

Protecting Homes and Communities from Wildfire

Preventative Cross-training Education for the Business Sector

Curriculum Outline

THE FIRE ENVIRONMENT

Module Time Frame: 1.25 hours

Curriculum Objectives:

Students will be able to:

1. Name the three ways that fire propagates
2. Identify how fuel, topography and weather affect fire spread
3. Name four common habitats/plant communities in San Diego County
4. Describe the five basic fire survival strategies of shrubland plant species
5. Understand the effects of changing fire regimes on native habitats.

Summary

More and more homes are built into the wildlands every year. San Diego's wildlands are prone to wildfire. An understanding of the how and why fires burn in San Diego wildlands and an understanding of the effects of fire and mitigation on local ecology will help us make better decisions about:

- How to modify the landscape around homes and communities.
- How to prepare structures to better withstand environmental forces such as wildfire.

Outline:

- a. Basics: Fire needs three things to burn, and more importantly propagate
 - i. Fuel: Vegetation, wood decks, houses, gazebos, etc.
 - ii. Oxygen: Fire will burn better in fuels where air can circulate; i.e. dead leaves still on the tree will burn better than leaves on the ground
 - iii. Heat - fuels can ignite through one, or through a combination, of three ways:
 1. Convection: The transfer of heat through gasses or liquid
 - a. Example: Structures on hill sides being pre-heated from fire down slope
 2. Conduction: The transfer of heat through objects in direct physical contact

- a. Example: embers falling on cotton patio chair cushions
3. Radiation: Transfer of heat through rays
 - a. Example: a hot fire in the yard igniting curtains inside the house through a window.
- b. Characteristics of fire behavior
 - i. Flame Length:
 1. Reach of the flame from the average base of the flame to ends of the lean (i.e. the tips of the attached flame.)
 2. Implications: A fire with six foot flame lengths probably won't ignite a house if the fire is 30 feet away (not accounting for embers). Therefore, can you reduce flame length?
 - ii. Fire line Intensity:
 1. Amount of BTU's produced in flaming front of fire.
 2. Implications: Reduce the impact of radiant heat, preferably by increasing the structural materials resistance to heat and by reducing the radiant heat of the fire itself immediately next to the structure.
 - iii. Embers:
 1. Smoldering pieces of fuel carried by winds that can travel well ahead of fire front and ignite homes and vegetation far from the main fire.
 2. Implications: Reduce ember impingement and utilize non-flammable materials where embers might gather (such as roof).
- c. Several factors affect fire behavior
 - i. Fuel
 1. Live fuel moisture
 - a. Rate of change dependant on fuel type: lighter fuels dry out quicker when relative humidity drops, heat rises from environmental temperature, winds or flame fronts. Heavier fuels take longer to dry out and therefore, in some instances can slow fire spread.
 - b. Live fuel moisture below 60% is considered critical; the fuel in question will promote rapid fire spread
 2. Light, flashy fuels
 - a. Grasses, annuals, etc
 - b. Dry quickly from weather or encroaching fire
 - c. "Sprinters" - Fire spreads quickly, especially under windy conditions
 3. Shrubs/Brush
 - a. Can provide dense and difficult environment for firefighters to work in
 4. Heavy fuels, timber
 - a. Maintain live moisture longer
 - b. Will sustain fire longer and produce more heat when dry
 5. Ladder fuels
 - a. Contiguous fuels that provide a path for fire to follow vertically; contiguous fuels horizontally also carry fire

- ii. California sagebrush (*Artemisia californica*)
 - iii. California buckwheat (*Eriogonum fasciculatum*)
 - iv. Laurel sumac (*Malosma laurina*)
 - v. White sage (*Salvia apiana*)
 - c. Height/Density characteristics
 - i. An average height of approximately three to four feet
 - 2. Chaparral – Dominant plant community in Southern California
 - a. The seven most common types of chaparral in our area are
 - i. Chamise chaparral
 - ii. Southern mixed chaparral
 - iii. Maritime chaparral (*Quercus dumosa*, *Ceanothus verrucosus* and other endemics)
 - iv. Red shanks chaparral
 - v. *Ceanothus* chaparral
 - vi. Scrub oak chaparral
 - vii. Montane chaparral (primarily manzanita sp.).
 - b. Key plant species
 - i. Chamise (*Adenostoma fasciculatum*) with scattered bunchgrasses (Holland 1986).
 - ii. Southern mixed chaparral is a plant community typically dominated by relatively broad-leaved shrubs or small trees such as Manzanita (*Arctostaphylos* spp.) Scrub oak (*Quercus dumosa*), toyon (*Heteromeles arbutifolia*), and *ceanothus* or wild lilac (*Ceanothus* spp.).
 - c. Height/Density characteristics
 - i. A range in height of approximately three to ten feet.
 - 3. Woodland/Forest
 - a. Coast live oak woodlands are present in the valleys and coastal slopes of the southern California foothills and are typically found on north-facing slopes, valley bottoms and shaded ravines in the south. Coast live oak woodland is dominated by the evergreen coast live oak (*Quercus agrifolia*). Conifers in Palomar area northeast of San Diego. 2003 Cedar fire may have changed distribution of conifers.
 - b. Key plant species (photos)
 - i. Coast live oak (*Quercus agrifolia*)
 - ii. Toyon (*Heteromeles arbutifolia*)
 - iii. Gooseberry (*Ribes* spp.)
 - iv. Mexican elderberry (*Sambucus mexicana*)
 - c. Height/Density characteristics
 - i. Coast live oak can grow up to approximately 80 feet.
 - 4. Riparian
 - a. Riparian systems are found around relatively abundant water sources such as run-off or streams in canyon floors. The regular or semi-regular water supply helps support greater vegetation growth potential

- b. Key plant species
 - i. Mule Fat (*Baccharis salicifolia*)
 - ii. Arroyo Willow (*Salix lasiolepis*)
 - iii. Cottonwood (*Populus fremontii*)
- iii. Conservation
 - 1. MSCP Program
 - a. The Multiple Species Conservation Plan (MSCP) is a comprehensive habitat conservation planning program for southwestern San Diego County. The plan was created to preserves open space habitat and biodiversity.
 - b. Sensitive plant species
 - i. *Dudleya variegata*
 - ii. San Diego thorn mint
 - iii. Otay tarplant
 - c. Sensitive animal species
 - i. Quino checkerspot butterfly
 - ii. Least Bell's vireo
 - iii. Stephen's kangaroo rat
 - iv. Coast horned lizard
 - v. California gnatcatcher
 - iv. Threats
 - 1. Invasive species
 - a. Native plant communities that remain in this region are threatened by fragmentation and invasion by exotic species (non-native vegetation and animals). Development is a major threat to the remaining communities as it directly impacts habitat and promotes invasive weeds to colonize previously pristine native dominated areas.
 - 2. Disturbance: promotes invasive weeds which increase the probability of fires
 - v. Fuel Modification Effects on Habitat/Sensitive Species
 - 1. Brush management introduction: REQUIREMENTS DIFFER BY JURISDICTION – Check with local fire marshal
 - a. Brush management zones – Usually totaling 100 feet
 - i. Zone 1 radiates out 35 - 50 feet from the home.
 - ii. Zone 2 is the latter 50 - 65 feet just outside of Zone 1.
 - 2. Vegetation management methods
 - a. Fuel management should follow specific guidelines found within the City of San Diego Municipal code or that of other local jurisdictions.
 - 3. Timing-effects on sensitive species
 - a. Vegetation management during specific times of year may adversely affect sensitive plant and animal species. For example, California gnatcatcher breeding season runs from February 15 through August 15th. During this time period, no

- brush management activities may proceed within or directly adjacent to gnatcatcher habitat.
- vi. Fire resistant plantings/erosion control
 1. Native plants/habitat in the management zone. How can it be accomplished?
 - a. Use of fire resistant natives from the local area are recommended.
 - b. The need to institute brush management and potentially threaten natural resources can potentially be reduced through fire resistant building modifications: PRC 4291 - “the director may adopt regulations exempting structures with exteriors constructed entirely of nonflammable materials, or conditioned upon the contents and composition of same, he or she may vary the requirements respecting the removing or clearing away of flammable vegetation or other combustible growth with respect to the area surrounding those structures”
 - vii. Erosion control
 1. Avoid vegetation *clearing*, which can leave open ground that is susceptible to erosion.
 2. Utilize thinning: Thinning can be accomplished without jeopardizing soil stability.
 3. If soil stability is jeopardized, appropriate erosion control measures that meet the Regional Water Quality Control Board standards should be implemented.
 - g. Local fire ecology – Why Sunshine, Shrubs and Wildfire?
 - i. Survival in a Mediterranean-type Climate
 1. The Mediterranean climate exists in only five places in the world, representing only 2% of the world’s land area. This unique climate helps makes Southern California’s flora and fauna some of the most unique and diverse in the world.
 2. Seasons dictated by rainfall that is dispersed quite differently than rest of nation.
 - a. Spring: After first rains, usually in November/December
 - b. Fall: Very brief, usually in June (or August at higher elevations)
 - c. Drought
 - ii. Adaptation: An adaptation is a pre-existing behavioral or physical trait of a group of organisms that allows it to survive an environmental condition.
 1. Drought adaptations
 - a. Leaf adaptations
 - b. Avoiders: Usually have deep tap roots that find water
 - c. Persisters: Shallow roots but hang on through conservation
 - d. Retreaters: Annuals
 - e. Chameleons: Hang out but leaves change; semi-deciduous

2. Difference between “fire” and fire regimes: Chaparral not adapted to fire per se, chaparral has been able to survive certain fire regimes based on frequency, intensity and seasonality of fire.
3. Fire adaptations
 - a. Obligate resprouters: Don’t completely die, resprout after fire
 - b. Obligate seeders: Can’t germinate unless scarified by fire in some way; adults die
 - c. Facultative seeders: respond both by resprouting and germination
 - d. Annuals and short-live perennial fire followers
 - e. Geophytes: bulbs that hang out until fire removes the canopy resulting in lots of available sunlight
- iii. Chaparral remains healthy without fire
- iv. Fire suppression has not led to bigger fires in Southern California
 1. Fire frequency has not reduced over the past century despite changes in fire suppression policy.
 2. Acres burned per decade shows increasing or increasing trend over the past century despite changes in fire suppression policy.
 3. Sources of ignition have always been primarily anthropogenic
 4. As population increases so too does recorded fire frequency
 5. Fire frequency and acres burned do correlate strongly to times of year with highest recorded Santa Ana wind days
- v. So what do we do about it?
 1. Create sustainable, fire-safe environments for our homes by starting from the house out rather than from the wildland in.
Through:
 - a. Community design
 - b. Building design
 - c. Landscape design
 - d. Personal responsibility

Reference Materials:

The Science of Wildland Fire, National Interagency Fire Center,

http://www.nifc.gov/preved/comm_guide/wildfire/fire_4.html

San Diego Wildfires Education Project, “How Fire Burns.”

<http://interwork.sdsu.edu/fire/resources/fire-burns.htm>

The Santa Ana Winds, UCLA p.1 (of 5)

<http://www.atmos.ucla.edu/~fovell/ASother/mm5/SantaAna/winds.html>

Wildland Fire Terminology, U.S. Forest Service

<http://www.fs.fed.us/r5/fire/management/terminology/>

Cabrillo National Monument Habitat Summary

<http://www.nps.gov/archive/cabr/florafau.html#SUM>

California Native Plant Society

<http://www.cnps.org/activities/natives.htm>

California Chaparral Institute Fire and Habitat page

<http://www.californiachaparral.org/bprotectingyourhome.html>

Department of Fish and Game Natural Community Conservation Planning page

<http://www.dfg.ca.gov/nccp/>

Multiple Species Conservation Program homepage

<http://www.sandiego.gov/planning/mscp/>

Brush management requirements as stated in the City of San Diego Municipal code (pgs 21-27):

<http://clerkdoc.sannet.gov/legtrain/mc/MuniCodeChapter14/Ch14Art02Division04>

Brush management incorporated into the landscape standards (pgs 29-30):

<http://www.sandiego.gov/development-services/industry/pdf/landdevmanual/ldmlandscape.pdf>

Fire safety and brush management guide depicting how to properly prune for brush management: <http://www.sandiego.gov/fireandems/pdf/brushpdf.pdf>