CALIFORNIA'S WATER

As the population of California grows, water is becoming increasingly scarce, and in drought years, there may simply not be enough for all of the people, plants, and animals that need it. Most of the state's water is stored as snow in the mountains, and when it starts melting in the spring, flows through areas like this before entering the rivers that supply water to the cities, farms and fish that depend on it.

Our Center is studying how water flowing through foothill woodlands is affected by such land management practices as oak tree removal, livestock grazing, and prescribed burning. This information will help woodland owners and managers better manage these lands to ensure a dependable high–quality water supply.

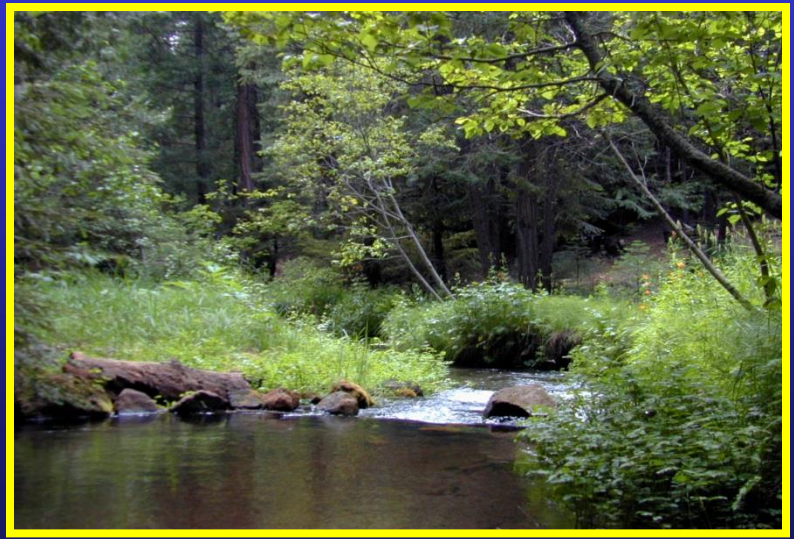
NATIVE AMERICANS

The first inhabitants of this area were Nisenan Maidu Indians who lived here for thousands of years before the arrival of "settlers" of European descent in the 1800s. The foothills provided a moderate climate and abundant food and supported several distinct tribes. The Nisenan ate deer and other game, waterfowl, and a wide variety of plants. The holes you see in these rocks were used for grinding seeds -- especially acorns -- into flour.

These "grinding rocks" are almost always found near rivers or streams because it was necessary to pour water over the acorn meal to leach out the bitter-tasting tannic acid. Each tribal member would collect up to 1000 pounds of acorns annually so acorns were a very important part of their diet. From the acorn flour the Indians made mush, soup, and bread. Native Americans also knew a great deal about all of the local plants and utilized many for food, medicines, and tools.

RIPARIAN VEGETATION

Plants that grow along streams or other wet areas are called *riparian species*. Riparian plants are important because they help stabilize soil and filter impurities from the water. In this area much of the riparian vegetation was removed 20 years ago, increasing the potential for erosion. We planted several woody species here including willows, cottonwoods and buckeyes to help make sure the banks are anchored by tree roots.



Some of these plants, such as willows and cottonwoods, are fairly easy to establish because they will root from stem cuttings. Others, such as oaks and buckeyes, require planting seeds or container-grown plants. Initially we used grow tubes around the young trees to protect them from browsing by deer and cattle and to help them grow faster. As you can see, this area is now fairly dense and the stream's banks are well-protected.

WILDLIFE HABITAT

In addition to helping filter water and stabilize soil, dense vegetation along creeks provides critical habitat for a variety of wildlife. All animals need to drink regularly, but many animals don't feel safe in the open. However, in the shelter and protection of streamside vegetation, deer, raccoons, skunks and foxes, among many animals that live in the foothills, regularly come to the creek to drink and rest.

Sometimes you can see their footprints in the soft soil near the water. The vegetation also provides ideal nesting sites for a wide range of birds which are very abundant in the spring. Even amphibians and reptiles rely heavily on these riparian areas for food, water and protection. Clearly riparian vegetation is very important for a wide range of wildlife!

IMPROVED PASTURES

Most oak woodlands in California are privately owned and the primary economic activity on these lands is livestock grazing. Cattle and sheep convert the stored energy of the green plants they consume into meat. Typically it takes 8 to 15 acres of dry rangeland to feed a cow and her calf for a year. However, by planting more productive plants and by fertilizing and irrigating these pastures, the same amount of forage can be grown on less than an acre.

The hillsides above here have been converted to improved pastures by tilling, removing rocks, seeding and fertilizing. They are also irrigated in the summer so they stay green year-around. Having such pastures on a ranch reduces the need to purchase expensive hay to feed when forage becomes scarce.

OAK WOODLANDS

The type and density of vegetation has changed dramatically as you climbed up from the creek to this drier hillside. Here the main plants are blue oak, interior live oak, foothill pine and annual grasses and forbs. It's easy to tell the two oak species apart because blue oak is deciduous and loses its leaves in winter, while interior live oak is evergreen and is green year-round . The larger oaks are over 200 years old so were present when Native Americans were the only people around.

These hillsides are extremely dry in summer, but the upland species present, unlike the riparian plants below, have adapted to these harsh conditions and have no trouble surviving, even during prolonged droughts. In the spring these hillsides are often covered by an assortment of wildflowers including lupines, clovers, fiddlenecks, brodias and mule ears.

OAK REGENERATION

Several species of native California oaks, including blue oak and valley oak, aren't regenerating well in certain locations. That is, there are not enough seedlings and saplings to replace the mature trees that will eventually die. Without adequate regeneration oak woodlands could convert to grasslands or shrublands. On the hillside across the road there are a variety of oak regeneration studies that have been established in the last 20 years to try to learn how to successfully plant and establish new oaks to replace those that die.

We have found that young oaks will survive and grow well if sufficient care is taken to plant and protect them. The most critical factors are providing adequate weed control and protecting the plants from the many animals, such as deer, livestock, rabbits, voles and even grasshoppers, intent on eating them.

MARSH VEGETATION

The vegetation along this portion of the creek differs from that where we stopped earlier (stop 4). Here there are few trees but numerous cattails, sedges, rushes, and blackberries. This vegetation, and the perennial water that flows through here, provides habitat for several ground nesting birds called rails. About 15 years ago we discovered a very rare bird species here called a black rail.

This species had never been found in the foothills before and was believed to be restricted to coastal marshes and a lower portion of the Colorado River. Based upon this discovery, an extensive inventory of this species has now discovered over 100 sites where black rails occupy foothill wetlands. These birds are extremely secretive and difficult to see but sometimes you can hear their *kee-kee-krr* three-note call or their deep throaty growl.

EUCALYPTUS GROVE

The trees on the hillside above you are eucalyptus, which originally came from Australia where they are native. The first ones were planted in California more than 100 years ago in hopes that they would become an important timber species. That never worked out, but they did find out that eucalyptus can grow exceedingly fast under the right conditions. We planted eucalyptus here at the SFREC because we wanted to find out which species would produce the greatest amount of wood for firewood.

After 5 years, some of the trees grew to more than 50 feet tall! The best species (of the 7 tested) produced nearly 10 cords per acre per year when watered and fertilized. While we certainly don't want eucalyptus to replace native oaks in the foothills, small eucalyptus plantings could potentially reduce the pressure on oaks by providing a cheaper source of firewood.

BROWSED OAKS

See these small trees here. These are blue oaks. They look kind of stunted don't they? This is because some animals apparently keep chewing on them, preventing them from growing very tall. The most likely culprits are deer and cattle People worry about this because if the seedlings can never grow very tall, they will never become full-grown trees. Browsing is one of the reasons why blue oaks aren't regenerating very well in some locations.

Without adequate regeneration, blue oaks could disappear from areas when all of the old trees die. This would be very bad because oaks are important for so many reasons – they provide excellent wildlife habitat, they help stabilize soil, and they are beautiful to look at. In addition to developing strategies to artificially regenerate oaks, we are evaluating whether protecting naturally occurring blue oak seedlings with grow tubes can enhance their growth and survival.

NATURAL RESOURCES

Even a short walk through these foothill woodlands reveals a rich array of natural resources which provide a wide variety of values including water, wildlife habitat, forage, food, and wood products. These areas are also beautiful to look at, walk through, and recreate in. Here at the Sierra Foothill Research and Extension Center we're committed to understanding how to protect and mange these resources to maintain and enhance their ecological integrity and the wide spectrum of benefits they offer to society. We plan to pass these resources along in a healthy and sustainable condition so that future generations will enjoy – and make use of – them as we do today.

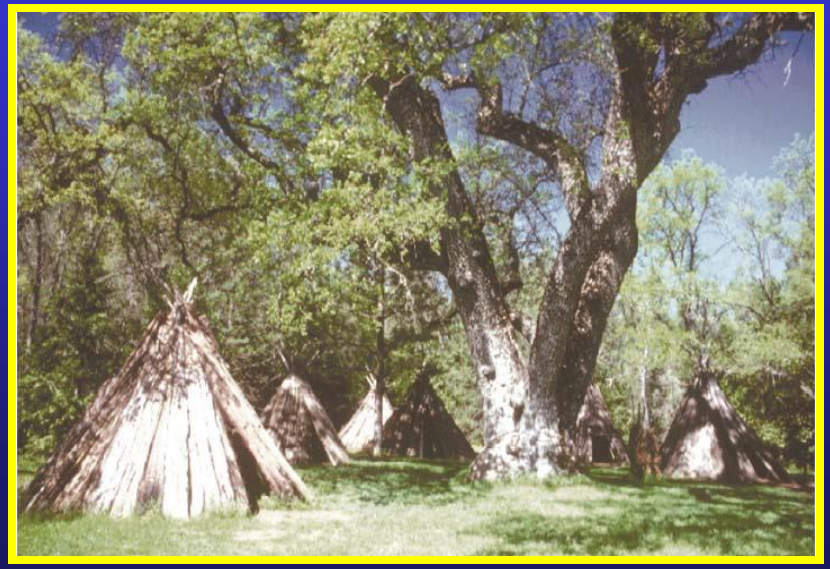
PIPEVINE

Pipevine is a vigorous, climbing woody vine with large, heart-shaped leaves and curved, purple, striped, pipe-shaped flowers. This deciduous plant is common in moist woods and along streams (like this one) in Northern California. Pipevine is poisonous to most animals because it contains toxic alkaloids. As a result it is rarely eaten, except by swallowtail butterflies which are immune to its poison.

The larva of pipevine swallowtails relies on California pipevine as its only food source. After mating, female butterflies lay eggs on the undersides of leaves. The caterpillars eat the leaves and then use the flowers as a secure, enclosed place to undergo metamorphosis. After ingesting the leaves, caterpillars sequester the toxins which then make them undesirable to predators even as adults. Adult swallowtails fly from late winter to early autumn, but are much more numerous before the 4th of July than later.

THOSE WHO CAME BEFORE US --

The first inhabitants of this area were Nisenan Maidu Indians who lived here for thousands of years before the arrival of “settlers” of European descent in the 1800s. The foothills provided a moderate climate and abundant food and supported several distinct tribes. The Nisenan ate deer and other game, waterfowl, and a wide variety of plants.



The holes you see in these rocks were used for grinding seeds -- especially acorns -- into flour. These “grinding rocks” are almost always found near rivers or streams because it was necessary to pour water over the ground-up acorn meal to leach out the bitter-tasting tannic acid. Each tribal member would collect up to 1000 pounds of acorns annually. From the acorn flour the Indians made mush, soup, and bread. Native Americans also knew a great deal about almost all of the local plants and utilized many of them for food, medicines, and tools.

COMMON TREES AT THE SFREC

Foothill regions like this one are called *oak woodlands* because the dominant species of trees are oaks. Here the two common oaks are blue oak and interior live oak. Blue oak is *deciduous*, which means that it loses its leaves in winter. Interior live oak, on the other hand, is *evergreen* and has leaves on it year-round. These oaks are important for a number of reasons – they provide excellent wildlife habitat, they help stabilize soil, and they are beautiful to look at.

The other common species of tree here is foothill pine. This tree grows taller than either of the oaks and has pine needles for foliage. Unlike most other pines, however, the needles are quite sparse and don't provide much shade. There are also valley oaks and California black oaks at the SFREC. Valley oaks generally grow near water so are common along streams and rivers. California black oaks occur at higher elevations. Both of these oak species are deciduous.

WILDLIFE USE

At a previous stop we mentioned that oaks provide important wildlife habitat. This means that they provide food, shelter, and cover for a variety of animals. Oaks are especially important since so many animals eat acorns, the seeds of oak trees. Can you think of some animals that eat acorns? There are even animals such as squirrels and acorn woodpeckers that collect and store acorns so they will have food to eat during the winter.

There are also many species of animals that use the Yuba River itself. Ever hear of river otters? They are like sea otters but live in fresh-water rivers. We sometimes see them swimming – and fishing – in the river below. Often there are also a variety of water birds such as mallard ducks and hooded mergansers that hang out here. Up on the river's bank you can sometimes see evidence of mammals such as deer, coyote, fox, bear and even cougar. Clearly the Yuba River is very important for wildlife!

YELLOW STARTHISTLE

Yellow starthistle is one of California's most noxious weeds that was accidentally introduced via alfalfa seed in the middle of the 19th century. By 1958 it had spread to a million acres. That was just the beginning. Today it occurs on over 15 million acres of rangelands, native grasslands, orchards, vineyards, pastures, and roadsides and can be found in 56 of California's 58 counties. Human activities are the primary mechanism for long distance movement of yellow starthistle seed as it is transported in large amounts by road maintenance equipment and on the undercarriage of vehicles.

Because of the spiny nature of yellow starthistle, livestock and wildlife avoid grazing it, except when it is very young . It is also toxic to horses. The one group of people that likes starthistle is bee keepers as it is regarded as an important honey source-plant in California. There are a variety of approaches for controlling starthistle, including grazing, fire, cultivation and herbicides, but all are aggravated by the fact that it is such a prolific seed producer, with a single plant producing as many as 75,000 seeds!

CATTLE GRAZING

In addition to being a place where important research on plants, wildlife, and water takes place, the Sierra Foothill Research and Extension Center (SFREC) also has a large cattle herd that grazes most of its 5700 acres. This herd is used for research on a variety of subjects including animal health, genetics, supplementation, and nutrition. This Nature Trail is in an area that is grazed each year, usually in the spring and fall.

Cattle put on most of their weight in the spring when the annual forage plants are actively growing and are extremely nutritious. While most of the ground vegetation is eaten, cattle do have their preferences and dislikes. Some of their favorites are clovers and filaree, which are both relatively high in nitrogen. At the opposite end are starthistle and medusahead, which are considered unpalatable noxious weeds. However, cattle will even consume these when they are young and tender. Many foothill plants such as fiddleneck and lupine are actually poisonous to cattle, but the animals seem to know not to eat them.

ACORNS ON OAK TREES

Have you ever heard the expression, "*A mighty oak from an acorn grows*? This expression tells us that even huge, majestic oak trees all start as small seeds. Oak trees produce acorns annually, but the number of acorns produced each year varies enormously. In "good" acorn years, there can be so many acorns that the branches bend under their weight and in the fall they rain down on anything under the tree. In "bad" years, it may be hard to locate a single acorn.

So what is going on? Research suggests that the weather at the time of flowering is the best predictor of acorn production. Since oaks are wind pollinated, cold, wet, springtime weather makes it more difficult for pollen to "find" female flowers and fertilize them – hence few acorns. Warm, dry and windy conditions do just the opposite. "Good" acorn years are also very good for wildlife since so many animals eat scorns. For instance, fawning rates improve during heavy acorn years. So when you see abundant deer, thank the oak trees and the acorns they produce.

SOAP PLANT OR AMOLE

A common plant in this area is called the soap plant or amole. It has long wavy leaves that come out in the spring. Beginning in early summer these leaves flatten on the ground and a central flower stalk starts to grow with dainty blue-veined white flowers. This plant was especially important for Indians, or Native Americans, and it had many uses. The bulb was baked for food, and the coarse fibers were used to make brushes. The crushed bulb made a soapy lather that was used as a shampoo.

In addition, the mashed bulb was applied to relieve sores and poison oak rashes and to cure rheumatic pains and cramps. The very young shoots are a very sweet food when cooked slowly in a pit oven. The older leaves were used for wrapping acorn bread during baking and the juice from the leaves was pricked into the skin for green tattoo markings. So you can see that even a single type of plant can have a wide range of uses.

WILD TURKEYS

Wild turkeys are common in foothill areas like this and we often see large flocks at the Sierra Foothill Research and Extension Center (SFREC) of a dozen or more birds. They are especially visible in the spring when they are mating and we regularly see male turkeys courting females by displaying their tail feathers as shown below. This display is apparently meant to impress the female birds and convince them that they would be a good "catch". Turkeys lay clutches of about 8-15 eggs which hatch after four weeks.

Wild turkeys are not native to California but were introduced here from various places including Mexico, Arizona and Texas, beginning in 1877. They have spread widely and are now present in 54 of 58 counties, with an estimated state population of a quarter of a million birds. They are very common in oak woodlands because they especially like acorns which are an important part of their diet. Turkeys are a highly prized game animal and the State Department of Fish and Game reports that approximately 20,000 birds are shot each year.

BLACKBERRIES

Blackberries are very common at the SFREC and produce abundant fruit in the late summer. There are actually three different blackberry species here including one native one (California or trailing blackberry), and two exotic or introduced ones (Himalayan and eastern blackberry). While blackberries provide important sources of food and cover for many birds and mammals, and humans enjoy eating them, some blackberry species can be very aggressive and "take over" areas by smothering out any other vegetation present.

That is why some ranchers (as well as the folks who manage the livestock here at the SFREC) that depend on forage for their livestock, are generally not crazy about blackberries, especially Himalayan. This species was introduced to the United States in the late 1800s and has spread widely in California, mainly because it can grow very fast in a wide range of habitats. Not only is this species generally considered unpalatable for cattle, but when they do eat it, the thorny stems can injure their nasal passages. On the other hand, is there anything better than warm blackberry pie covered with ice cream? We think not.

DON'T EAT THAT PLANT!

Many plants in the foothills are poisonous to both people and animals and should never be eaten. Sometimes just the fruits are toxic. Other times it may be the foliage. And in some cases, the entire plant is poisonous. Plants have evolved toxic properties to protect themselves from being eaten. The mushroom pictured below is an *Amanita smithiana* and can cause death if ingested. Unfortunately it appears similar to some edible mushroom species.

Some of the more common plants in this area that have at least some poisonous parts are buttercups (whole plant), buckeyes (fruit), vetch (seeds), and mistletoe (berries). Another example of a plant that contains parts that are edible and parts that are poisonous is blue elderberry, shown above. In this case, the red berries are toxic, but the blue berries are OK and are commonly used in jams and syrup. The red berries, however, contain a toxic alkaloid that can give you a severe tummy ache if you eat enough of them. So unless you know for certain that a plant is edible, don't eat it!

CALIFORNIA WILD GRAPE

California wild grapes are common in this area and you can often see the vines draped and climbing over other vegetation, especially in riparian areas. They are able to “climb” on other plants by using tendrils that attach to anything rigid, giving them support to grow upward. Like domestic grapes, the wild purple grape is edible and was highly prized by the native peoples that lived here. In addition, Indians used the vines in basketry and the large leaves were applied as poultices for snakebites.

The vines were also used in construction by wrapping them around upright poles to form the frames for acorn storage granaries and to bind together the pole framework for temporary houses. Wild grapes still provide important wildlife habitat. Many bird and mammal species eat the fruits and the vines provide critical thermal and hiding cover. Wild grapes were once so abundant in this area that the earliest Spanish explorers named the river system “Uva” which is the Spanish word for grape. Later this was Anglicized to become the “Yuba” River.

WORKING LANDSCAPES

In general, working landscapes are lands actively used for the production of food, fiber, earth products and outdoor recreation. In contrast, developed areas are lands taken out of production and converted to buildings as part of residential and/or commercial construction. In California and elsewhere, there is a widespread movement to make sure rural areas are maintained as working landscapes so that the wide array of economic and ecological benefits these lands provide are enhanced and maintained.

In the foothills of the Sierra Nevada, the majority of the lands are privately owned and the primary economic activity is livestock grazing. In 2005, seventy five different groups signed a *Rangeland Coalition Resolution* to recognize that California's livestock industry is largely responsible for providing a wide array of amenities to the public at little or no cost through its grazing management practices. This resolution also seeks to ensure that ranching in California remains healthy.