are about 75% water! Do you drink 6-8 glasses of liquid each day? (yes/no)
4. Do animals other than humans need water? (yes/no).  
If so, what for?
5. Do plants need water? (yes/no)  
If so, what for?
6. Although it seems like there is water everywhere, there is actually a very limited amount of fresh water that is available to humans, plants, and animals. To ensure that there is enough fresh water, we need to conserve. Name three ways that you can conserve water.
  - 1) \_\_\_\_\_
  - 2) \_\_\_\_\_
  - 3) \_\_\_\_\_
7. Humans use water for more than just drinking. We use boats to travel in and to carry cargo on. We fish in lakes and streams. Companies use water to make the products they sell. List five other reasons why we need water.
  - 1) \_\_\_\_\_
  - 2) \_\_\_\_\_
  - 3) \_\_\_\_\_
  - 4) \_\_\_\_\_
  - 5) \_\_\_\_\_

8. The picture below represents the water cycle. Water travels in a never-ending circle from clouds to rain or snow, to rivers, streams, or lakes, to the ocean, where it then again becomes part of a cloud. The four parts of the water cycle are: evaporation, condensation, precipitation, and accumulation.



9. Snow is one example of precipitation. Can you name some other types of precipitation?

- 1) \_\_\_\_\_
- 2) \_\_\_\_\_
- 3) \_\_\_\_\_

10. Clouds are forms of condensation. For water to get from the surface of an ocean, a lake, or a stream to a cloud takes a process that is part of the water cycle. What is this process called?

Below are two water activities: a water word search and a secret message scramble. If you are 7-10 years old, try to find all of the words in the word search. If you are 11 years old or older, try to unscramble the words and uncover the secret message.



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Water Word Search

P	W	A	S	H	I	N	G	A	L
Q	E	B	M	E	D	R	I	Y	I
S	T	R	E	A	M	V	K	B	Q
O	S	P	I	F	N	U	C	I	U
P	E	G	T	U	B	K	L	C	I
A	Y	R	E	I	J	H	O	E	D
I	B	U	C	K	E	T	U	N	L
L	E	F	H	J	S	A	D	O	P
N	R	A	I	N	C	W	T	U	A
D	Q	P	H	L	E	A	K	D	E

stream  
liquid  
leak

bucket  
pail  
wet

cloud  
washing  
tub

rain  
ice

1. When I am not frozen I am a \_\_\_\_\_.
2. I am a miniature version of a river.
3. Water will \_\_\_\_\_ out of a hole in a cup.
4. At a beach water can be gathered in a \_\_\_\_\_.
5. I am larger than a pail.
6. When you jump in water you get \_\_\_\_\_.
7. Rain falls from me.
8. Water is used for \_\_\_\_\_ clothes.
9. To take a bath you fill this with water.
10. I am drops of water that fall from clouds.
11. I am frozen water.





## Water Word Search—Answer Key

P	W	A	S	H	I	N	G	A	L
Q	E	B	M	E	D	R	I	Y	I
S	T	R	E	A	M	V	K	B	Q
O	S	P	I	F	N	U	C	I	U
P	E	G	T	U	B	K	L	C	I
A	Y	R	E	I	J	H	O	E	D
I	B	U	C	K	E	T	U	N	L
L	E	F	H	J	S	A	D	O	P
N	R	A	I	N	C	W	T	U	A
D	Q	P	H	L	E	A	K	D	E

stream  
liquid  
leak

bucket  
pail  
wet

cloud  
washing  
tub

rain  
ice

1. When I am not frozen I am a \_\_\_\_\_. liquid
2. I am a miniature version of a river. stream
3. Water will \_\_\_\_\_ out of a hole in a cup. leak
4. At a beach water can be gathered in a \_\_\_\_\_. pail
5. I am larger than a pail. bucket
6. When you jump in water you get \_\_\_\_\_. wet
7. Rain falls from me. cloud
8. Water is used for \_\_\_\_\_ clothes. washing
9. To take a bath you fill this with water. tub
10. I am drops of water that fall from clouds. rain
11. I am frozen water. ice





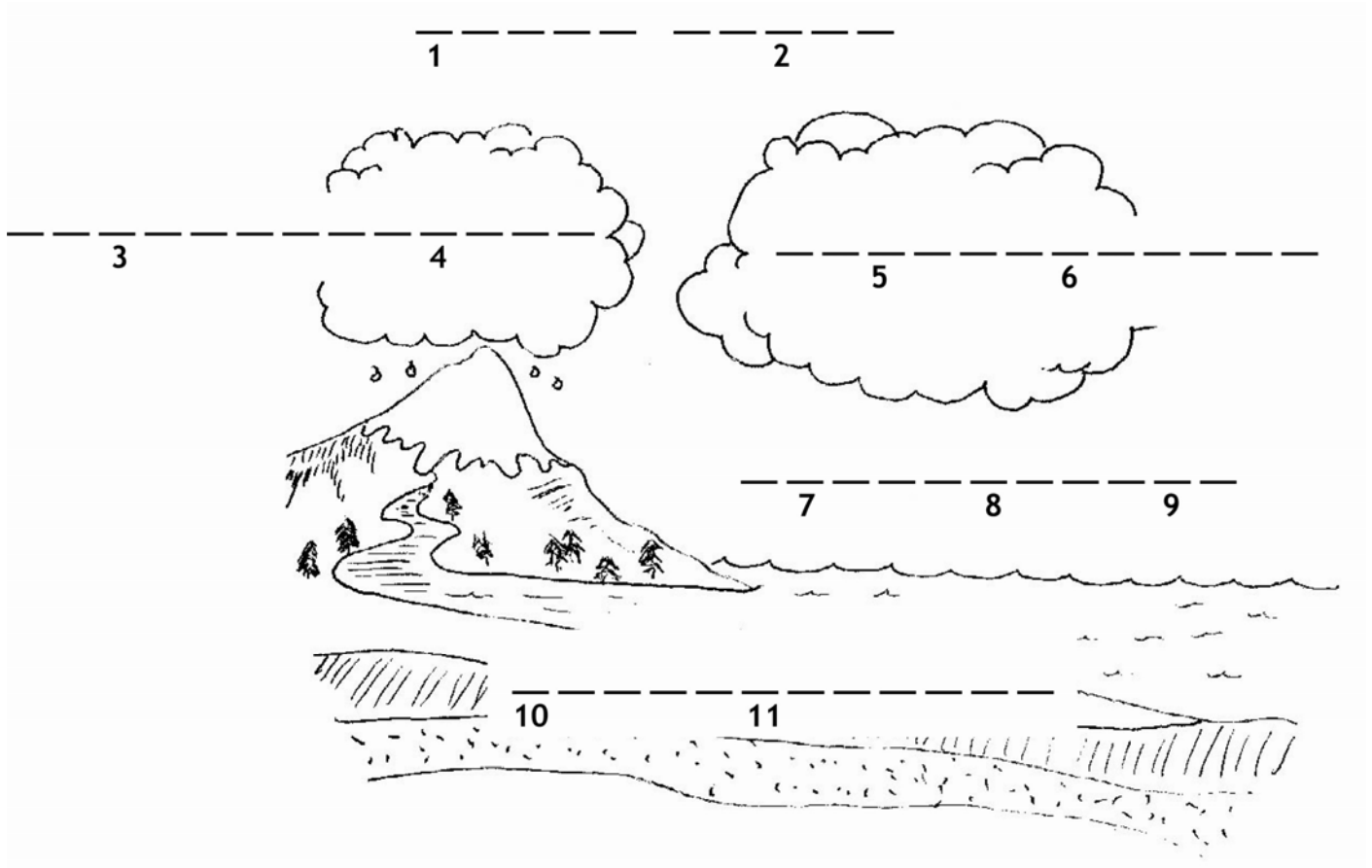
# JUNIOR RANGERS



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Water Secret Message Unscramble

Hint: All of the words to unscramble are found in the worksheet.



$\overline{1}$   $\overline{10}$   $\overline{6}$   $\overline{4}$   $\overline{3}$        $\overline{5}$   $\overline{9}$   $\overline{4}$  ,       $\overline{1}$   $\overline{10}$   $\overline{5}$   $\overline{4}$        $\overline{5}$   $\overline{9}$   $\overline{4}$  ,  
 $\overline{2}$   $\overline{9}$   $\overline{5}$   $\overline{6}$   $\overline{3}$   $\overline{8}$   $\overline{7}$   $\overline{3}$        $\overline{9}$   $\overline{11}$   $\overline{8}$        $\overline{1}$   $\overline{10}$   $\overline{4}$   $\overline{3}$   $\overline{8}$









Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Weather and Climate

Weather is a part of our lives every day. Sometimes the weather surprises us, and we have to adjust to it. To find out more about weather, get a pencil or pen, and start!

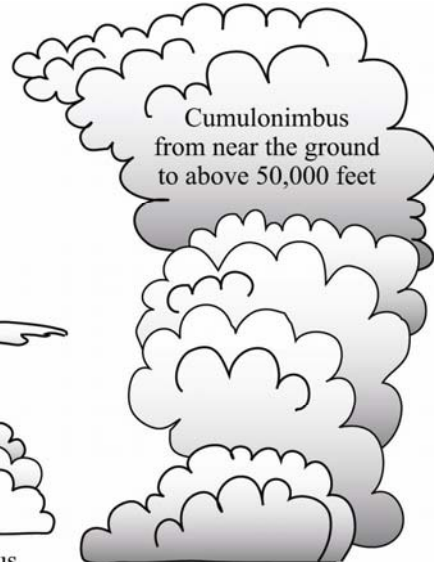
1. Describe the weather conditions outside today.
2. Did you consider the weather today when you picked out what you are wearing? (yes/no)
3. What is normal body temperature for humans?
4. Describe how your body feels when you get too hot.
5. When a person gets much too hot, that condition is called hyperthermia (hyper = high, thermia = temperature). How can you prevent getting too hot?
6. Describe what your body feels like when you get too cold.
7. When a person gets too cold, that condition is called hypothermia (hypo = low, thermia = temperature). How can you prevent getting too cold?
8. Are there any clouds today? If so, circle the types of clouds you see below.



Cirrocumulus  
(mackerel sky)  
above 18,000 feet



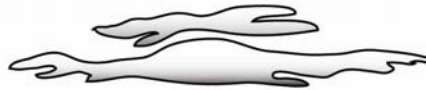
Cirrus  
above 18,000 feet



Cumulonimbus  
from near the ground  
to above 50,000 feet



Altostratus  
6,000 - 20,000 feet



Altostratus  
6,000 - 20,000 feet



Stratocumulus  
below 6,000 feet



Stratus  
below 6,000 feet



Cumulus  
below 6,000 feet

9. Cumulonimbus clouds are often called “thunderclouds” because they signify that heavy rains and thunderstorms are likely. Should you stand under a lone tree during a thunderstorm? (yes/no)
10. Are you safe in the car during a thunderstorm? (yes/no).
10. Does the park you are in get a lot of rain? (yes/no).
11. What type of climate does this park have? Is it dry? Is it moist? Is it hot, or cool?
12. Do you think it snows at the park you are in? (yes/no)

Some of those questions were tough! Here's some information you can use to fill in any answers you didn't know.

**Hyperthermia** is when your body gets too hot! First you sweat a lot, then your temperature will go above your normal body temperature (about 98.6 degrees). To make sure you avoid hypothermia, drink lots of water on a hot day, especially if you are hiking or doing any other kind of exercise. Wear a hat in the sun, and rest in the shade if you feel shaky, hot, or tired.

**Hypothermia** is when your body gets too cold. Your body temperature will drop below 98.6 degrees, you will begin to shiver, and your skin will get very pale. This happens because your blood is trying to keep your insides (like your heart and lungs) warm. To avoid hypothermia, make sure to bring lots of warm clothing with you when you will be outside. Even if it looks like it will be a warm day, the best idea is to bring several layers of clothing with you (for example, an extra shirt, a sweater, a windbreaker, and/or a jacket). Then, if it gets too hot, you can tie the extra clothes around your waist.

**Lightning**, although it can be dangerous, rarely hurts anyone. You just have to be careful. The worst places to be during a lightning storm are under the tallest objects, since lightning tends to strike the tallest thing in the area. You should not touch metal objects during a lightning storm, because if the object got hit by lightning, you would get shocked. Cars, though, are safe. Although you are surrounded by metal, you aren't usually touching metal inside the car (seats, dashboards, etc. are usually made out of cloth, plastic, vinyl, or leather).

**You have finished!**





Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Jobs in Parks

Park employees have an important job: they take care of the places that have special scenic or historic value in California. See how many different jobs you can observe while you are at the park!

1. Watch an employee of this park as that person works, and answer the following questions.

Make a check mark beside the special skills that the employee needs to do his or her work.

\_\_\_\_\_ Strong muscle

\_\_\_\_\_ Safe use of equipment

\_\_\_\_\_ A smile

\_\_\_\_\_ Swimming

\_\_\_\_\_ Speaking

\_\_\_\_\_ Other skills? Please list below

\_\_\_\_\_ Counting money

\_\_\_\_\_ First aid

\_\_\_\_\_ Knowledge of plants, animals, or history

\_\_\_\_\_ Knowledge of park rules/safety

2. Safety is important in our parks to both employees and visitors. One way to play and work safely in the sun is to wear a hat and use sunscreen. Write down three other things you can do to have a safe visit in the park.

1.

2.

3.

3. State parks hire many people with different talents. List two talents or abilities you have that would help you if you worked in this park.

1.

2.

4. Draw a picture to show you doing the job of a park employee. Show in the picture whether you think this job would be fun to do or not.



**Good work!**



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Working in Parks

California's state parks depend on many people to help them function smoothly. Learn about different state park careers as you complete this crossword puzzle. Use the following clues:

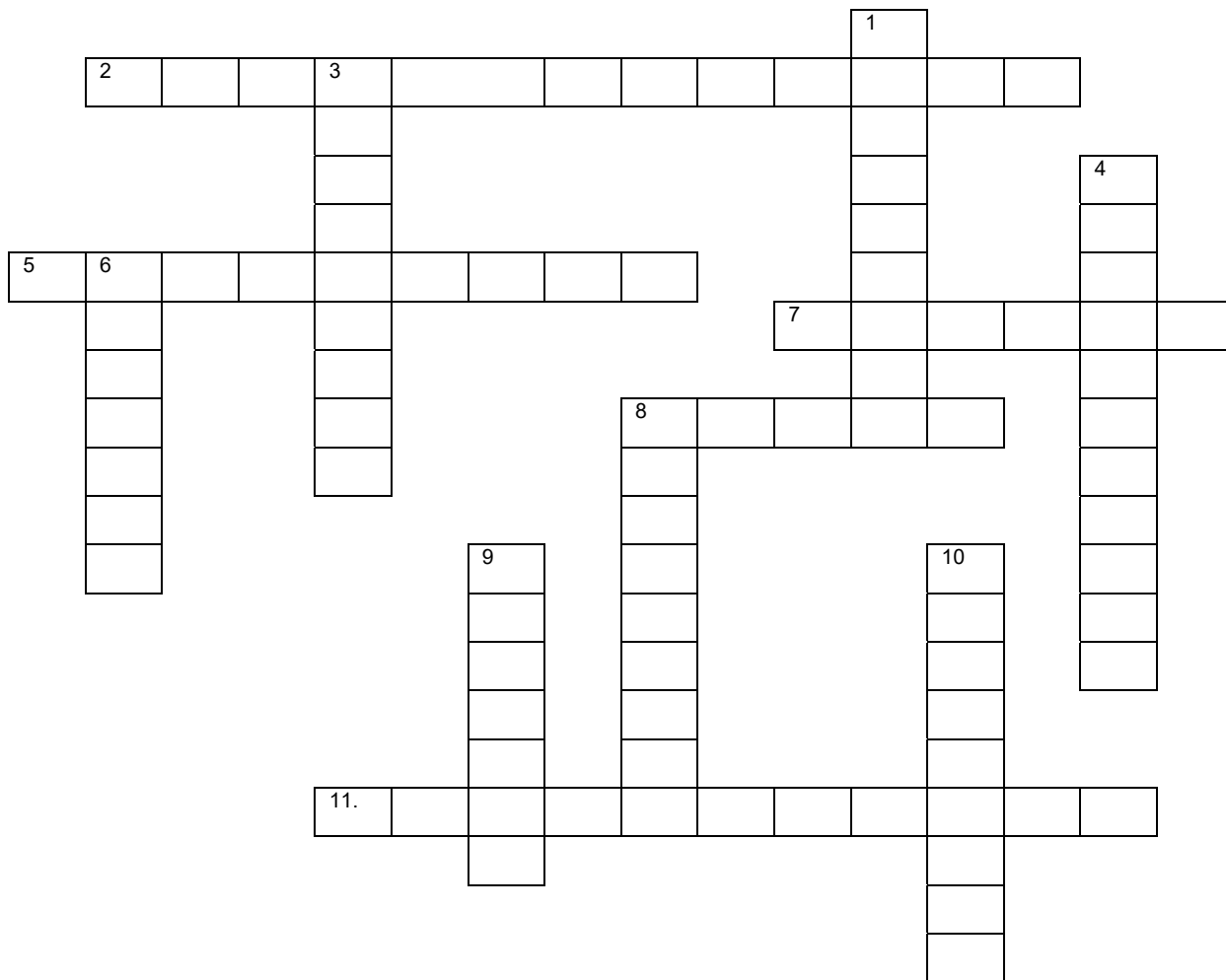
### ACROSS

2. My job involves carefully digging in the dirt to find artifacts that tell me about other people.
5. A Resource \_\_\_\_\_ works to protect, restore, and maintain the natural resources in state parks.
7. Even though I wear a badge, I also do interpretation and resource management.
8. I explain exhibits and historic objects to the public during a tour.
11. As a \_\_\_\_\_ Worker, I keep park buildings, campgrounds, roads and trails in good condition.

### DOWN

1. I rescue people who are in trouble in the water.
3. History is my job. Who am I?
4. I work to make connections between the interests of the audience and the park resources.
6. As a Museum \_\_\_\_ I take care of artifacts that are used in exhibits to tell the history of the park.
8. Rocks are fascinating to me.
9. As an \_\_\_\_\_ Designer, I create educational and interpretive displays using photographs, text, and artifacts.
10. I build buildings and structures for parks.

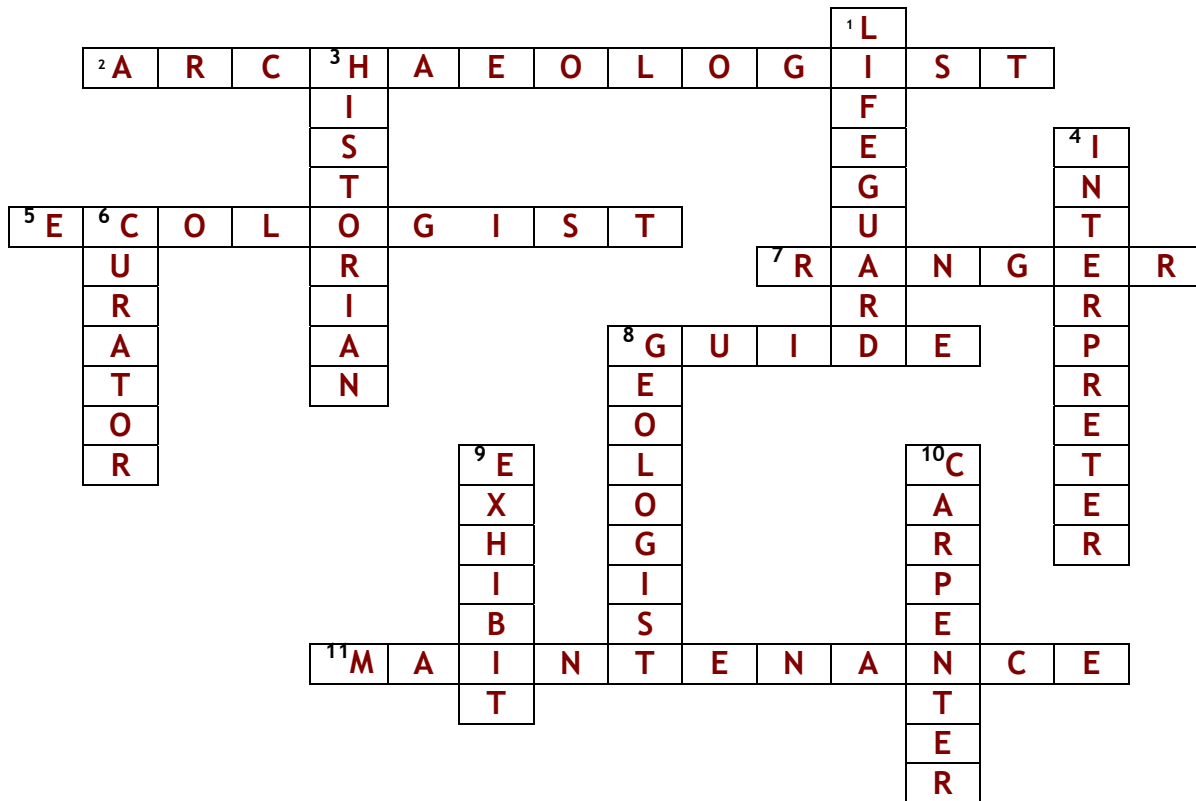
# Working in Parks Crossword Puzzle



- |               |           |             |           |             |           |
|---------------|-----------|-------------|-----------|-------------|-----------|
| Archaeologist | Carpenter | Curator     | Ecologist | Exhibit     | Geologist |
| Guide         | Historian | Interpreter | Lifeguard | Maintenance | Ranger    |

**Good work—you are finished!**

# Working in Parks—Answer Key



## Across

- My job involves carefully digging in the dirt to find artifacts that tell me about other people.  
**Archaeologist**
- A Resource \_\_\_\_\_ works to protect, restore, and maintain the natural resources in state parks.  
**Ecologist**
- Even though I wear a badge, I also do interpretation and resource management. **Ranger**
- I explain exhibits and historic objects to the public during a tour.  
**Guide**
- As a \_\_\_\_\_ Worker, I keep park buildings, campgrounds, roads and trails in good condition.  
**Maintenance**

## Down

- I rescue people who are in trouble in the water. **Lifeguard**
- History is my job. Who am I?  
**Historian**
- I work to make connections between the interests of the audience and the park resources.  
**Interpreter**
- As a Museum \_\_\_\_ I take care of artifacts that are used in exhibits to tell the history of the park.  
**Curator**
- Rocks are fascinating to me.  
**Geologist**
- As an \_\_\_\_\_ Designer, I create educational and interpretive displays using photographs, text, and artifacts. **Exhibit**
- I build buildings and structures for parks. **Carpenter**



# Appendix B: Directed Activity Handouts

Each chapter of the handbook contains sample programs and directed activities related to the topic. Some activities have a corresponding handout. Those handouts are located in this Appendix for ease of reproduction for programs.

<b>Handout</b>	<b>Program Title</b>	<b>Page Number</b>
<i>Bats Eat Bugs Song</i>	Junior Cub Sample Program	2-18
<i>Animal Tracks</i>	Animal Tracks	3-10
<i>Cross Cultures List</i>	Sample Program: California Indians	4-4
<i>Song: There Once Was a Daisy</i>	Sample Program: Energy	6-4
<i>Lanternfish Pattern</i>	Schooling Fish	13-8
<i>Determination of Wind Speed</i>	Sample Program: Weather & Climate	14-3









Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Bats Eat Bugs Song<sup>1</sup>

### Chorus:

Bats eat bugs, they don't eat people.  
Bats eat bugs, they don't fly in your hair.  
Bats eat bugs, they eat insects for dinner,  
That's why they're flyin' up there.

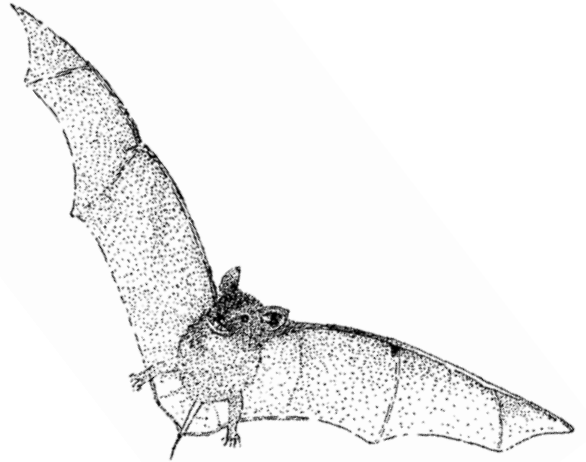
Coyotes eat rabbits, they don't eat people.  
Coyotes eat rabbits, 'cause you're too big to bite.  
Coyotes eat rabbits, they eat bunnies for dinner,  
That's why they're out in the night.

Snakes eat mice, they don't eat people.  
Snakes eat mice, that's why they crawl on the ground.  
Snakes eat mice, 'cause you're too big to swallow,  
So they don't want you hangin' around.

Bears eat berries, they don't eat people.  
Bears eat berries, they won't eat you and me.  
Bears eat berries, and they'll steal your dinner,  
So you best hang it up in a tree.

Nothing out there wants to eat you.  
Nothing out there wants to make you its meal.  
Nothing out there wants to have you for dinner,  
'Cause they know just how sick they would feel.

### Chorus



---

<sup>1</sup> Song by Steve Van Zandt and the Banana Slug String Band. *Dirt Made My Lunch*. [Cassette tape, 1988].





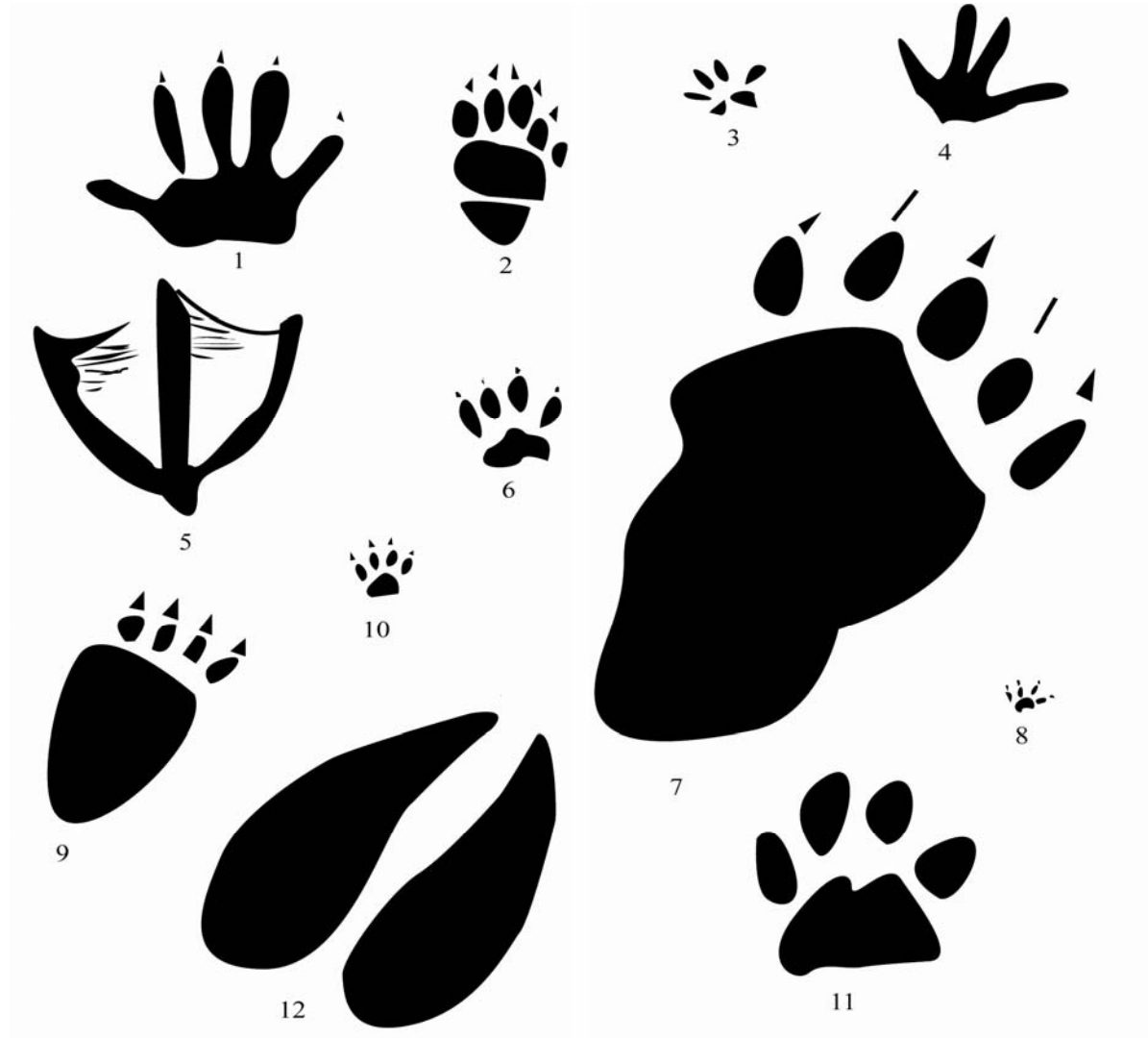
# JUNIOR RANGERS



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Animal Tracks

Which tracks belong to which animals? (Answers below)



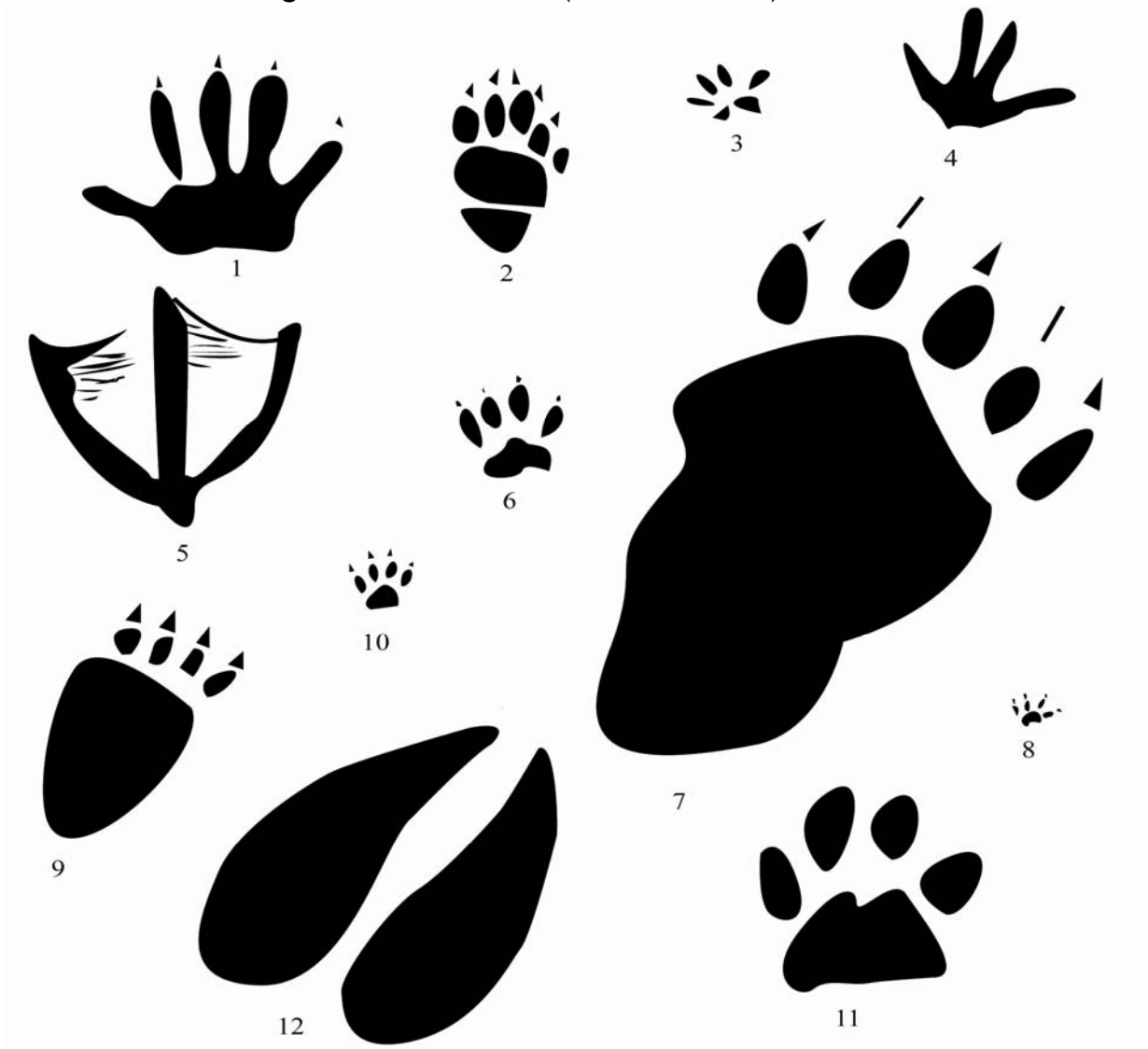
- \_\_\_ Rat
- \_\_\_ Mule Deer
- \_\_\_ Black Bear
- \_\_\_ Mouse
- \_\_\_ Bobcat
- \_\_\_ Skunk

- \_\_\_ Chipmunk
- \_\_\_ Duck
- \_\_\_ Raccoon
- \_\_\_ Muskrat
- \_\_\_ Porcupine
- \_\_\_ Weasel



## Animal Tracks—Answer Key

Which tracks belong to which animals? (Answers below)



  3\_ Rat

  12\_ Mule Deer

  7\_ Black Bear

  8\_ Mouse

  11\_ Bobcat

  2\_ Skunk

  10\_ Chipmunk

  5\_ Duck

  1\_ Raccoon

  4\_ Muskrat

  9\_ Porcupine

  6\_ Weasel





Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Cross Culture List

California Indians found everything they needed in nature. Can you guess which Indian materials were used in place of our contemporary items? Try to match what we use to what the California Indians used. Some things have more than one use.

### Contemporary Items

\_\_\_ Money

\_\_\_ Baseball Cards

\_\_\_ Insect Repellent

\_\_\_ Glue

\_\_\_ Tea

\_\_\_ Soap

\_\_\_ Aspirin

\_\_\_ Rug

\_\_\_ Matches

\_\_\_ Tooth Brush

\_\_\_ Blender

\_\_\_ Drill

\_\_\_ Earrings

\_\_\_ Vitamin C

\_\_\_ Graffiti

### California Indian Materials

1. Feathers as Trade

2. Clamshell Discs

3. Petroglyphs/Pictographs

4. Willow Bark

5. Bone Awl

6. Tule Mat

7. Yerba Santa Leaves

8. Men's Ear Plug

9. Pine Pitch

10. Bay Leaves

11. Rose Hips

12. Ceanothus Leaves

13. Fire Starting Kit

14. Peeled Dogwood Twigs

15. Mortar and Pestle







## Cross Culture List—Answer Key

California Indians found everything they needed in nature. Can you guess which Indian materials were used in place of our contemporary items? Try to match what we use to what the California Indians used. Some things have more than one use.

### Contemporary Items

**\_2\_** Money

**\_1\_** Baseball Cards

**\_10\_** Insect Repellent

**\_9\_** Glue

**\_7\_** Tea

**\_12\_** Soap

**\_4\_** Aspirin

**\_6\_** Rug

**\_13\_** Matches

**\_14\_** Tooth Brush

**\_15\_** Blender

**\_5\_** Drill

**\_8\_** Earrings

**\_11\_** Vitamin C

**\_3\_** Graffiti

### California Indian Materials

1. Feathers as Trade

2. Clamshell Discs

3. Petroglyphs/Pictographs

4. Willow Bark

5. Bone Awl

6. Tule Mat

7. Yerba Santa Leaves

8. Men's Ear Plug

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13. Fire Starting Kit

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15. Mortar and Pestle







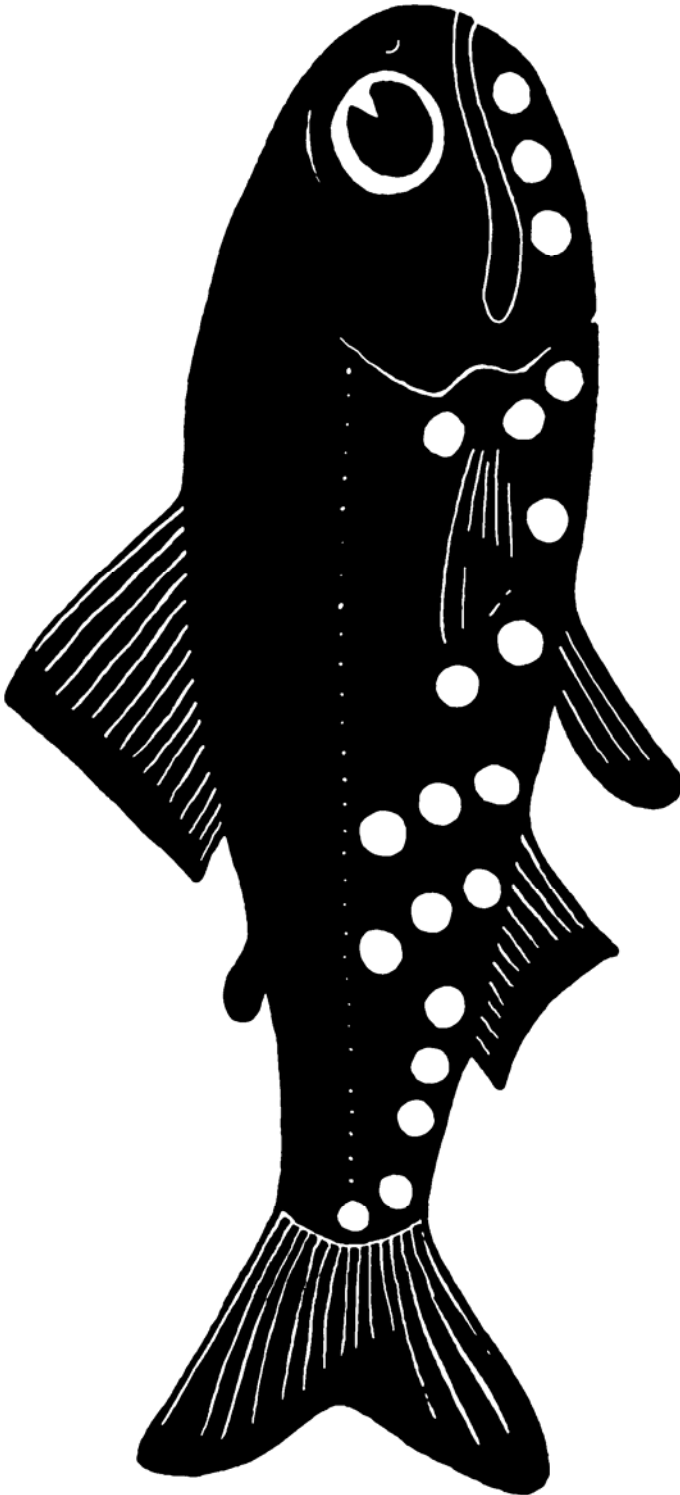
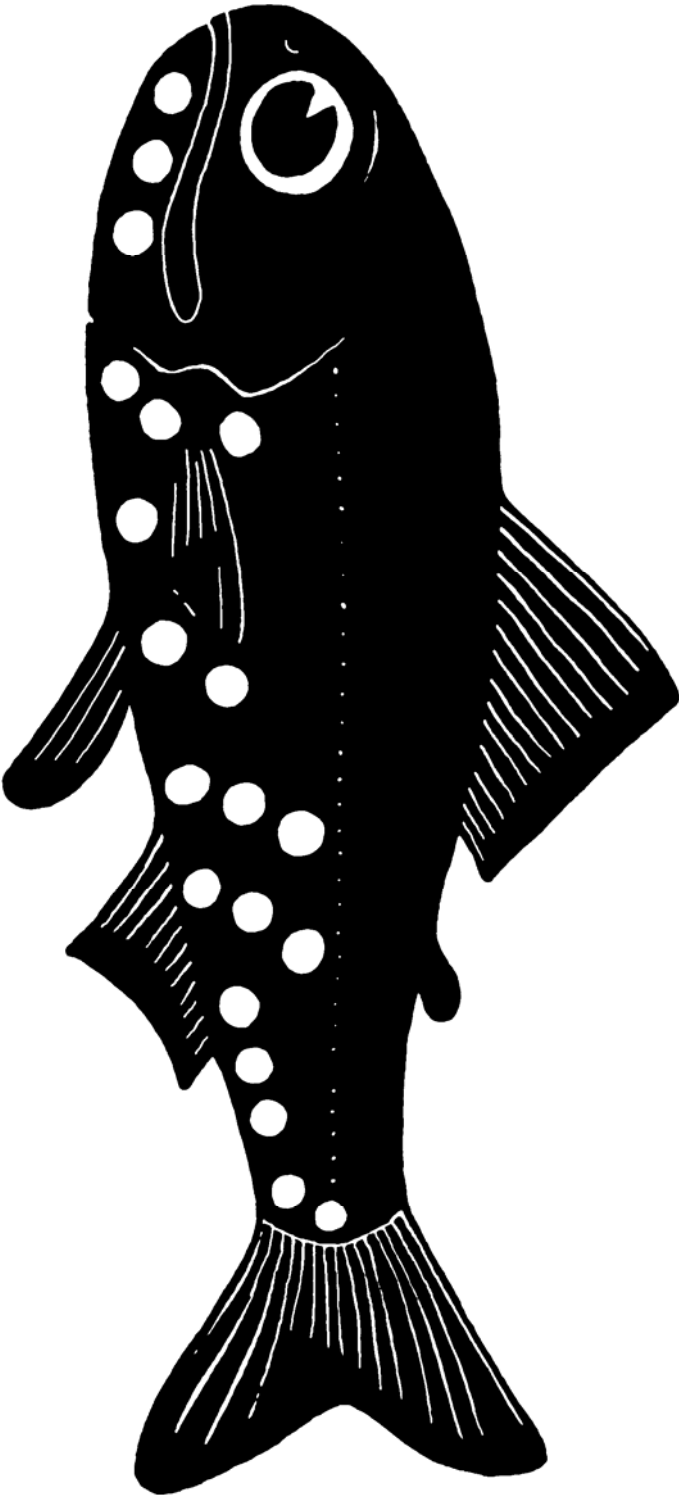
Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Determination of Wind Speed

Wind Speed (Miles per Hour)	Description of Effects
Under 1	Smoke from a fire rises straight up; no perceptible motion of anything.
1-3	Smoke drift shows direction; tree leaves barely move; wind vane shows no direction.
4-7	Leaves rustle slightly; wind felt on face; ordinary weather vane moved by wind.
8-12	Leaves and twigs move; loose paper and dust raised from the ground.
13-18	Small branches are moved; dust and paper raised and driven along. Good beginner windsurfer speed.
19-24	Small trees sway; large branches in motion; dust clouds raised. Good speed for more advanced windsurfers.
25-31	Large branches move continuously; wind begins to whistle; umbrellas used with difficulty.
32-38	Whole trees in motion; walking difficult.
39-46	Tree twigs break; walking progress slow.
47-54	Slight structural damage.
55-63	Exposed trees uprooted; heavy structural damage.
64-75	Widespread damage.
Above 75	Severe damage and destruction.



Schooling Fish Cutouts







# JUNIOR RANGERS



Name: \_\_\_\_\_ Park: \_\_\_\_\_ Date: \_\_\_\_\_

## Song: There Once Was a Daisy

(sung to the tune of "There was an Old Lady who Swallowed a Fly")

Daisy Team      There once was a daisy that grew on a plain,  
Where the sun helped it grow, and so did the rain-  
Links in a food chain.

All  
Bug Team      There once was a bug who nibbled on flowers,  
Nibbled on flowers for hours and hours!

Daisy Team      The bug ate the daisy that grew on the plain,  
Where the sun helped it grow, and so did the rain-  
Links in a food chain.

All  
Wren Team      There once was a wren who gobbled up bugs,  
And creepies and crawlies and slimies and slugs.

Bug Team      There once was a bug who nibbled on flowers,  
Nibbled on flowers for hours and hours!

Daisy Team      The bug ate the daisy that grew on the plain,  
Where the sun helped it grow, and so did the rain-  
Links in a food chain.

All  
Snake Team      There once was a snake who often grabbed birds,  
And swallowed them whole, or so I have heard.

Wren Team      There once was a wren who gobbled up bugs,  
And creepies and crawlies and slimies and slugs.

Bug Team      There once was a bug who nibbled on flowers,  
Nibbled on flowers for hours and hours!

Daisy Team      The bug ate the daisy that grew on the plain,  
Where the sun helped it grow, and so did the rain-  
Links in a food chain.

All  
Fox Team      There once was a fox, and I'll make a bet:  
He'd eat anything he could possibly get.

Snake Team      There once was a snake who often grabbed birds,  
And swallowed them whole, or so I have heard.

Wren Team      There once was a wren who gobbled up bugs,  
And creepies and crawlies and slimies and slugs.

Bug Team      There once was a bug who nibbled on flowers,  
Nibbled on flowers for hours and hours!

Daisy Team      The bug ate the daisy that grew on the plain,  
Where the sun helped it grow, and so did the rain-  
Links in a food chain.

All  
Last Verse  
Team      The fox, he grew older and died one spring day,  
But he made the soil rich when he rotted away.  
A new daisy grew where he died on the plain.  
The sun helped it grow, and so did the rain-  
Links in a food chain.

All







## Appendix C: Additional Program Information

As additional information is developed by Department staff on topics related to their areas of expertise, this appendix will be used to provide more detailed information about the various programs areas discussed in the main chapters of this handbook.

### Park Careers: Archaeology



#### Introduction

Saying the word “archaeology” can arouse a child’s imagination, conjuring up images of roaming dinosaurs, ancient fossils, and even Indiana Jones leaping across a pit of snakes. While all of these representations about the discipline are entirely false, archaeology is still one of the most exciting and inspiring Junior Ranger topics to participate in. This is a great opportunity to remove any fictitious and popular misconceptions about the subject and help instill in children a conservation ethic that will help preserve and manage cultural resources for future generations.

Park staff conducting Junior Ranger programs can emphasize many different topics related to archaeology in California State Parks. Out of the 278 state park units, 235 of them contain cultural resources of one type or another, so the probability is very high that a Junior Ranger program will take place in a park with a rich collection of archaeological resources and/or historic structures. Whether it is an archaeological site, a historic building, a cultural preserve, or a historic landmark, State Parks preserves California’s rich heritage and employs a staff of archaeologists, historians, and curators to help achieve this mission.

An important emphasis while interpreting this subject is to clearly define the role, actions, and responsibilities of archaeologists. Archaeologists do not study dinosaurs and fossils, which paleontologists specialize in, nor are they treasure hunters. Rather, archaeologists study how humans lived in the past by looking at material remains left behind by different cultures. They do this using various scientific techniques including surveying, excavation, and research. Archaeology reinforces the concept of a shared human heritage and provides people today with perspectives on their own place and time in history.

All prehistoric archaeological sites are very sacred and important to related California Indian tribes. Teaching young children about archaeology can also instill in them a respect for other people's beliefs, history and the natural environment.

The great thing about this subject is that archaeology tends to borrow from many disciplines (i.e., history, California Indian studies, geography, geology, environmental studies and math); therefore, the staff conducting Junior Ranger programs can relate many topics at once. Archaeologists do not claim to have the one and only view to the past and rely on California Indian groups, specialists from all disciplines, and the public when they draw their reconstructions.

Many topics related to archaeology like California Indians and History are already covered by the Junior Ranger Program. This chapter focuses more on archaeology as a discipline with regards to the stewardship roles of archaeologists, their ethics, and the diverse interests in the past that they explore.

## Interesting California Archaeology Facts

- 235 of the 278 park units in California State Parks contain significant cultural resource features.
- California State Parks is responsible for 1 million museum objects, more than 3 million archival documents, and 2 million archaeological specimens.
- At the time early Spanish settlers arrived in California, it is estimated that there were as many as 300,000 Indians present.
- The bedrock mortar at Indian Grinding Rock SHP is one of the largest in the state with at least 1,185 mortars and 363 petroglyphs present.
- The only preserved remnant of a Chumash canoe came from an archaeological site on State Park lands.
- Sumeg Village at Patrick's Point SP is a reconstructed Yurok village that was built in cooperation with the Yurok Tribe.
- The cultural heritage of California begins no less than 12,000 years ago.
- California archaeology is not just all prehistory, but also includes Spanish exploration and the establishment of the Missions, Russian expansionism, the Mexican Rancharo or "Californio" period, the Gold Rush and the 49ers, and the agricultural, urban, and industrial developments of the 19th and early 20th centuries.

## Basic Information

Be able to answer the following questions for the Junior Rangers:

- How many archaeological sites exist in your state park?
- What California Indians are represented in your area?
- How many archaeologists work for State Parks? Do any work for your particular district or sector?

Also, feel free to read the “background information” section as it provides a brief examination of archaeology, its techniques and practices, and its ethics.

## Sample Program

### I. Introduction

Introduce yourself.  
Introduce the Junior Ranger Program.

### II. Objectives

Today we are going to learn about archaeology in California and this particular park. We are going to take a trip back through time and explain the history under your very feet. Every archaeological site or historic building talks, telling a story about the people who created it and lived there. Archaeology is the study of people in the past and not about dinosaurs, fossils, or other resources studied by paleontologists.

### III. Focus the group

- A. To get the group in the mood think about what would it be like to be an archaeologist. Who are archaeologists, what do they do, and how do they work?
- B. Archaeology is the study about what people did in the past by looking at artifacts and sites as well as the relationships between them. Future archaeologists will study us and the artifacts that we leave behind. Maybe one day your house, room, even trash will become artifacts and an archaeologist will learn about you and the world you lived in.
- C. If possible, show replicas of artifacts. If hand-on museum collections are available in your area, those are great.

### IV. Inquiry/Discussion

#### A. Activity

1. First, have a bag of “artifacts” with describable objects that the Junior Rangers can handle and look at. These items can be museum replicas, or everyday objects found at a local store (good examples of store goods are plastic items like insects, balls, rings, etc.). The important thing is to have a unique item for each participant to hold on to for the entire program.
2. Next, ask the following questions: Do you think archaeology is important? Why are archaeological sites important?
3. Then, pass out an “artifact” for every response—one “artifact” per child. Every Junior Ranger should have one “artifact” at the end of the activity, so make sure that even the shy or younger children receive an “artifact.” This will be important during the session.

#### B. Interpreting archaeological clues:

1. What kind of artifacts do you think archaeologists find in sites?

## *Junior Ranger Program Handbook: Appendices*

2. Do you think items like baskets or clothing would be preserved in archaeological sites? What about wooden objects? What about stone or objects made from shell? What about a plastic button, a glass bottle, or a coin?
  3. Certain places like pine tree forests tend to have very acidic soils. These soils tend to disintegrate organic items like baskets, wood, and clothing, so by the time archaeologists get to look at the site, these items no longer remain.
  4. Now, let's look at our artifacts that were handed out earlier. What kinds of material do we have here? Which artifacts might preserve better than others—which artifacts might archaeologists locate 10 years from now? 50 years from now? 100 years from now? Over 100 years from now?
- D. How do archaeologists interpret that past?
1. Clearly, not everything people made in the past survives for archaeologists to find.
  2. Can you imagine trying to put a puzzle together with missing puzzle pieces? Archaeologists realize that the artifacts they uncover piece together only a portion of the puzzle. Therefore, they have to infer what the missing pieces might have looked like.
  3. Let's say, an archaeologist finds a bone awl in an archaeological deposit. Awls were used to make basketry and baskets were normally made by women. So an archaeologist would infer that women were present at the site making baskets even though the baskets no longer remain.
  4. What would an archaeologist infer if they found a projectile point? What about a shell bead or a piece of groundstone? What about a coin with a date of 1936?
  5. Activity: What story do your artifacts tell?  
Use the artifact passed out at the beginning of the program to help answer these questions.
    - a. Are there any time defining objects? (What time period does the sample represent? A coin with a date helps.)
    - b. What kind of people were present? (How old were the people, old or young, or a mix of ages? How many people were there?)
    - c. Are there any habitation objects? (Were these people living in a house, or camping out on vacation?)
    - d. Let the items tell the story. Every group of children might interpret the same artifacts differently.
- E. Diverse Interests:
1. Do you think archaeologists are the only people who can interpret the past? What about historians, biologists, and Native Americans?
  2. Everyone can interpret the past differently. Some people use history books or old photographs to define the past, whereas other people use oral stories to retell their history.
  3. Activity: Read a creation story from a California Indian tribe in your area; if no story is available, select any Indian creation story to read.

V. Application/Conclusions

A. Preserving Archaeological Sites:

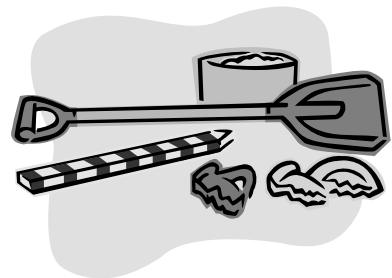
1. Do you think it is important to preserve archaeological sites? Why? Each archaeological site has a unique story to tell, like individual fingerprints across the landscape. When one is lost, a piece of the puzzle is lost forever.
2. What would you do if you found what you thought might be an archaeological artifact? Would you bring it back to show a State Park employee? It is very important when an artifact is found that it is left in its original place until an archaeologist can look at it. If it is moved, all information that could be gathered from the object and its surroundings will be lost. The best thing to do when coming across artifacts is to do what archaeologists do. They record the artifact by taking photos and plot the location on a map. If a map is not available, simply count your paces from the artifact to the nearest identifiable location, i.e. a restroom, a trail marker, etc. Then tell a parks person or leave them a note at the park's kiosk. This allows them to relocate the artifact, and archaeologists can be consulted to see what kind of preservation efforts need to be taken.
4. Do you think archaeologists can dig wherever they want? Archaeologists need to get permission from landowners before they dig. There are also many State and Federal Laws that not only protect archaeological resources but set guidelines that archaeologists must follow while they dig.
5. Would you like a person digging in your backyard or campsite without your permission? Why is this offensive? Archaeologists must also consult (or talk) with Native American groups before they excavate because many projects tend to take place in these groups ancestral "backyard."
6. Do you think archaeologists excavate randomly? California State Parks protects thousands of archaeological sites and recognizes these sites as non-renewable resources. Basically, what this means is that once an archaeological site is destroyed, there is no way to get it back again. So archaeologists only excavate sites as a last resort.

B Let's face it, archaeologists have to get DIRTY! . . .

1. If there is enough time and resources, do the Archaeological Dig Activity (see activity section below).

## Suggested Program Aids

Artifact replicas, hands-on museum replicas or artifacts are great. If you cannot locate these materials, feel free to contact the Cultural Heritage Section of the Archaeology, History & Museums Division for more information. The location of archaeological sites is confidential and should not be distributed to the public.



## Activities/Games

### Charades

Number of children: 5 or more

Environment: Open space

Equipment Needed: None

Purpose of Activity: To learn about archaeology tools, artifacts and other associated terms

Activity:

Here's an old favorite that most people will know, but keep the theme archaeological. Fill a bucket with slips of paper on which are written archaeological terms and definitions such as trowel, measuring tape, trench, pottery, dig, and artifact. Or you might want the theme to be cultural and include words and ideas relevant to the particular culture you are teaching.

### Estimation Game

Number of children: 2 or more

Environment: Open space

Equipment Needed: metric measuring tape

Purpose of Activity: To understand how to use the metric system in measuring distance.

Activity:

1. You will need a metric measuring tape for this one. Have all the team members estimate how far it is to the nearest tree, telephone pole, car, cactus. A little introduction to the metric system may be necessary here. But they will catch on quickly, especially if they know that best guesses get tootsie rolls or jolly ranchers as prizes.
2. Another variation to this game: Have children figure out how many meters, their pace is and then count their paces to get the distance (most paces will be under a meter, so a calculator will be handy!). Distance = (# of paces) x (amount pace equals in meters), so for example if my pace is 0.83 meters and I walked 10 paces, then the distance = (10) x (0.83), which equals 8.83 meters.

### Archaeological Dig

Number of children: 3 or more

Environment: Open space with tables

Equipment Needed: 6 plastic bins (16" x 11" x 6") filled with about 5 inches of sand, 6 - 7 "artifacts" buried at different levels. Each bin should contain artifacts taken from a specific location, i.e. a child's room, a school, a tool shed, a garage etc. Each station should have popsicles sticks, small trowel, ruler, grid paper, sifter, and newspapers.

Purpose of Activity: To simulate an actual archaeological dig, measure and record finds, and make inferences about the site uncovered.

Activity:

1. Use groups and assign each group a bin to excavate and record findings. Give exact directions on the correct way to excavate. Remove layers of soil slowly one inch at a time with a trowel.
2. When discovering an artifact, use popsicle sticks to push dirt away from the artifact without breaking or destroying the artifact. When the artifact has been mostly uncovered, find its location on the grid paper.
3. If time allows, using a predetermined scale, draw the artifact. Next to the drawing of the artifact record the depth at which it was found.
4. Each layer of soil removed should be sifted on newspaper to make sure all artifacts have been discovered. When students have excavated to the bottom of the bin, carefully return soil to the bin and put the found artifacts on top.
5. Each group should look at the artifacts and make inferences about the site where the finds were made. Can something be inferred about the people who lived there, what they did, how old the people who lived there were? etc.
6. Point out that sites and artifacts can be messengers from the past. If we know how to read their messages, material remains can tell us about the people who made and used them and then left them behind. The Junior Rangers can explain how they drew their conclusions.

These activities were developed at [www.digonsite.com/drdig/index.html](http://www.digonsite.com/drdig/index.html).

## **Background Information: Archaeology**

### **Archaeological Skills**

Every artifact talks, telling a story about the people who created it. Archaeology is the study about past cultures and what people did in the past by looking at artifacts and sites. Archaeology is not a study about dinosaurs, fossils, or other resources studied by paleontologists. Even though archaeologists might come across fossils while digging, they are more interested in the remains of ancient people. Future archaeologists will study us and the artifacts that we have left behind. Maybe one day your house, room, even trash will become artifacts and an archaeologist will learn about you and the world you lived in.

Archaeologists uncover the past through a scientific process called excavating. Over time, things get buried under layers of dirt from various processes like floods, landslides, or just the natural accumulation of soil. Excavating is scientific digging, neat and organized in square holes or units. Permission from the landowners is also required before excavating takes place. After gaining permission, archaeologists also need to talk with the area's ancestral Native American tribe. This process is called consultation and sometimes monitors from the tribe will participate in the archaeological excavation. Knowledge from Native American tribes is invaluable and archaeologists cannot properly study the past without help from the tribes.

Archaeologists use many different tools when excavating. Some tools are as simple as a toothbrush, whereas others are sophisticated machines that can only be used by a trained specialist. The most common tool is a flat masonry trowel which is used to scrape layers of dirt away in an excavation unit. Dust pans and brushes are used to sweep loose soil into buckets and small handpicks and shovels help loosen the soil. The dirt is then taken away in buckets or wheelbarrows where it can be put through a screen to catch small artifacts. When delicate items are discovered in excavation units, smaller tools, like dental picks and tiny brushes, are used. Some archaeologists excavate underwater sites and use different tools. Instead of shoveling dirt into buckets, underwater archaeologists use tools called dredges or airlifts that suck up sand and loose sediment to uncover artifacts. Heavy artifacts are lifted to the surface using gigantic balloons called lift bags. Underwater archaeologists usually wear standard diving gear and also have special plastic notepads that let them write underwater (see Dr. Dig's online web site reference for more).

### **Inferential Skills**

Archaeologists need to infer human behavior from the artifacts recovered from excavating. What do certain artifacts say about the cultures that deposited them? Projectile points found in archaeological sites are very important to archaeologists. They can be used as time indicators by looking at their shapes and sizes. A point that fits a certain type can tell an archaeologist when it was used. Projectile points also indicate that hunters, normally men, were present at the site.

Bone awls were used to make basketry, and since baskets rarely survive in the archaeological record, a bone awl would give the archaeologist a lot of insight. The presence of awls in a deposit would lead to the conclusion that basket-makers, generally women, were present at the site. Wooden awls were also used in the past, but do not preserve well in the ground. Evidence of basketry and wooden awls normally come from dry cave deposits in the desert areas.

Grinding stones like manos (handstones), metates (grinding slab), pestles, and mortars are found in many California archaeological sites. The presence of these artifacts normally suggests that food processing was taking place in the area, normally by women.

### **Stewardship**

Looters or "pothunters" are very destructive to archaeological sites. When encountering an archaeological site, they might think that they have discovered treasure, but the damage they do is irreparable, and the information that an archaeologist can learn from the site is lost forever.

Archaeologists tend to use the term "*in situ*" a lot when collecting artifacts, meaning the place where an item was originally deposited. An artifact being *in situ* is critical to the interpretation of that artifact and, consequently, to the culture which formed it. Once an artifact's provenience (or original location) has been recorded, the



artifact can then be moved for conservation, further interpretation or display. An artifact that is not discovered *in situ* is considered out of context and will not provide an accurate picture. It is very important when an artifact is found that it is left in its original place until an archaeologist can look at it. If it is moved, all information that could be gathered from the object and its surroundings will be lost.

Archaeologists do not get to keep the items that they find because they don't belong to them. In California, artifacts belong to the owner of the land where the artifacts were found, and the owner may donate them to a museum or park. If the artifacts are discovered on public lands, then they belong to the respective city, county, state, or federal government. There are also strict laws to remind archaeologists that they cannot excavate sites to acquire artifacts for their own enjoyment or profit. Taking anything away from an archaeological site is against the law.

### **Conservation Ethic**

Knowledge of past cultures helps to teach us where we come from, what it means to be human, and how we are all connected; every archaeological site can teach this. The loss of archaeological sites through natural processes and modern development takes place everyday. Therefore, the need to protect and preserve the past is extremely important. State Parks protects and preserves almost 10,000 archaeological sites and 3,000 historic structures for California's future generations.

Archaeological sites record past human interactions with the environment and help us understand how we can preserve the world and its resources for many thousands of years to come.

Archaeological sites are non-renewable resources, and archaeologists consider excavation to be a last resort when testing their hypotheses. Any investigation of a Native American cemetery, grave, or other sacred site is done only AFTER detailed consultation has taken place with the representative(s) of the Native American tribe.

### **Science in Archaeology**

**Radiocarbon dating:** This is by far one of the most important dating methods for archaeologists. As long as there is organic material present, radiocarbon dating is a universal dating technique that can be applied anywhere in the world. It is good for dating for the last 50,000 years to about 400 years ago and can create chronologies for areas that previously lacked calendars. In 1949, American chemist Willard Libby, who worked on the development of the atomic bomb, published the first set of radiocarbon dates. His radiocarbon dating technique is the most important development in absolute dating in archaeology and remains the main tool for dating the past 50,000 years.

Radiocarbon is produced in the upper atmosphere of Earth. Radiocarbon is then taken in by plants through photosynthesis, and these plants in turn are consumed by all the organisms on the planet. So every living thing has a certain amount of radiocarbon

within it. After an organism dies, the radiocarbon decreases through a regular pattern of decay. This is called the half-life of the isotope. The time taken for half of the atoms of a radioactive isotope to decay in Carbon-14's case is about 5730 years. So, 100% of radiocarbon in a sample will be reduced to 50% after 5730 years. In 11,460 years, half of the 50% will remain, or 25%, and so on.

There are, however, limits to this process, and a certain amount of calibration is required. When Libby was first determining radiocarbon dates, he found that before 1000 BC his dates were earlier than calendar dates. He had assumed that amounts of Carbon-14 in the atmosphere had remained constant through time. In fact, levels of Carbon-14 have varied in the atmosphere through time. One good example would be the elevated levels of Carbon-14 in our atmosphere since WWII as a result of atomic bombs testing. Therefore, radiocarbon dates need to be calibrated with other dating techniques to ensure accuracy.

**Obsidian Hydration:** This is a technique used by archaeologists to date obsidian artifacts. California archaeologists depend heavily on this dating technology because of the overwhelming presence of obsidian in the archaeological record.

When an piece of obsidian is broken, for example by a flintknapper, the newly exposed surface collects microscopic amounts of water and forms a band. The idea here is that the thicker the band, the older the artifact.

**Geochemical sourcing:** Volcanic and igneous rocks have a certain signature that can only be found at the source, and every source is unique. So archaeologists can determine the location of sources, understand trade routes and subsistence patterns, and determine where pottery materials originated.

**Protein Residue Analysis:** This technique helps archaeologists understand what animals or even plants were processed by prehistoric people. Lithic artifacts are used most often in these studies to understand what people were hunting. This technique is so valuable that governments throughout the world use it to track down poachers.



**DNA studies:** There are many applications of ancient DNA analysis. It helps with sexing specimens, gives insight into infectious and genetic disease within populations, can help with migration studies, and assists in diet and environmental reconstructions—just to name a few!

DNA can be extracted from bones, teeth, mummified tissue, and even coprolites (fossilized scat). Although this science has its share of preservation and contamination problems, it is a booming part of archaeology and reveals many of the missing puzzle pieces not found in the archaeological record.

**Diet analysis using faunal remains:** Currently, this is a very popular research issue in archaeology, especially in California. Faunal remains are animal remains, such as bones, associated with human activity, but not used as tools. These remains, when present in the archaeological record, can shed light on the diets, seasonal migration patterns, and the population density of prehistoric communities.

**Diet analysis using stable isotopes:** As mentioned in the radiocarbon dating section, isotopes are atoms with the same number of protons, but different numbers of neutrons, thus resulting in a different atomic mass. By looking at what isotopes are found in everyday food like corn, shellfish, and the animals that feed on these resources, archaeologists can reconstruct the diets of past people.

Another amazing result of this research is that stable isotopes can reconstruct migration patterns. Some isotopes enter the body only when a person is born and remain in the body, thus leaving a geographical fingerprint from their birthplace. Sometimes a water source can leave an isotopic fingerprint in children's teeth enamel. If a person's isotopic signature does not match the local geological record, then archaeologists infer that they were migrants to the region.

**Archaeobotanical studies:** Archaeobotanicals are plant materials found in the archaeological record. These remains are recovered during excavations through a process called flotation where soil samples are placed in a bucket of water and then screened through a variety of different screen sizes designed to collect even the minutest sized seeds. Later in the laboratory, these seeds are sorted out by type and help archaeologists reconstruct diets, the environment, and even climatic events.

**Dendrochronology:** This is the study of tree rings and helps archaeologists date sites, set up climate histories, and reconstruct the environment. Dendrochronology studies also help calibrate radiocarbon dates. This technique can date wood to actual calendar years!

**Palynology:** This is the study of fossil pollen and is used by archaeologists to reconstruct past environments. Fossil pollen can also be found on food processing artifacts like manos and metates and help archaeologists understand ancient diets. Palynology not only helps answer questions about food and the environment, but it can help answer questions about past climate activity too.

**Evolution of linguistics:** Although not really a science, the history of linguistics is very important for archaeological research. The preservation of ancient languages still spoken by native people is important for reconstructing past cultures and migration studies.

## Vocabulary

**Archaeological site:** A place where human activity occurred and material remains were deposited. This can include village sites, smaller camp sites, caves, collecting areas, and processing areas. Historic buildings and structures are also considered archaeological sites when a buried deposit is present.

**Archaeologist:** A scientist who studies archaeological sites and how people lived in the past.

**Artifact:** An object or specimen made, modified or used by humans in the past.

**Debitage:** Flakes of stone that are discarded during the flaked tool reduction process (flintknapping).

**Excavate:** The process of recovering artifacts and other evidence from an archaeological site in a scientific manner.

**Flintknapping:** The process California Indians used to make tools and weapons from different rocks. Basalt (a fine-grained igneous rock), chert (a cryptocrystalline variety of quartz that comes in many colors), and obsidian (a volcanic rock that looks like glass) are all major sources for flintknapping in California.

**Lithics:** A general category to include all stone artifacts like projectile points, spear points, and ground stone; basically any worked or flaked stone.

**Mano and Metate:** A handstone (mano) is used to grind grass seeds and other foods on a flat slab of stone (metate). (See mortar also)

**Midden:** An area used for trash disposal. Sometimes a midden is composed mostly of shell refuse (shell midden).

**Mortar:** A conical depression in a rock or bedrock created by a pestle during acorn and food processing. A pestle is a cylindrical shaped groundstone with rounded ends used with mortars to process acorns and other food stuffs.

**Prehistoric:** The period of time before written records.

**Provenience:** The specific location of archaeological data within a site.

**Record:** To measure, draw, photograph, videotape, or otherwise document the remains at an archaeological site.

**Site:** Any place, large or small, that shows evidence of previous human activity or occupation.

## Suggested Resources: Archaeology

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Moratto, Michael J. *California Archaeology*. Orlando, FL: Academic Press, Inc., 1984.

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Vitelli, Karen D., Ed. *Archaeological Ethics*. Walnut Creek, CA: Altamira Press, 1996.

Willey, Gordon R., and Philip Phillips. *Method and Theory in American Archaeology*. Chicago: The University of Chicago Press, 1958.

Willey, Gordon R., and Jeremy A. Sabloff. *A History of American Archaeology*. San Francisco, CA: W.H. Freeman and Co., 1974.

## **Other Sources of Information**

Archaeologyfieldwork.com. [www.archaeologyfieldwork.com](http://www.archaeologyfieldwork.com). Lists fieldwork opportunities throughout the world.

Archaeological Institute of America. [www.archaeological.org](http://www.archaeological.org).

Archaeology Magazine. [www.archaeology.org](http://www.archaeology.org).

“Ask Dr. Dig.” [www.digonsite.com/drDIG/index.html](http://www.digonsite.com/drDIG/index.html). This is a great resource for archaeology and young children.

California Department of Forestry and Fire Protection, Archaeology. [www.indiana.edu/%7Ee472/cdf](http://www.indiana.edu/%7Ee472/cdf).

California State Parks, Archaeology, History and Museums Division. [www.parks.ca.gov/?page\\_id=22491](http://www.parks.ca.gov/?page_id=22491).

National Geographic. [www.nationalgeographic.com](http://www.nationalgeographic.com)

Public Broadcasting Station. [www.pbs.org](http://www.pbs.org). A good source of information on various archaeological projects. Also look at NOVA programs.

Society for American Archaeology. [www.saa.org](http://www.saa.org).

Society for California Archaeology. [www.scahome.org](http://www.scahome.org).

University of Arkansas. “Archaeological Parks in the United States.” [www.uark.edu/misc/aras](http://www.uark.edu/misc/aras).

## **Appendix D: Sample Press Releases for Junior Ranger Programs**

See the following pages for some sample press releases that can be adapted for use in getting the word out about Junior Ranger program offerings.

# News Release



FOR IMMEDIATE RELEASE  
Date

Contact: Name  
Phone Number

## **Kids Participate in California State Park's "Junior Rangers" Program During Summer 2005**

San Luis Obispo Coast District, CA: Children between the ages of 7 and 12 years of age can earn their "Junior Rangers" award this summer. (Insert your SP unit name) will begin their traditional guided Junior Rangers program on (Insert Date). There are 12 different activities to the Junior Rangers Program. Geology, ecology, history, safety, plants, and wildlife are some of the activity areas that kids will be exploring in the program.

"Junior Rangers" is a statewide educational program in which children aged 7 to 12 may participate. The program emphasizes stewardship of park resources and connects park resource issues to global concerns. Awards such as pins, certificates, and patches are given to participants as they progress through the program. This exciting program is designed to help children discover the rich natural and cultural heritage preserved in California State Parks.

For more information, please call (Insert your name & classification) at (Area code) Phone Number.

# # #



# News Release



FOR IMMEDIATE RELEASE  
Date

Contact: Name  
Phone Number

## Kids Can Participate in California State Park's Self-Guided "Junior Rangers" Program During Summer 2005

San Luis Obispo Coast District, CA: Children between the ages of 7 and 12 years of age can earn their "Junior Rangers" award this summer. (Insert your SP unit name) will begin their self-guided Junior Rangers program on (Insert Date). There are 12 different activities to the Junior Rangers Program.

Using the *Junior Ranger Adventure Guide*, children can start at one California State Park, and then at another time go to a different California State Park to complete the program. The 12 activity areas that kids will be exploring in the program include geology, ecology, history, safety, plants, and wild life.

"Junior Rangers" is a statewide educational program in which children aged 7 to 12 may participate. The program emphasizes stewardship of park resources and connects park resource issues to global concerns. Awards such as pins, certificates, and patches are given to participants as they progress through the program. This exciting program is designed to help children discover the rich natural and cultural heritage preserved in California State Parks.

For more information, please call (Insert your name & classification) at (Area code) Phone Number.

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