

Chapter 11

Connecting Californians with the Chaparral



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Abstract Chaparral is California’s most extensive, native ecosystem. We examined nature centers, publications, curricula, and volunteer naturalist programs in southern California to determine how the chaparral is being presented to the public. We found that a number of centers do an excellent job presenting accurate content. However, the majority need updates to reflect current science and the major contribution chaparral makes to the state’s biodiversity. Easily accessible publications and curricula with accurate information about the chaparral are lacking. More than half of the nature centers reviewed offer extensive naturalist training courses. Passion and enthusiasm of staff and volunteers are as important as content in creating and maintaining successful volunteer naturalist programs as well as the nature centers themselves. Utilizing active learning methodology versus lecturing can be a key factor in a program’s success. We offer an approach to nature education that combines active learning where students participate in the teaching process, and meaningful interpretation that establishes personal connections with nature. The greater understanding resulting from this approach can inspire a diverse, new generation of long-term nature advocates and help create an informed public, facilitating an appreciation for the value of the chaparral ecosystem.

Keywords Active learning · California native plants · Chaparral · Naturalist · Nature center · Nature education

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11.1 Chaparral Education—For the Love of Nature

“We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time.”

—T.S. Eliot

For many Californians, the most accessible place to experience nature is in the chaparral, a shrub dominated ecosystem rich in biodiversity that can be found in every county in the state (Keeley and Davis 2007). As a consequence, chaparral provides one of the best places for Californians to learn about and connect with the natural environment (Fig. 11.1).

Connecting and learning about nature, and chaparral specifically, can be greatly enhanced by information and interpretation provided in nature centers and the natural history programs they offer. The success of these facilities and their efforts to help people better understand nature and encourage a broader appreciation of chaparral depends on not just the quality of the exhibits, but the enthusiasm of the rangers and volunteers who support these centers. One of the first nature centers we visited during our research highlighted the role of such enthusiasm.

Devil’s Punchbowl, a protected natural area administered by the Los Angeles County Department of Parks and Recreation, is a deep canyon carved through huge, uptilted slabs of sedimentary rock on the northern side of the San Gabriel Mountains. Surrounded by numerous earthquake faults, including the San Andreas, the



Fig. 11.1 Mixed chaparral in the Santa Monica Mountains National Recreation Area. Photo by Richard Halsey



Fig. 11.2 Ranger Dave Numer at the Devil's Punchbowl Natural Area, Los Angeles County Parks. Photo by Richard Halsey

Punchbowl is a testament to California's dynamic geological history. Hardy desert chaparral decorates much of the landscape with pinyon pines scattered throughout.

When we first entered the park's wood-paneled nature center, a small building with an open, uncluttered display hall, it appeared as if we were on our own. Along two walls were cabinets filled with an array of bird and mammal taxidermy, artifacts, and photos. Embedded within the other two walls were ten terrariums holding an assortment of live reptiles and insects. In the far corner was a tall counter with a doorway behind that led into a small office containing an old book case with additional specimens from the park, all neatly arranged on shelves. On the counter sat a dissection scope and a two-foot tall glass cylinder filled with soil. Attached to the wall was a two-foot diameter section of a cut pine log. It was hollowed out and faced with a plate of glass to reveal an active beehive within.

Dave Numer, ranger and superintendent of Devil's Punchbowl, emerged from the back office. "So, how do you think the bees get in and out of there?" he asked. Wearing a crisp uniform and a wide brimmed hat, he leaned against the desk with a broad smile and he let us consider the question for a brief moment. Tapping the back of the log with a small, metal pointer that he extended with a snap, he provided the answer. "It's connected to the outside by a PVC pipe right back there" (Fig. 11.2).

Numer then turned our attention to the glass cylinder. "And take a look at this!" He pulled out a thumb-sized flash light and shined it into a small, excavated chamber. Translucent, marble-sized golden globes hung from the chamber's ceiling. The

globes were moving slightly from side to side, glistening in the beam of light. The scene was right out of a nature documentary.

“Honeypot ants!”

“Honeypot ants, yes!” Numer answered back. “And they’re native here in the park.” Numer added that the globes were the enlarged abdomens of specialized worker ants of the species (*Myrmecocystus mexicanus*) capable of storing a honey-like substance used to provide food for the colony during lean times. Then he pointed out the glass cylinder’s partially open lid and a little pile of dirt on his desk. “How do you think that got there?”

“The ants?”

“Yes, the ants! They leave the nest at the end of the day and roam the nature center all night.” He enjoyed waiting for our reaction. “They always return by morning though. One day when I came in early, I caught them hauling up a dead moth they had found on the floor somewhere.”

Numer shared more of his knowledge about the ants, the bees, and the center’s other displays, then offered to take us outside. Joined by his assistant Olivia, they discussed their favorite points of interest until being interrupted by a raucous noise from above. An old raven was calling out from his perch in the large pinyon pine near a small building across from the center. Numer laughed then nodded toward the building. “That was my home for five years when I lived on site.” He looked back at us. “I’ve been here for nearly 43 years now.”

Numer continued sharing his knowledge about the park’s desert chaparral, scattered between the pines and junipers, and the recent drought’s impact on the manzanita. The gnarled, gray stems of several dead individuals were still pointing skyward. Looking off into the distance he said, “A fire burned over that farthest ridge in 1953.” The area was still relatively bare. The pines and junipers had not come back well. Turning our attention into the canyon below, Numer encouraged us to explore it. “There’s a little turn off along the trail by a large log. You can climb over a few boulders there and have a great view.”

When finalizing our review of the Punchbowl’s nature center, we were surprised to realize that references to the chaparral, and nearly everything else we were measuring in our evaluation including the Mediterranean-type climate, fire ecology, and the significance of watersheds, were missing. Yet the place inspired us. It was the learning environment Numer had created over the past four decades, his questions, and more importantly how he asked them, that caught our attention. The most compelling part of our experience was Numer’s enthusiasm and personal warmth, not the content of the exhibits. We wanted to come back.

After completing our evaluation of southern California’s chaparral connected nature centers and speaking with dozens of naturalists, our Devil’s Punchbowl conclusions were affirmed. The state of chaparral education cannot be discovered by merely reviewing content. The people behind the desk, the outdoor educators, and the volunteer naturalists on the trail play a critical role in whether or not the content is meaningful to visitors. These people create relationships that establish the foundation required to encourage lasting change within the minds of those they inspire. This observation offers an alternative to how nature education is often approached.

Rather than focusing *what* we want to teach, a naturalist's goals might be better served by focusing on *how* we can teach to better facilitate the change we hope to achieve.

What change do we seek as nature educators? A general consensus emerged during our research—to inspire a love for nature that will foster curiosity to learn more and the desire to care for and protect the natural environment. For us, Dave Numer's approach to interpretation, one that involved us and allowed him to share his passion for nature, achieved exactly that. A nature center's content and design becomes more effective when a naturalist facilitates the center's learning experience with interactivity and sincere enthusiasm.

11.2 The Benefits of Chaparral Education

Although the positive attributes of experiencing nature have received a significant amount of attention since the publication of *Last Child in the Woods* (Louv 2008), and more recently, *How to Raise a Wild Child* (Sampson 2015), strong societal pressures continue to prevent people from getting outside. According to several studies, the average American young person spends less than 7 min a day in unstructured outdoor play, but more than 7 to 10 hr in front of some kind of electronic screen (Hofferth and Sandberg 1999; Juster et al. 2004; Rideout et al. 2010). “That outdoor time is 90% less than most of their parents had,” Scott Sampson (2016) said in a recent interview. “So in one generation, we've flipped this around.”

It is reasonable to speculate that many adults suffer from the same deficit. Such lack of activity led the former US Surgeon General Richard Carmona (2004) to speculate that, “... we may see the first generation that will be less healthy and have shorter life expectancy than their parents.”

Enhancement of mental and physical health through recreation and relaxation is one of the most direct, obvious contributions the chaparral can provide. These benefits have been elucidated in a number of interesting studies examining how people respond while being in nature (Suttie 2016) including reduced stress (Lee et al. 2014; Tyrvalinen et al. 2014), less worrying (Bratman et al. 2015), increased creativity (Atchley et al. 2012; Aspinall et al. 2013), increased generosity (Zhang et al. 2014; Piff et al. 2015), feeling more “alive” (Ryan et al. 2010), and improved immunity (Li et al. 2008).

In addition to empirical research, a number of writers and philosophers have suggested that nature can play a role in increasing confidence and self-respect. Abrams (2014) writes,

“Nature teaches you that there is nothing wrong with you. When you're in nature, you don't have to look at advertising that tries to convince you there's something wrong with you, in order to sell a product. Nor do you have to look in mirrors. Instead, you're either focused on the setting around you, or on what you are doing, like climbing, setting up a tent, or gardening”.

Fostering an awareness and greater appreciation for the chaparral will likely help increase the public's interest in exploring their local, natural environment and hence, acquire the physical and mental benefits such activity can provide. Multiple studies have also shown that personal experience and direct knowledge can reduce negative biases (Tadmor et al. 2012). When nature becomes familiar, fear of nature can be replaced by enjoyment. As knowledge and appreciation for the environment builds, local nature can become incorporated into a person's place attachment, creating a "sense of place"—an intimate connection that combines physical setting with what we bring to the place and how we interact with it (Steele 1981).

A sense of place is extremely personal. It does not exist independent of us. This is why nature education programs in chaparral environments should emphasize creating enjoyable, engaging experiences that help develop personal meanings about the chaparral and the organisms that live there. Establishing a sense of place with the chaparral can form a basis for community cooperation and action such as participation in local volunteer programs and political activism (Manzo and Perkins 2006). This community involvement can then be mobilized to expand participation in nature education programs, ultimately leading to efforts to protect local nature because people have learned to care about the natural environment in which they live. Teaching content is important, but without personal connections and meaning (why do I care about this place?), content usually fails to inspire the behavioral changes we seek as naturalists.

This is what conservationist Baba Dioum (1968) was referring to in his speech to the General Assembly of the International Union for Conservation of Nature and Natural Resources when he said, "In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught."

11.3 The Consequences of Anonymity

Despite the chaparral's dominant presence and its significant contribution to biodiversity in California (Halsey and Keeley 2016), a large portion of the public remains unaware of its presence or that it is a viable community of living things on the same level as more familiar ecosystems like forests and grasslands. This lack of awareness has been observed anecdotally during hundreds of educational presentations presented by the non-profit California Chaparral Institute to thousands of people over the past 10 years. When asked to explain what chaparral is, many audiences are unable to do so. In fact, many chaparral ecological processes remain a mystery to the scientific community, especially those relating to animal species (van Mantgem et al. 2015).

Huell Howser, the well-known host of the long-running public television series, *California's Gold*, highlighted the chaparral's anonymity several months after producing an episode about the ecosystem. With his characteristic enthusiasm and Tennessee twang he said, "I've been up and down the state filming our show, and

you know what I've seen? I've seen chaparral! It's everywhere! I had no idea!" (pers. comm. 2005).

The public's lack of awareness of chaparral is not particularly surprising since the landscapes it dominates are not identified as such. In fact, chaparral is frequently referred to as a forest or is ignored all together in deference to other features present. The four largest public chaparral preserves in California are the Cleveland, San Bernardino, Angeles, and Los Padres national "forests." Chaparral and other native shrublands cover 52–88% of these federally managed landscapes. Similarly, one of the last remaining stands of old-growth southern maritime chaparral is named for the trees present—the Torrey Pines State Natural Reserve. The University of California's Emerson Oaks Reserve in Riverside County is primarily chaparral. Even where chaparral is the exclusive feature, it is identified as a miniature "forest" such as the El Moro Elfin Forest Natural Area in Los Osos and the Elfin Forest Recreational Reserve in Escondido.

The chaparral ecosystem's anonymity likely reflects a historical bias favoring more economically valued forests and rangelands over native shrublands (Halsey 2011a, b). This bias led to derogatory references to chaparral as "worthless brush" on late nineteenth century survey maps (Ward 1984), as a dangerous and unsightly "menace" (as reported in the local Daily San Diegan newspaper on September 26, 1889), and as troublesome "brushfields" in more recent documents from the Stanislaus National Forest that claim chaparral will prevent the establishment of forest habitat and "impede wildlife movement" (USFS 2016). In the popular press, chaparral is often disparaged as merely "over-grown brush" (Rocha and Kelley 2017). Some have even expressed the view that large stands of chaparral are unnatural because early Spanish explorers made "little mention of brush" in their written accounts (Santa Barbara County Fish and Game Commission 2008). What is ignored by all these perspectives is that chaparral has come to dominate much of California's natural landscape over 15 million years of evolution (Rundel et al. 2016) and that large, impenetrable, old-growth stands of chaparral represent the ecosystem's natural condition (Keeley and Davis 2007).

So chaparral remains nameless and misunderstood for many, and hence unknown as a viable ecosystem. Under such conditions, an entity can be defined by incorrect perceptions and biases. Such definitions can lead to eventual loss because the entity's value is not properly recognized. The California grizzly bear, the now extinct denizen of the chaparral, but central on the state's flag, serves as a poignant example. While the grizzly bear was certainly well known, its important ecological contribution was unrecognized until it was too late to protect the species.

Ignorance of a group has also been directly tied to prejudice and stereotypes (Stephan and Stephan 1984). While prejudice most often refers to unsubstantiated judgments and opinions between people, it can also influence one's view of nature. Such views can impact public policy and lead to damaging land management practices. Ignorance and prejudice can also cause individuals unfamiliar with the chaparral's sometimes counter-intuitive ecology to be susceptible to accepting misconceptions as fact. The misconceptions are then promulgated frequently enough to form stereotypes that are difficult to dislodge. Most chaparral

misconceptions relate to fire suppression impacts and vague notions about ecological health, all of which have been used to justify various forms of chaparral management for “ecological reasons” by mechanical clearing (mastication), the application of herbicides, or prescribed burning. The most commonly encountered misconceptions include the following:

- Past fire suppression is claimed to have created large stands of unnaturally dense chaparral leading to large, high-intensity wildfires. This is false. Chaparral naturally creates large stands of dense vegetation that are historically subject to large, high-intensity fires (Keeley et al. 2004; Keeley and Zedler 2009; Lombardo et al. 2009). In fact, fire suppression has provided important ecological benefits by preventing excessive fire in chaparral that can lead to a loss of biodiversity and eventually type-conversion, the transformation of native shrubland to non-native grassland (Keeley 2001).
- It is frequently claimed that chaparral “needs” frequent fire to stay “healthy.” This is a misnomer because old-growth chaparral is a viable ecosystem that is capable of regenerating after long fire-free periods (Keeley et al. 2005). The chaparral’s natural fire-return interval of 30 to 150 years or more allows shrub species to restock the soil with seeds and restore starch supplies in under-ground tubers or roots between fires. If fire burns chaparral more than once per 10- to 15-year period (depending on location), native species can be extirpated. The void is usually filled with non-native grasses, leading to increased flammability and eventual type-conversion (Keeley and Brennan 2012).
- It has also been hypothesized that fire is needed in chaparral to remove germination-inhibiting chemicals in the soil that were produced by mature plants (allelopathy), resulting in reduced competition. This hypothesis has been rejected because the seeds of most chaparral species are innately dormant, with germination stimulated by fire cues, not the denaturing of soil chemicals by fire or other means (Halsey 2004).

One way to help the public recognize the chaparral’s value is by publicizing the benefits the ecosystem offers human communities. Recently, there has been a renewed interest in quantifying these “ecosystem services.” For example, the chaparral’s dense cover offers protection to a region’s watershed, allowing water to slowly recharge aquifers rather than racing across the landscape and causing flash floods, large debris flows, and significant damage to public infrastructure (Gartner et al. 2009) (see Chap. 7). Supplying water is one of the most important provisioning ecosystem services that chaparral provides. Other benefits include “regulating” services (e.g., carbon sequestration), “supporting” services (e.g., nutrient cycling), and “cultural” services (e.g., recreation).

The ecosystem services concept is limited, however, because of its utilitarian, anthropocentric focus—it fails to recognize that nature has value regardless of the benefits it provides humans (Vucetich et al. 2015). Strictly focusing on ecosystem services to value nature is similar to valuing one’s friends purely on the material “friendship services” they provide. Clearly, friends and nature are more than the goods and services we can gain from them. In addition to providing a significant

amount of habitat for a multitude of species, chaparral has intrinsic value, a value that is neither conferred nor revocable, but springs from its evolutionary heritage and potential (Soulé 1985). Chaparral has value for what it is, not only for what it does for human society.

11.4 The Current State of Chaparral Education

To examine how chaparral is presented to the public, we visited nature/interpretive centers in southern California associated with native shrublands, reviewed volunteer naturalist training programs, and evaluated available educational curricula and publications.

We did not conduct an extensive review of nature programs in individual schools because many of these are connected to the local nature centers and parks we visited. We were also most interested in young adults and families because this is where we believe the greatest need for “nature literacy” education exists. We define nature literacy as being able to identify several local, native species (plant and animal), familiarity with the community in which those species exist, participating in several excursions per year to local wild areas for the purpose of enjoying nature, and having a clear understanding of the need to protect nature for its intrinsic value as well as for the benefits it provides us.

There are a number of programs exposing elementary-aged children to nature including sixth grade camps, school field trips, and opportunities supported by organizations like the Children & Nature Network. However, based on interactions with many young adults over the last 10 years we have found a surprising lack of nature literacy. Equally concerning is the current children-in-nature-movement, while booming, lacks needed diversity as it largely operates “at the fringes of affluent white society” (Sampson 2015).

11.4.1 *Nature/Interpretive Centers*

All of the nature/interpretive centers we visited in Los Angeles, Orange, and Riverside Counties are either deeply embedded in chaparral or have a significant amount of chaparral or California sage scrub nearby (Fig. 11.3). There are also a number of nature centers located within urban areas, such as the El Dorado Nature Center in Long Beach and the Turtle Rock Nature Center in Irvine. Although we did not evaluate these centers, they can also play an important role in helping the public become familiar with nature, and are particularly important given their strategic position in developed areas (Halsey 2009).

We evaluated four key components at each nature center: the level of focus on chaparral (ranging from 0 to 4, with 4 being the greatest, most accurate focus), the presence and accuracy of the description of chaparral fire ecology (again, ranging

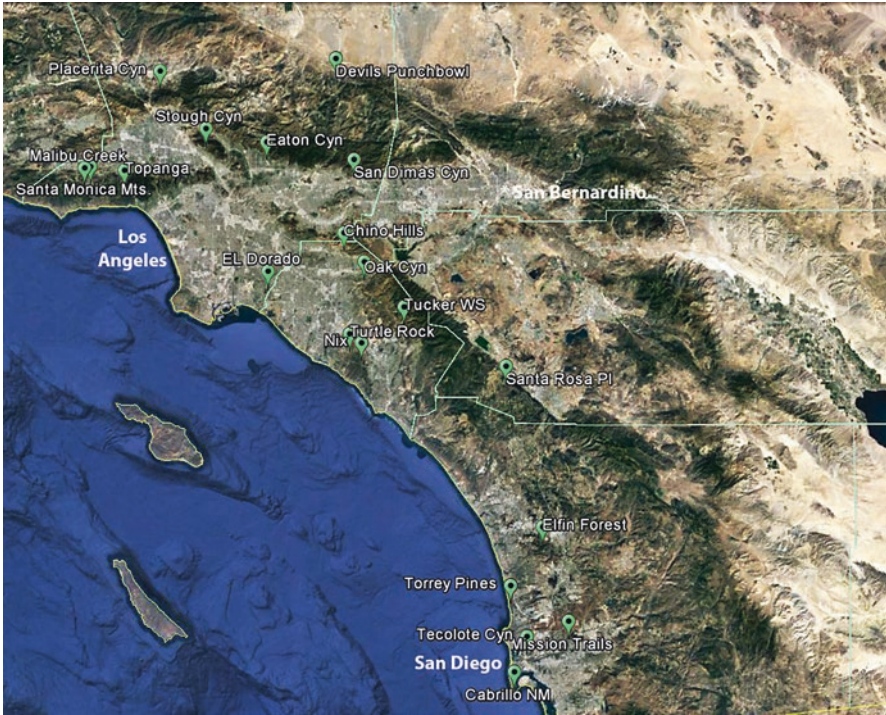


Fig. 11.3 Location of nature centers/museums. Image from Google Earth

from 0 to 4), the availability of naturalist training, and finally, the date the exhibit(s) were last updated (Table 11.1). Each center was visited once. The levels were based on the representation of the most current science and the absence or presence of misconceptions.

An encouraging finding was that the most reliable predictor for the amount and accuracy of information provided about chaparral was the age of the nature center exhibits. Seven of the ten centers updated or built over the past decade offered the most thorough information about chaparral, especially those at Placerita Canyon, Chino Hills, and the San Diego Natural History Museum. Their displays provide extensive details about the natural history of species within the context of the chaparral (rather than providing information about the species in isolation), accurately explain the ecological role of fire and the threat of type-conversion from too frequent fire, and how the ecosystem is shaped by the Mediterranean-type climate. One of our top-rated centers, San Diego Natural History Museum's exhibit *Coast to Cactus* in which the chaparral is significant component, won the prestigious Overall Excellence for an Exhibition Award from the American Alliance of Museums in 2016 (Fig. 11.4).

Some newer nature centers also offer specialized features or expanded content. For example, the Santa Rosa Plateau center in Riverside County is unique because

Table 11.1 Chaparral exhibits in nature centers/museums (by last update)

Name of center	Location	Admin agency	Exhibit update	Chap focus	Fire ecology	Naturalist training
Mission Trails Regional Park	San Diego	San Diego City	2016	1	2	Yes
Placerita Canyon Natural Area	Newhall	LA County	2015	4	4	Yes
San Diego Nat. Hist. Museum	San Diego	Museum	2015	4	4	Yes
Topanga Canyon State Park	Topanga	CA State	2015	3	2	Yes
Chino Hills State Park	Chino Hills	CA State	2014	3	4	
Santa Monica Mountains	Calabasas	National Park Serv.	2012	2	4	
Santa Rosa Plateau	Murrieta	Riverside County	2010	3	3	Yes
Elfin Forest Rec. Reserve	Escondido	Olivenhain Water Dist.	2009	1	0	Yes
Nix Nature Center	Laguna Beach	Orange County	2007	1	0	— ^a
Tucker Wildlife Sanctuary	Silverado	Cal State Fullerton	2007 ^b	2	m	
Tecolote Canyon Natural Park	San Diego	San Diego City	2003	1	0	— ^c
Stough Canyon	Burbank	Burbank	2003	1	0	
Eaton Canyon	Pasadena	LA County	1998	0	m	Yes
San Dimas Canyon	San Dimas	LA County	1993	2	m	Yes
Torrey Pines State Reserve	San Diego	CA State	1988	1	1	Yes
Devils Punchbowl	Pearblossom	LA County	1988	0	0	
Oak Canyon	Anaheim	Anaheim	1980 ^d	0	0	
Malibu Creek State Park	Calabasas	CA State	1976 ^e	1	m	Yes
Cabrillo National Monument	San Diego	National Park Serv.	— ^f	0	0	— ^f

Chaparral Focus score key: (4) an entire exhibit area focused on chaparral, (3) separate set of panels/displays describing chaparral, (2) a distinct panel/display describes chaparral in context to the nature center, (1) mention of chaparral only in context of a species or general habitat reference, and (0) no mention of chaparral

Fire Ecology score key: (4) accurate explanations with recognition of type-conversion due to increased fire frequency, (3) two correct references to fire ecology, (2) one correct reference to fire ecology, (1) causal reference to fire, (0) no mention of fire, (m) misconceptions concerning fire

^a1 day public interaction workshop

^bUpdates in progress

^cUses Mission Trails training

^dExhibit update is approximate

^eDate represents when the park was created, but center updates/rotates exhibits on an ongoing basis

^fNo permanent chaparral exhibits, but has an extensive intertidal education program



Fig. 11.4 The Coast to Cactus exhibit at the San Diego Natural History Museum which has separate displays for all the region's major habitat types. The chaparral portion is accessed through the opening to the left of the central mural. Photo by Richard Halsey

it extended its displays into the field with detailed trailside signs along a short circular path. The adjoining Granite Loop Trail has fifteen numbered signposts that correspond to content in a brochure. Also noteworthy was the Santa Monica Mountains National Recreation Area center which did an excellent job describing the chaparral's relationship to fire.

Four of the nine nature centers with older exhibits did not mention chaparral at all. The five that did, casually reference it in connection with fire or a particular species. Concerning fire, four of the centers with older exhibits contained misconceptions in the display text, mostly implying that dense chaparral is either unnatural or undesirable. Specifically, the exhibits mistakenly claim that: (1) fire suppression has created overly dense chaparral, or (2) fire "prunes tightly packed vegetation," or (3) fire "thins thick brush" to create vast new stands of "open grasslands." The natural growth pattern of chaparral shrubs, their physical structure, and the dynamics of fire contradict such claims. And while chaparral can be converted to open grasslands, such a landscape is typically composed of non-native annual grasses (e.g., *Bromus* spp.) and is caused by unnatural disturbances such as overly frequent, low-intensity fire or soil disturbance. One of the centers with newer exhibits contained some of these errors, but staff indicated the display is scheduled for an update.

We encountered passion and enthusiasm from staff and volunteers at most of the nature centers we visited. Four in particular stood out for us: Placerita Canyon, Tucker Wildlife Sanctuary, Santa Rosa Plateau, and of course, Devil's Punchbowl.

Like Devil's Punchbowl, Placerita Canyon is a Los Angeles County Park. It has its own supporting non-profit as well as being part of the greater Nature Center Associates of Los Angeles County. The development of the nature center's new exhibits was a collaborative effort between the center's staff, volunteers, and the community, all successfully coordinated by Jennifer Rigby, the director of the interpretive planning and design firm, The Acorn Group.

Recreation Supervisor Frank Hoffman is the dynamic public face of Placerita Canyon and has served as a ranger there on three different occasions over the past 20 years. We found his enthusiasm infectious. He summarized his approach to nature education by saying, "Mother Nature is talking all the time. You just have to know what she is saying. You need to execute all your senses. You need to know the audience. It's not what you say, it's how you say it." Hoffman credits a supportive staff and dedicated group of volunteers for the nature center's positive environment.

Tucker Wildlife Sanctuary is unique from the other nature centers we visited as it is administered and funded by California State University, Fullerton. About 9 years ago when site manager Marcella Gilchrist arrived, the facility was in disrepair. Her first task was moving the center to another building that was larger and more accessible. Through her vision and dedication, the nature center has become a bustling educational opportunity for local schools and the surrounding community. Kurt Miethke, the center's grounds manager and landscaper, has been working closely with Gilchrist to improve and maintain the facility's well-marked trails, interpretive panels, and study areas. Between the two of them, they have turned the Tucker Wildlife Sanctuary into a compelling natural history experience.

The Santa Rosa Plateau Nature Center has a successful education program for local schools led by volunteer naturalists and interpretive ranger Rob Hicks. All of the volunteers have their own unique way of sharing information. Volunteer Jim Lockyer has developed a method to inspire students through what he calls "a simple formula for nature discovery." Printed out on a twofold business card that Lockyer gives to students is a curious photo of a cork with the word "Inspire" underneath. Inside, a "simple formula for nature discovery" is revealed: "COR = K", meaning Curiosity, Observation, Research, equals Knowledge. Lockyer uses the formula to provide his students an easily remembered approach to exploring the natural environment.

Although passionate individuals are essential in shaping successful nature center experiences, centers need adequate financial support. The one facility we found lacking such support was the Oak Canyon Nature Center, operated by the city of Anaheim. During its heyday, from 1972 through the mid-1990s, the nature center was a bustling place, open every day and supported by a full-time staff and dedicated volunteers. Three large notebooks at the center document this period, filled with newspaper clippings, photos, and art. The public's ability to experience the center now is limited to weekends. A part-time staff does its best to operate the center and accommodate school groups during weekdays.

In summary, we found 7 out of 19 nature centers reviewed accurately represented chaparral in a manner commensurate with its presence. All seven had exhibits installed within the last decade.

11.4.2 Naturalist Programs

As well as evaluating individual nature centers, we also assessed the extent they provided naturalist programs. We noted the number of training sessions provided to volunteers on a number of topics including interpretation, ecology, botany, zoology, history, and geology (Table 11.2).

Nine of the 19 nature centers have independent volunteer naturalist programs designed to lead public nature hikes and guide school groups through the connected shrubland preserves. Each training program has its own unique blend of topics, but all are organized by individuals who are passionate about helping the public understand, appreciate, and value the local natural environment. Interestingly, more than half of the naturalist training programs began in the 1970s at the height of the environmental movement and many were integral components of preservation battles to protect open space.

For example, a community action group, Citizens to Save Open Space (SOS), was formed in 1971 to stop the development of San Diego's Tecolote Canyon. After years of effort, including letter writing campaigns and a march on city hall, SOS was successful in achieving its goal. The city acquired the canyon and dedicated it as open space in 1978. The nature center was built 5 years later and a small group of volunteers began sharing the canyon's natural history with the public. Two of the current volunteers, Eloise Battle and Sherlie Miller, have been there since the beginning. Both women were instrumental in leading the preservation battle. Commenting on what the preserve means to her, Miller expressed a perspective that aligns with one of the primary goals of chaparral education. "People ask, Chaparral? What does it mean? Sage scrub? What is that? People need to know!"

The San Diego Natural History Museum's Canyoneers was founded by Helen Chamlee, an associate botanist at the museum, after she helped defeat a plan by the San Diego Zoo to turn the nearby Florida Canyon into a parking lot. The Canyoneer's mission was to educate the public to appreciate the chaparral filled open space so they would support its protection. The Canyoneers led their first hikes into the canyon in 1973. Chamlee's continued efforts eventually lead to a master plan for the canyon in 1975. The plan's landscape architect, Stephen L. Halsey, received the American Society of Landscape Architect's National Honor Award for the design. Although efforts to properly manage the canyon have yet to be formally adopted, its wild space remains undeveloped. The Canyoneers eventually expanded beyond Florida Canyon and now lead public hikes in 70 locations throughout San Diego County. Descriptions of the hikes are available in a comprehensive publication co-written by numerous Canyoneers (Lindsay et al. 2016).

The Canyoneer model has spread to other locations in San Diego County as well. Bill Howell, the Canyoneer's lead trainer since 1988, founded the Trail Guides naturalist program at San Diego's Mission Trails Regional Park in 1994. Mission Trails is one of the largest municipally owned parks in the United States. The volunteer Chaparral Naturalist Certification program at the Elfin Forest Recreational Reserve in Escondido was started in 2015 by one of Howell's long-time Canyoneer colleagues, Richard Halsey.

Table 11.2 Naturalist training programs

<i>Naturalist Program (Date Originated)</i>	Vol #	Int	Hab	Fire	Eco	Bot	Vert	Arth	Hist	Geo	Total hours
Placerita Nature Center (1971)	35	x			xx	x	xxx	x	xx	x	90 ^a
Mission Trails (1994)	100		Ch	p		xx	xx	x	xx	x	63
Tecolote Canyon (1994)	10										— ^b
Topanga Canyon State Park (1974)	35	x			x	xx	xxx	x	x		51 ^c
San Diego Natural Hist. Mus. (1973)	100 ^d		Ch	p		xx	xx	x	x	x	47
CA Naturalist Ojai (2016)	— ^d		p		x	x	x	p		x	43 ^e
Torrey Pines (1975)	250	x			x	x	x	x	xx	x	42 ^f
Elfin Forest Rec. Reserve (2015)	— ^d	x	Ch	x		x	p	p	x	x	36
Eaton Canyon (1978)	30				x	x	xxx	x	x	x	35
Irvine Ranch (2011)	400		Ch p	p	p	p	p	p	p	p	32 ^g
Malibu Creek State Park (1976)	60	x	x			x	x		xx		30 ^h
Cold Creek Docents (1977)	8 ^d	x	Ch		x	x		x	xx	x	30
Santa Rosa Plateau (1991)	87										30 ⁱ
San Dimas Canyon (1997) (1) Jr. Naturalist (2) Jr. Ranger	30 Age: 12–17	x									25 ^j
	180 Age: 7–11				x		x	x			12 ^k
Nix Nature Center (2007)	125 ^d	x									6 ^l
Cabrillo National Mon. (1996)	70	x									— ^m

Topic key: Vol # = Active Volunteers; Int = Interpretation methods: Hab = Habitats (Ch indicates class focuses on chaparral and the Mediterranean-type climate), Fire = Chaparral fire ecology, Eco = Ecology, Bot = Botany training sessions, Vert = Vertebrates (reptiles, birds, and mammals), Arth = Arthropods, Hist = History/Native American, Geo = Geology

Training sessions key: x = number of full in-class sessions dedicated to the topic (x = 1, xx = 2, xxx = 3), with “p” indicating partial sessions dedicated to the topic, based on class syllabi. Class sessions typically run between 2–3 h. Both in-class sessions and field trips included in total hours

^aOngoing in-service opportunities

^bUses Mission Trails training

^c18 h additional workshops

^dNaturalists not tied to a central location

^e40 additional volunteer hours required

^fFinal project required

^gPlus 1½ days for introduction/interpretation

(continued)

Table 11.2 (continued)^b3 additional classes per year, 7 h habitat class per year^cNo formal training, 30 h volunteering required, occasional lectures^dVolunteer hours, learn to care and feed animals on site, lead tours^eFall and spring sessions offered (60–90 students each), 8 classes per session^f1 day public interaction workshop^mTide pool training only with 2 day conference plus supplemental training

A strong social fabric fostered by some of the volunteer programs is also an important part of the volunteer naturalist experience. Two programs stood out in particular: the Torrey Pines Docent Society and the Placerita Canyon docents. Both organize frequent social and advanced educational events.

The Torrey Pines organization, with 250 active volunteers, is the largest of the groups we reviewed. Members keep in touch with each other through the *Torreyana* newsletter, published regularly since 1975. Their monthly meetings and other social gatherings usually attract up to 100 participants. In addition, there are various sub-groups that have their own get-togethers. Reflecting on the personal nature of the Docent Society, Jeannie Smith, one of the longest serving members said, “You should see the trouble the president has every month in getting everyone into the meeting and shutting us up before the poor speaker can take the floor.”

The origin of the Placerita docents is a testament to volunteer action. Prior to the opening of the nature center in 1970, several members of the American Association of University Women would show up on weekends at the entrance of the canyon and share natural history and scientific knowledge with the public. Operating out of the trunk of their cars, the women would pull out animal pelts and other specimens to inspire the visitors. One of these early docents, Shirley Morano, still volunteers at the nature center. Morano is 94 years old and drives herself the 30 miles (~50 km) from her home to center on weekends.

Orange County has a well coordinated effort to expose the public to their parks, although not chaparral in particular. The Orange County *Wild Passport* program provides a way for members of the public to earn a “Wilderness Lover” patch by visiting five different parks and preserves. Orange County Docent Day is held each year, attracting about 100 volunteer naturalists from various parks and organizations who attend a full day of workshops and lectures concerning the region’s natural history.

The California Chaparral Institute is initiating a similar Passport program in San Diego County with its *Passport to the Chaparral*. Participants earn a pocket naturalist guide and a certificate if they complete 10 hikes or activities within the Escondido Creek and San Dieguito River watersheds.

Although the Irvine Ranch Conservancy in Orange County does not have a nature center, it does manage about 8000 ha (20,000 acres) of open space and has taken a lead role in training the region’s naturalists and other volunteers. The trained volunteers not only assist with the Conservancy’s public education programs, but also the recreational and stewardship activities on behalf of landowners who contract with the Conservancy. Their training emphasizes not only natural history, but also interpretive skills modeled by the National Association for Interpretation.

Brian Hughes, the co-facilitator of the Conservancy's training program clarified their educational philosophy. "What we do is more about sharing than teaching." He added that the best strategy is to, "think of yourself as a host for the site you are interpreting, treating visitors as invited guests."

Although there is not a chaparral based program at the National Park Service's Cabrillo National Monument, there is one that focuses on the intertidal zone that can provide a model for a future effort. Facilitated by approximately 70 trained volunteers, the program engaged 37,010 interpretive contacts in 2015. The program's success can be partially attributed to what the monument's scientific program coordinator Alexandria Warneke called the "three touch approach." Monument educators go to the participating schools and prepare the students for what they will see, interpret what the students encounter during their visit, then return to the classrooms for a follow up. The program is all based on an engaging/interactive model whereby the students are not lectured to, but rather actively participate in the learning process.

The naturalist program at the San Dimas Canyon Nature Center is unique in that it focuses exclusively on youngsters. Founded in 1997 by Park Supervisor Roddy Gregory, who still plans and coordinates the effort every year, the program has two components. The first inspires as many as 180 7- to 11-year-olds per year to learn about nature as Junior Rangers through nine, 90-min engaging, activity-based classes at the center. About 10–20% of these students go on to participate in the Junior Naturalist program for 12- to 17-year-olds. These naturalists learn the skills of interpretation and care for the animals at the center's zoo which houses a number of native species.

Gregory provides the vision and inspiration for the entire program and organizes an annual Hawaiian Ho'olaulea Festival in June to raise the needed funds to support his volunteers. When asked about training adults, Gregory laughed and suggested kids are much more fun and do not have set ideas that get in the way of learning. "Adults are harder to control," he added with another laugh. Discussing the program's future, he grew pensive when considering what would happen to it all after he retired. Programs usually fade when the organizer leaves, he said with a sense of resignation in his voice. Although it will be difficult to replace Gregory, we are hopeful Los Angeles County Parks will endeavor to continue the valuable program he has inspired and has worked so hard to maintain.

At the state level, the California Naturalist Program is an ambitious effort sponsored by the University of California, Division of Agriculture and Natural Resources. It endeavors to create a working group of naturalists who receive certification after completing a 40+ h course that involves classroom and field experience. Once certified, the naturalists are encouraged to complete another 40 h of community service focusing on nature-based volunteer opportunities.

The program is relatively decentralized, allowing local providers to tailor about half of the content to what exists in their surrounding natural environment. The courses are generally organized around the program's official text, *The California Naturalist Handbook* (de Nevers et al. 2013). However, the text presents a content problem for chaparral education because of its forest/rangeland centric bias.

Chaparral is only given two paragraphs within a chapter on plants. Forests on the other hand are given 20 pages in a chapter dedicated to forest, woodland, and range resources (the only chapter dedicated to plant communities). The forest/rangeland centric influence may partially explain the presence of a common misconception in the text that chaparral is merely a successional phase in forest development. The text claims that, “Mature stands of chaparral provide a shaded seedbed for their successors, oak woodland and conifer forest.” While this can be true for some montane chaparral stands which arise after forest fires, the vast majority of chaparral is a climax community and not a successional stage to forest.

Fortunately, revisions and supplemental documents to The California Naturalist Handbook text are being discussed. The program is a vision in progress, so the text is a working document. Creating a state-wide group of certified naturalists who will be interacting with the public in a coordinated manner has tremendous potential in helping citizens become better connected with the natural environment. Hopefully, future editions of the program’s main text and supplemental materials will reflect the chaparral’s importance in the state.

Our general finding regarding the inclusion of chaparral ecology in naturalist training programs is that most mention the ecosystem at various times during their courses. Only half of the programs, however, dedicate an entire class session or a specified amount of time focusing on chaparral as a functioning ecosystem.

11.4.3 Publications

To assess the extent of published material about chaparral that is easily available to the general public and schools, we conducted a review of books on the subject. There are relatively few publications that focus exclusively on the ecosystem. Unfortunately, it is not unusual to find misconceptions in these materials, especially regarding the chaparral’s fire regime. We have only reviewed those publications that avoid such errors.

The most thorough treatments of chaparral are contained within books that review all of the vegetation communities in California (e.g., Keeley and Davis 2007; Parker et al. 2016). Halsey (2008) offers an overview of chaparral ecology, a detailed discussion of the chaparral’s fragile relationship to fire, and suggestions on how human communities can adapt to California’s fire-prone environment. Keeley et al. (2012) provides an excellent analysis of fire in Mediterranean-type climate regions.

An old publication that is still available in the used book market is *The Elfin Forest*, by Francis M. Fultz (1927), the first popular book written about California’s chaparral. Fultz provides a description of the chaparral community that most chaparral explorers can appreciate when he wrote, “The Chaparral is very dear to me now, but when I first “hit the trail” that led me into it, it did not strike me at all favorably. And everything about it was so new and strange that I almost felt as if I were in another world.”

There are several plant identification publications that offer excellent information on the most common chaparral species. Kauffmann et al. (2015) is a well-organized field guide to the chaparral's most characteristic shrub, manzanita (*Artostaphylos* spp.). McLean and McLean (2003) produced a CD containing an easy to use guide to the common plants of the San Gabriel foothills (obtained at the Eaton Canyon Nature Center in Pasadena, California). A guide to the flowering plants of the Santa Monica Mountains written by Dale (1986) is out of print but can be purchased used online. It remains one of the best chaparral plant books available because in addition to the excellent photos, it provides interesting anecdotes about each species. Fillius (2005) offers a comprehensive guide to native plants at Torrey Pines State Reserve. The classic work on chaparral shrubs that should be on every chaparral enthusiast's bookshelf is Lester Rowntree's (1939) *Flowering Shrubs of California*.

11.4.4 Curricula

In terms of materials for schools, we found limited chaparral related curricula available to Kindergarten through 12th grade teachers. High school biology texts, mostly those for higher level courses such as Advanced Placement (AP) Biology, often include chaparral in the section on ecology as one of the world's major biomes. For example, the AP edition of Campbell Biology (Reece et al. 2011) provides an accurate, one page summary of chaparral, including the negative impacts of human-caused fires.

A popular elementary science text series in California by Macmillian/McGraw-Hill mentions chaparral in the third and fourth grade versions (Hackett et al. 2008). However, when it comes to listing plant communities, chaparral is missing. Only deserts, grasslands, forests, and Arctic tundra are discussed. Ignoring chaparral in deference to other communities is replicated in the new national Framework for K-12 Science Education which forms the foundation for California's Next Generation Science Standards. The Framework mentions deserts, grasslands, rainforests, coral reefs, and wetlands, but not Mediterranean-type climate region plant communities (NRC 2016). The absence is unfortunate because of the significant contribution chaparral and other Mediterranean-type climate ecosystems provide to the world's biodiversity.

In an effort to improve environmental education, California Assemblywoman Fran Pavley authored legislation in 2003 to develop an environmentally-based curriculum called the California Education and the Environment Initiative (EEI). It produced an environmental curriculum in 85 separate units for kindergarten through twelfth grade. The program was approved by the California State Board of Education in 2010.

Chaparral makes its first complete appearance in the EEI curriculum in the third grade. It is given a four page description in a booklet on California's natural regions that provides good descriptions of some of the ecosystem's species. However, the

description of chaparral includes problematic language that fosters the anthropocentric notion that fire is needed because it “cleans out old brush and brings about new growth.” On the other hand, a creative activity in the student workbook does accurately portray issues such as the threat of too much fire and development. In addition, a map of the major habitats in California including chaparral is provided as a supplement. Chaparral does not appear again in the EEI curriculum until the sixth grade with a brief mention of it being one of the nine biomes of the world. At the high school level, a unit examining biodiversity incorrectly lists chaparral as existing in only three of ten regions in California, the central coast, south coast, and the Sierra Nevada (EEI 2011). In contrast to the chaparral’s three appearances in the EEI curriculum, forests and deserts are discussed six times.

There are a large number of implementation partners in the EEI Program including the California Regional Environmental Education Community Network (CREEC) and the non-profit organization Ten Strands. When using the CREEC website search engine (accessed 5/2016) to find programs focusing on chaparral, only two appeared. One was a five-lesson packet about chaparral shrublands for fourth grade provided by the San Diego Child and Nature Collaborative. The other was a field program from the Ocean Institute for fourth, fifth, and sixth graders who visit six California plant communities, one being chaparral.

Overall, we found the coverage of chaparral in available curricula to be lacking in both accuracy and depth.

11.5 Recommendations

Chaparral occurs in every county in California and dominates the southern part of the state where more than 60% of the population lives. Furthermore, since chaparral is especially concentrated near many of the most populated areas of the state, it also represents one of the best places to explore nature, especially for individuals who do not have the resources to travel to more distant locations. As a consequence, chaparral should be a significant topic in environmental education programs throughout California. Otherwise, neither the public nor the government agencies that serve them are likely to grasp the significance of chaparral to us and the native species that live there.

All naturalist programs should identify chaparral as an important ecosystem by providing a full session, or at least a major part of one, dedicated to the subject. Only five of the 17 programs we evaluated did so. The basic themes that should be discussed in context of the chaparral ecosystem should include the following:

- **Mediterranean-type climate.** How it shapes the chaparral ecosystem and how it is expected to change in the future
- **Biodiversity.** The distinction between different types of chaparral (e.g., manzanita chaparral, red shanks chaparral, etc.), the high level of biodiversity in Mediterranean-type climate regions compared to the rest of the USA, and the chaparral’s most common native species

- **Botany.** Chaparral plant families, plant structure, and reproductive strategies
- **Evolution and ecology.** The origin and evolution of chaparral, speciation, and the ecological relationships between chaparral species
- **Fire ecology.** Chaparral plant and animal responses to fire, understanding that chaparral is adapted to a particular fire regime (not fire per se), that too much fire can destroy the chaparral ecosystem, and the role fire plays in the spread of non-native grass species
- **Chaparral physical environment.** The role of geology (e.g., soils) and geography in the distribution and diversity of chaparral, chaparral species (e.g., manzanitas), and other Mediterranean-type climate region shrublands such as California sage scrub
- **Chaparral ethics.** The importance of protecting an intact, healthy chaparral ecosystem for its intrinsic value and for human needs

Most nature education programs (and the grants that fund them) focus on elementary aged school children. The lack of opportunities for young adults to experience nature can negatively impact the transfer of these childhood experiences into adulthood. In California, some schools offer sixth grade camp experiences where students spend a week in a wildland area during the school year. Support for such camps needs to be increased and more nature education programs need to reach out to high school and college students, as well as families.

There is also a growing population of retired citizens who have a wealth of environmental knowledge and time to pass along the wisdom they gained when outdoor activity was the norm. Programs need to take advantage of this resource before the wisdom is lost. These volunteers can play an important role in initiating and supporting nature education programs for young adults. This means more than assigning older volunteers as trail guides. Older adults should serve as mentors through individualized programs that inspire younger adults to rediscover nature and motivate their peers to do the same.

The lack of diversity in the naturalist community is a critical issue that needs to be addressed. The United States Census estimates that by 2044, more than half of all Americans are projected to be people of color (any group other than non-Hispanic white) (Colby and Ortman 2015). In contrast, people of color compose only 12.4% of the staff in non-profit environmental groups (Taylor 2014). We have found even less diversity in the naturalist training programs we evaluated. If we intend to expand, much less maintain a population interested in the natural environment, naturalist education organizations must make a major effort to diversify their populations and approaches to learning. Lanham (2015), Professor of Wildlife Ecology at Clemson University, addresses the diversity issue in his short video, *Rules for a Black Birdwatcher* when he says, “When I meet another black birder, it’s like encountering an Ivory-billed Woodpecker, an endangered species. Extinction looms. We have to do something to make birding, to make nature study in general, more interesting to people of color.”

How do we increase diversity? How do we inspire more people to care about, and ultimately incorporate the chaparral into their lives? One place to start is by examining the way we teach natural history.

The most common method by which natural history information is shared with naturalist trainees and the public in the programs we reviewed is through lecture. While there is definitely a place for lectures, the method has been proven to be an ineffective way to develop meaningful, long-lasting learning (Bligh 2000). Lecturing also does not allow an individual to develop the personal meanings necessary to connect to a place and the species that live there. On the other hand, active learning techniques requiring students to engage in the learning process (e.g., discussions, presentations, interactive projects) result in better retention, deeper understandings (Prince 2004), and higher achievement (Freeman et al. 2014). In addition, active learning differentially benefits students of color (Haak et al. 2011). In other words, lecturing can discriminate against under-represented communities.

The question arises then, why do we keep lecturing when we want to pass along information we feel is important? One possible answer is that most of us have experienced lectures as the dominant teaching strategy, and as such we replicate what is familiar. Unfortunately, lectures fail to take advantage of the multiple ways people receive and process information (Gardner 1993).

Hughes, the interpretive specialist at the Irvine Ranch Conservancy suggested that, “99% of the people you talk to are going to remember you, not what you told them.” Therefore, he limits the number of new ideas or topics in any presentation to five, plus or minus two, and actively engages the listeners in the process. “Otherwise, people’s eyes just start to gloss over.”

11.5.1 The ENGAGE Model

The brain often wanders while being subjected to a lecture, and it frequently does (Halsey 2016). To engage the mind and inspire the passionate naturalists we endeavor to create, we recommend that naturalist education programs employ active learning strategies. One such strategy is the ENGAGE model (Halsey 2011b).

The ENGAGE model takes a six step approach to teaching content by using active learning techniques combined with utilizing meaningful interpretation. The ENGAGE model is based on the observation that single modality teaching (i.e., lecturing) is not effective because it is passive. The model can be used by a single interpreter working with a group on the trail or while teaching content in a traditional classroom. The point to remember is that those who do the teaching do the learning.

It is important, however, that practitioners of this model be prepared for moments of doubt and failure. Helping people to become engaged in their own learning is not easy. It takes a confident, often audacious coach to keep participants involved and willing to do the kinds of activities suggested by the model because most of us are accustomed to passive “sit and get” lectures. But learner involvement is critical if we actually want people to remember what we teach and to use that knowledge to change behaviors.

Work through the following six steps to help others learn, remember, and care about the content you wish to share. Be aware that without coaching, most who are asked to learn and follow this model will at first spend most of their time on step two because it is closest to the teaching style we are accustomed. The percentages listed indicate the approximate amount of time that should be spent on each step.

- **Step 1—Energize Learners (15%)**

Optimal learning begins when you energize people *before* the interpretation experience/class begins. This primes the learning process. Giving visitors/students interesting items to look at and analyze will introduce them to the subject and allow the brain to access similar information, increasing receptivity to learning. Provide a thoughtful question that can be answered individually or by a group. If you have contact information before the class/event, send out a short article on the subject.

- **Step 2—Navigate Content (35%)**

Provide a summary of the content through a brief discussion, supplemented with written documents, outlines, photos, and field specimens as appropriate. Then utilize a wide variety of activities to allow the participants to “teach back” the material to others (e.g., demonstrations, skits, stories, games, interactive discussions, jigsaw learning). Your role as a facilitator is to coach participants through the learning process and create enough diversity of activities to give everyone a chance to leverage their strengths as learners and maximize learning. Finally, review the content your participants have learned with a few quick questions. This is essential. The point of the questions is not to baffle, but to help participants demonstrate how they are smart.

- **Step 3—Generate Meaning (5%)**

Once the learners have grasped the key content through teach backs, help them develop meaning for that content by employing *meaningful interpretation*, a method often utilized by outdoor educators in national parks. Help the learners care for the subject they are learning about.

In his book, *Meaningful Interpretation*, David Larsen (2011) provides the answer to why we share our passions about the natural environment—we want people to care, and ultimately help protect the natural treasures we value. The way we do this is through meaningful interpretation—helping others find personal connections and meanings to the plants and animals, the places, and the ecological communities we love. Larsen writes, “Helping visitors connect to meanings is the entire goal. Meaning is more important than knowing! Your job is not to fill their heads with information... Even those people who want information want to connect it to personal meanings. Audiences want to connect to your place intellectually and emotionally.”

Once a meaningful connection is made, people care and will more likely *care for* the natural places we value.

Establishing meaning is often challenging because we are usually more focused on passing along content. It can begin by showing a sincere interest in the individual

you are communicating with. Ask rather than tell. Develop connections between an individual's interests and the subject being shared. Ask, "How do you think this place, this animal, this plant could be important to you?" Asking leading, follow-up questions can further the process. "Watch your daughter as she listens to the wren singing in the distance. What do you think is going on in her mind? Since a major part of a bat's diet is insects, how might your life change if bats disappeared? How did it feel to sit quietly, with your family, listening to the wind moving through the leaves?" When teaching a group, have participants discuss *why* the learning is important in their world. Have them list the values, benefits, and personal meanings of what they have learned in a journal, on an index card or flipchart. Asking "why" questions open minds to the next stage of learning.

- **Step 4—Apply Learning (35%)**

We often teach people what we want them to know (isolated facts), but do not have them demonstrate their knowledge in the setting where they can use it. If observation techniques are being taught, provide field journals and have participants practice describing sounds, sights, and smells on the trail. By using dots and dashes on a graph, bird calls can be easily documented and remembered. To apply interpretation skills, practice asking questions with other willing visitors that inspire curiosity about the subject, making sure the questions are designed to encourage further thought, not just simple answers. Ask participants to pick up a handful of soil and describe what it looks and feels like rather than asking difficult content questions that require prior knowledge. As participants apply what they have learned, they are creating new memories and deepening retention of content.

- **Step 5—Gauge and Celebrate Learning (10%)**

Checking for understanding is a critical component to ensure the learner has an accurate grasp of the new knowledge learned and meanings established. This was started in step two. During your interactions, continually check with the group you are teaching by asking questions, making sure they have understood what has been shared. Use creative ways to reward participants for learning (e.g., flash card games, crossword puzzles, bingo, interactive reviews, stump the panel, quiz shows, group mind maps). Let people "show how they are smart" as they answer questions and demonstrate their new knowledge.

- **Step 6—Extend Learning to Action**

Do not let the experience stop once the class or interpretation has concluded. Collect contact information if appropriate and offer follow-up extensions to what has been learned. Give everyone a token or talisman as a symbol of their new knowledge and ask the participants to pass it along to someone else they may inspire in the future. This is the principle behind Jim Lockyer's "COR = K" card he gives to students at the Santa Rosa Plateau. The idea is to keep the learning alive by creating a process to foster more curiosity, additional meanings, and a stronger relationship to the subject. This can also be used to establish a community of nature advocates. The Chaparral Naturalist Certification program at the Elfin Forest Recreational Reserve

which utilizes the ENGAGE model, awards three green marbles to its graduates—one to keep and two to share with people they may meet who also express an interest in inspiring others to love their local, natural environment.

The basic message of the ENGAGE model is that people learn best when they play an active, critical role in the learning process, apply what they have learned, and are encouraged to discover their own meanings to places and things.

11.6 Teaching to Inspire Life-Long Learning

Although we can identify the most effective way to communicate with people about nature, as Larsen (2011) reminds us, audiences hold power. He wrote, “No matter how enthusiastic, professional, knowledgeable, and creative an interpreter is, it is the audience that will ultimately decide if they had a meaningful experience, connected emotionally and intellectually, and believe the place (or subject) is worth caring about and for.”

Nature provides a wonderfully complex story with actors of many kinds that can inspire emotional connections and life-long passions. All we need to do is to show we care, provide the guidance, and then get out of the way. People do not care about how much you know unless they know how much you care. Rachel Carson (1965) addressed the significance of emotional connections when she wrote, “If facts are the seeds that later produce knowledge and wisdom, then the emotions and the impressions of the senses are the fertile soil in which the seeds must grow... Once the emotions have been aroused—a sense of the beautiful, the excitement of the new and the unknown, a feeling of sympathy, pity, admiration, or love—then we wish for knowledge about the object of our emotional response. Once found, it has a lasting meaning.”

When designing a program to increase awareness of California’s most extensive ecosystem, we need to ask not only *what* we want to teach about the chaparral, but *how* can we teach it to help develop meaning and connections. Our purpose as naturalists is to foster behavioral changes that will create a diverse population of life-long nature advocates—individuals who understand how and why nature, and specifically the chaparral, is such an integral part of our sense of place. Engaging, meaningful interpretation that reflects the significance and value of chaparral offers a compelling educational experience to accomplish this goal. Such an approach is within reach of every nature center, naturalist program, and classroom in California.

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