

# Oaks in Environmental Education in California

by Carol J. Baird  
California Institute for Biodiversity  
California, USA

**O**f the over two hundred identified habitat types in the state of California, 80 percent are threatened by anthropogenic sources. Ninety percent of California's coastal wetlands have been partially or totally destroyed; the State's montane forests are suffering from overexploitation and overmanagement; and our scrubland habitats are being bulldozed to make way for malls and suburban development (Barbour et al. 1993; Jensen et al. 1993). Oak habitats are not immune to these pressures.

Throughout many areas of the state, oak and other hardwood rangelands are rapidly giving way to residential and commercial development, golf courses and malls. The fact that the various oak woodland, riparian and forest habitats are largely in private hands has hastened the concern of many. A recent statewide public opinion poll conducted for the California Oak Foundation demonstrated that, *when informed about the issues* affecting oak trees, almost 70 percent of the respondents supported protection of California's native oaks (85 percent of the urban respondents, 45 percent of the rural respondents: J. Cobb, personal comm.). Clearly education has a tremendous role to play in the development of attitudes of stewardship toward our native oaks.

Long-term attitudinal shifts towards stewardship are most likely to resonate throughout a population if successive cohorts of younger people are continuously exposed to and engaged by the messages coming out of ecological science and conservation biology. The California Institute for Biodiversity is a nonprofit, nongovernmental, organization dedicated to providing educational resources in the field of biological diversity. This article reports on an interactive multimedia software program, called *Cal Alive! —Exploring Biodiversity*, targeted for classroom use for young people ages 10 to 15 years. In this paper we focus especially on the formative

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assessment of its Oak Story subprogram. Because of its success here in California, oak enthusiasts around the world are encouraged to consider developing similar resources that embody images and stories about local/regional oak habitats, using software technology as a tool for dissemination.

### Methods and materials

#### *Background and local focus of the program*

Educators from primary schools all the way to the colleges and universities of California agree that there are scant materials, including textbooks and posters, that directly relate to California's natural environment. Teachers are inundated with resources focusing on the tropics, or on eastern U.S. animals and plants. In desperation, many teachers even try to produce their own pamphlets and handouts because students respond more readily to local and regional references than exotic ones (Fuentes, 1996; Rigby 1997). Our CD-ROMs focus on California biological diversity, and are popular among teachers and professors for that reason above all.

#### *Biodiversity exploration*

*Cal Alive! —Exploring Biodiversity* gives the instructor the option to explore the state's tremendous biodiversity (6000 native vascular plant species, 1000 wildlife species, colossal marine and insect diversity) either *geographically* (by region) or *ecologically* (by biome). Each habitat is thus assigned to both a region and a biome. *Cal Alive!* includes tutorials that relate to the sources of richness of the state's biota. There are panoramas, digitized satellite maps, and activities and stories that link several habitats together into a landscape or rep-

resentative biome. Since California has a huge number of native oak species (24), oaks are featured in the subprogram "Oaks in California" and also represented in 14 of the 50 total habitats considered by *Cal Alive*.

#### *Science bias*

The educational curriculum is science-based, but cross-disciplinary. Much of its science content is quite rigorous and rich. Recently California (and the U.S. in general) has come under criticism for poor performance on standardized science and math exams. Considering that several different measures of intelligence and intellectual ability suggest that California students are more *capable* than ever, one might conclude that, at least in part, schools have failed to engage students in these subjects. Our current program strives to excite students about science and doing science, while allowing them to control and interact with the material. This study focused on an activity that uses constructivist learning strategies when presenting science information to young students.

#### *The medium*

Multimedia computing adds a new dimension to learning, by engaging students' spirit of inquiry, stimulating their imaginations through visual/auditory inputs, and providing the potential for one-on-one experimentation and stepwise learning. If used appropriately, multimedia CD-ROMS (and web sites) offer intellectual challenges at the same time that they provide a concise and holistic summary of the discipline.



### *Instructional objectives and cognitive tasks*

A clear objective of the oak study was to engage students' interest and illustrate the consequences of poor management decisions on this habitat. The curriculum uses the resident acorn woodpecker as a faunal mascot to grab the students' interest and illustrate the tight interconnection of life in the oak woodland/forest/savanna. Since these birds harvest acorns for food (highly unusual among woodpeckers), and later store the acorns, they capture the student's attention. As the subject of an activity, the oak/woodpecker relationship points out many interesting facts relating to the ecological value of oak woodlands.

An interactive activity was placed in the oak story segment. Following a constructivist learning strategy, the material (a) allowed students to participate in their own learning experience by placing them in control of the navigational options; (b) provided navigational tools that allowed students to control content; (c) and designed a user-friendly interface that stimulated inquiry learning.

Briefly, the student enters an oak-tree-studded landscape, presumably an "oak savanna". He has learned that acorn woodpeckers (delightful birds with clown-like "faces") feed on acorns and store them for later use. He is given a shovel to plant more oak trees; in planting virtual trees, he sees how, with a larger acorn crop, many new birds are then attracted to the landscape. A second activity relates to the value of leaving dead oaks (snags) in place to serve as storage granaries for the woodpeckers (hatchets allow the student to remove snags, and then observe the decline in woodpeckers.)

### *Integration with curriculum*

The *Cal Alive* oak subproject interweaves well with the major themes of the Science Framework for California Schools (California Department of Education, 1990), especially the sections relating to ecology, ecosystems, geophysics and biology. The CD-ROM's oak story segment also includes interdisciplinary

activities that connect with the themes of the Mathematics Framework. For instance, in the woodpecker activity (with visuals of bar charts that animate as the number of acorns, of trees, of snags and of woodpeckers increase or decrease), the student is challenged to describe with words each mathematical effect of each manipulation. Teachers are also thrilled that the CD includes some material on native Indian uses of California oak trees (a photo-essay), as it connects very well with the state's History-Social Science Framework.

### **Formative assessment**

Between October 29 and November 19, 1996 we conducted a formative assessment of the oak story segment in eight schools. The total sample population, drawn from five grade levels, was 160 students. Both pre-testing and post-testing were conducted using formal questionnaires. The study emphasized the central role oaks play in the life cycle of the local oak fauna, and students' understanding of the importance of oak tree habitats in the state.

In addition, we analyzed the response of the students to the use of the CD on videotaped interviews with well-known personalities who shared their feelings about California's oaks, and of animal video. There was a series of questions that were designed to solicit student comment on overall response to the oak story. We included detailed questions about specific aspects of the oak story program, as well as reactions to the computerized format.

Responses to the student questionnaire were recorded, codified and analyzed. Quantitative assessment of content knowledge was based on scoring correct answers. Qualitative data results were synthesized into coherent summaries. Descriptive statistical procedures were used to illuminate specific results. Some of the significant findings are conveyed to the reader in narrative mode (Renn 1996).

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### **Results**

#### *Content*

Comparisons of factual material about oaks known or understood by students before and after they went through the oak story segment showed that overall, close to 95 percent of all students had gained a great deal of information about California oaks from the experience. While there were between-school differences in pre-test knowledge about the trees themselves, all schools showed a significant increase in understanding of the ecological material, including issues involving oak conservation, as given by post-test scoring. Follow-up tests administered three months later confirmed retention of, on average, 85 percent of the information tested.

#### *Use of computers in learning*

When asked if they like using a computer to learn about native plants and animals, 83 percent responded very positively ("yes, this is the best learning method"). And over 75 percent of the respondents found that exploring on their own, through the interactive navigational instrument found in the oak activity section, was a very good way to learn and get information. Only 1% found that they did not like that mode of learning. (The remainder checked middling categories on their questionnaires.)

One question on the questionnaire asked the students if this was the first time they had used a CD-ROM to learn. Only 24 percent responded that it was their first time. There was an even distribution between boys (12 percent) and girls (12 percent). In a related question, students were asked if they used computers at home; 45 percent of the sample did use computers at

home. A closer examination of the data showed that 23 percent of fourth graders used computers at home, while 79 percent of eighth graders did.

#### *Interest level*

The most relevant data gleaned from this student survey focused on the interest level of the students. Overall, they were most interested in the acorn woodpecker activity and had learned a great deal about oaks and woodpeckers from it. The interview with Malcolm Margolin was popular too. We compared the level of interest with the interest level in textbooks about California habitats, and found that many more of these students (89%) were excited and motivated by the computer presentation than by textbook presentation of similar material.

### **Conclusions**

Many Californians are unaware of the remarkable biological diversity of their state, and of the great diversity and importance of oaks within its borders. Formal education can be used in helping people become more aware of the status of oaks in their region. One very effective tool in this process of reaching out to young people is through the use of computer technology. Multimedia CD-ROMs can effectively convey information and images to large numbers of students, who then create their own learning regime. *Cal Alive!—Exploring Biodiversity* is a new, high-quality CD-ROM title for 4<sup>th</sup> to 8<sup>th</sup> grade levels, that focuses on oaks.



### Literature Cited

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## Back Issues

*The following back issues of this journal are available at the prices indicated:*

### #2, fall/winter 1992

U.S. \$5.50  
(includes information about oak books, oaks in Australia, propagation of oaks)

### #3, summer/fall 1993

U.S. \$5.50  
(oak hybridization, oaks for urban sites, bur oaks, kermes oak, oaks in philately)

### #4, spring 1994

U.S. \$5.50  
(oaks in Mexico, chinkapin oak, growing oaks in Australia)

### #5, fall 1994

U.S. \$5.50  
(oaks of Turkey, Walter Cottam, new oak on Mt. Tam, oak wilt, acorn intoxication, oak mushrooms)

### #6, fall 1995

(conference proceedings)  
U.S. \$9.50  
(13 papers presented during the 1994 conference)

### #7, winter 1996

U.S. \$5.50  
(Spanish moss, pollen, oak reproduction, oaks of Kaliningrad, Oglethorpe oak, oaks in Sweden)

(NOTE: Proceedings issues #8 and a reprint of issue #1 were published in 1999.)

The new book "The Life of an Oak" by Glenn Keator is now available for U.S. \$17.95 plus U.S. \$3 domestic shipping, or U.S. \$5 foreign shipping (surface mail).