

UC Agriculture & Natural Resources

Forestry

Title

Forest Stewardship Series 1: Introduction to Forest Stewardship and Glossary of Terms

Permalink

<https://escholarship.org/uc/item/8001z5gm>

Authors

Harris, Richard
Valachovic, Yana
Nakamura, Gary

Publication Date

2007-12-01

DOI

10.3733/ucanr.8231

Peer reviewed



**UNIVERSITY OF
CALIFORNIA**

Division of Agriculture
and Natural Resources

<http://anrcatalog.ucdavis.edu>

FOREST STEWARDSHIP SERIES 1

Introduction and Glossary

RICHARD HARRIS, UCCE Forestry Specialist, Department of Environmental Science, Policy, and Management, University of California, Berkeley; **YANA VALACHOVIC**, UCCE Forest Advisor, Humboldt and Del Norte Counties; **GARY NAKAMURA**, UCCE Forestry Specialist, Department of Environmental Science, Policy, and Management, University of California, Berkeley

The Forest Stewardship Series has been developed to provide owners of California forestland with a comprehensive source of information pertinent to the management and enjoyment of their lands. The authors hope that the information provided will help you formulate and implement strategies for achieving your personal goals as a landowner.

Your property is unique, and your vision or expectations for it are equally unique and personal. This series covers many topics. You may already be knowledgeable about some of them; you are encouraged to consult whatever leaflets you find useful. The series is not organized like a textbook. Some of the topics naturally relate to each other and should be read together, whereas others are virtually independent. Together, the series provides an introduction to the lifelong study of forest stewardship that is part of owning forest property.

The publications in the series do not tell you what to do but instead help you learn more about your forest and your many management options, and give you some of the tools necessary to define and achieve your goals. Reading the publications may lead you to conclude that you need to know more about a particular topic. The University of California Cooperative Extension (UCCE) offers workshops and courses that can further your education and planning for your property. You can find out about these courses by consulting the UC Berkeley Forestry Center Web site at <http://forestry.berkeley.edu>.

This first publication in the series introduces the series and also contains a glossary of terms used in forest stewardship.

WHAT IS FOREST STEWARDSHIP?

Forest stewardship is a general approach to management. Definitions abound, ranging from simple to complex, but the thrust of all definitions is that forest stewardship entails an approach to management that meets the needs of the current owners but does not detract or degrade the use by future generations. Furthermore, forest stewardship is based on conservation principles that ensure protection of all forest resources including wildlife, timber, soil, water, recreational opportunities, and natural beauty. Forest stewards actively manage their land on a long-term basis by following management objectives that are multiple-resource based, economically viable, conservative of natural resources and socially, environmentally and ecologically responsible.

The Forest Stewardship Series provides many of the intellectual and scientific premises underlying the forest stewardship management approach. The other equally important element is personal commitment to carry out management activities that are based on stewardship objectives and principles.



PUBLICATIONS IN THE SERIES

Stewardship management requires broad knowledge that crosses a variety of disciplines. The Forest Stewardship Series currently includes the publications listed below. In the future, more publications may be added or existing publications may be revised.

- A Forest Stewardship Framework (Publication 8232)
- Forest Ecology (Publication 8233)
- Forest History (Publication 8234)
- Tree Growth and Competition (Publication 8235)
- Forest Vegetation Management (Publication 8236)
- Forest Regeneration (Publication 8237)
- Forest Wildlife (Publication 8238)
- Forest Streams (Publication 8239)
- Riparian Vegetation (Publication 8240)
- Forest Water Quality (Publication 8241)
- Fish and Fish Habitat (Publication 8242)
- Threatened and Endangered Plants (Publication 8243)
- Exotic Pest Plants (Publication 8244)
- Wildfire and Fuel Management (Publication 8245)
- Forest Pests and Diseases (Publication 8246)
- Forest Roads (Publication 8247)
- Stewardship Objectives and Planning (Publication 8248)
- Laws and Regulations Affecting Forests, Part I: Timber Harvesting (Publication 8249)
- Laws and Regulations Affecting Forests, Part II: Activities Other Than Timber Harvesting (Publication 8250)
- Economic Considerations in Forest Stewardship (Publication 8251)
- Forest Taxation, Estate Planning, and Conservation Easements (Publication 8252)
- Technical and Financial Assistance (Publication 8253)
- Professional Assistance (Publication 8254)

Each publication provides a general introduction to the topic and suggests ways in which you may learn more about your property. The underlying premise is that as a forest landowner you should be informed enough to know the implications of your management actions. For example, you should know enough about forest ecology and wildlife to be able to weigh the benefits and impacts of practices such as timber harvesting. In many cases, you may be the one carrying out the management actions on your property. But in situations where others are doing work on your behalf, you should be able to communicate your objectives and avoid unpleasant surprises.

The best outcome of all would be that if reading these publications stimulates you to develop a forest stewardship plan for your property. The tools for developing a plan are provided here. With a plan, you are not only able to communicate with others but also have a benchmark to assess your progress.

We welcome you to the Forest Stewardship Series and hope you enjoy using it.

AUTHORS

Contributing Authors

MICHAEL DE LASAUX, UCCE Natural Resources Advisor, Plumas and Sierra Counties

GREGORY GIUSTI, UCCE Forest Wildland Ecology Advisor, Mendocino County

RICHARD HARRIS, UCCE Forestry Specialist, Department of Environmental Science, Policy, and Management, University of California, Berkeley

SUSAN D. KOCHER, UCCE Natural Resources Advisor, El Dorado County

JOHN LEBLANC, California Registered Professional Forester, Garden Valley, CA

LAURIE LITMAN, InfoWright, Stockton, CA

HEATHER MORRISON, California Registered Professional Forester, Camptonville, CA

GARY NAKAMURA, UCCE Forestry Specialist, Department of Environmental Science, Policy, and Management, University of California, Berkeley

CLARALYNN NUNAMAKER, California Registered Professional Forester, Scotland, UK

KIMBERLY RODRIGUES, Regional Director, UC Agriculture and Natural Resources North Coast and Mountain Region

YANA VALACHOVIC, UCCE Forest Advisor, Humboldt and Del Norte Counties

Series Editorial Committee

YANA VALACHOVIC, GARY NAKAMURA, and RICHARD HARRIS

GLOSSARY

Abney level. An instrument used to determine slopes, elevations, and heights. Replaced by clinometers.

anadromous. Fish such as salmon, steelhead, and shad that spend part of their life cycle in fresh water and part of it in the ocean. As adults they migrate from salt water to fresh water to spawn. The young are partly raised in fresh water and then migrate to the ocean until they reach sexual maturity.

aspect. The direction a landscape slope faces, expressed as a cardinal direction or compass direction.

bankful discharge. The maximum volume of water that a stream channel can carry before it overtops its banks. It is further defined as the flow that occurs on average once every 1.2 years.

beneficial uses. Legally defined as the priority uses of water for humans and nonhumans, including drinking water, irrigation water, hydropower generation, recreation, fisheries, and aquatic habitat.

best management practice (BMP). In water-related usage, a practice or combination of practices that is determined by a state government agency to be the most effective, practicable means of preventing or reducing the amount of pollution generated by point and nonpoint sources (such as forests and farms) to a level compatible with water quality goals.

biodiversity. The variety of organisms in a community, their ecological roles, and their genetic variation.

biological control. The application of a natural control agent to regulate pest species, such as using *Bacillus thuringiensis* (Bt) to control foliage-eating caterpillars.

biomass. The living or dead weight of organic matter in a tree, stand, or forest; also, the wood product from in-woods chipping of whole unmerchantable trees, limbs, tops, and slash for energy production in a wood-burning electric power plant.

BLM. See Bureau of Land Management.

BMP. See best management practice.

- BOF.** California State Board of Forestry and Fire Protection, which develops rules and regulations for management on private forest lands.
- bole.** The main stem or trunk of a tree. Seedlings and saplings have stems, not boles.
- browse.** Woody vegetation, buds, stems, and leaves consumed by livestock or wildlife, mainly ungulates.
- buffer strip.** Zones adjacent to a watercourse that are managed to preserve water quality and protect aquatic habitat.
- Bureau of Land Management (BLM).** An agency of the U.S. Department of the Interior that manages 15 million acres in California for multiple uses, today primarily recreation and watershed or environmental protection but formerly for cattle grazing; also manages some forested land in Northern California. Formerly known as the Grazing Service and the General Land Office, which was responsible for disbursing public lands under the Homestead Act.
- CAL FIRE.** See **California Department of Forestry and Fire Protection.**
- California Department of Fish and Game (CDFG).** Agency that reviews timber harvest plans and provides recommendations for the protection of wildlife and threatened and endangered species.
- California Department of Forestry and Fire Protection (CAL FIRE).** The primary agency responsible for review and approval of timber harvest plans; formerly known as the CDF.
- California Environmental Quality Act (CEQA).** The California equivalent of the federal National Environmental Policy Act.
- California Geological Survey (CGS).** Formerly the Division of Mines and Geology (Department of Conservation). Agency that participates in review of timber harvest plans in regard to landslides, debris flows, and other geological hazards.
- cambium.** Layer of stem cell tissue between the inner bark (phloem) and the wood (xylem) that generates new cells annually for the inner bark and wood.
- canopy cover.** The outer limits of a tree or shrub's crown projected on the ground (or water) surface. Usually expressed as a percentage, such as 50 percent cover.
- carrying capacity.** The maximum number or biomass of a species that can be sustained or survive on a long-term basis within an ecosystem.
- cat.** A Caterpillar tractor, which runs on steel treads and is used to move soil for road construction and maintenance, logs to a landing, vegetation for site preparation and planting, or fuels and vegetation for fire suppression.
- cat ex.** See **categorical exclusion.**
- categorical exclusion (cat ex).** An exemption for federal agencies from requirements to prepare an environmental impact statement or an environmental assessment for categories of action that have been determined not to involve significant environmental impacts. A conformance determination record exempts federal agencies from having to prepare an EIS or EA for actions that have already been covered in existing EISs or EAs. See **National Environmental Policy Act of 1969.**
- CDFG.** See **California Department of Fish and Game.**
- CEQA.** See **California Environmental Quality Act.**
- CESA.** California Endangered Species Act.
- CFPR.** California Forest Practice Rules.
- CGS.** See **California Geological Survey.**
- channel classification.** Categorization of stream channels or parts of a stream into discrete types based on physical or biological criteria including channel slope, geometry, confinement, flow, aquatic habitat, or location within a watershed.
- channel complexity.** Characteristics of a stream channel determined by the relative proportions of different habitat units (pools, riffles) and structural elements (large woody debris, boulders) and their arrangement in the stream.
- channel substrate.** Rock and soil materials that comprise a streambed.

- chaparral.** A plant community characterized by fire-adapted shrubs and other plants.
- chipper.** A machine for chipping logs, tree tops, and slash into chips, consisting of a conveyor belt, debarker (to produce clean chips for paper or other products), and chipping blades, with the chips being blown into a chip truck for transport, onto a pile, or onto the ground as a mulch.
- choker.** A short length of wire cable or chain that forms a noose around the end of a log to be moved to a landing for processing and loading.
- choker setter.** A person whose job is to wrap a choker around the end of the log so that the yarder or skidder can drag the log to the landing.
- CHRIS.** California Historical Resources Information System.
- Class 1 stream.** Year-round stream in which fish are always or seasonally present. It may also be a stream that provides a source of domestic water supply.
- Class 2 stream.** Stream within 1,000 feet upstream from a Class 1 stream; contains aquatic habitat for nonfish species such as amphibians. May be a seasonal stream.
- Class 3 stream.** No aquatic life present. Capable of sediment transport to a Class 1 or 2 under normal water flow conditions. Usually flows only in response to storms.
- Class 4 stream.** Man-made watercourse, ditch, or diversion.
- clear.** Wood or lumber that does not have (is clear of) knots. Clear wood is produced in the tree stem where branches have been shed or pruned. All the wood grown radially after the branch has been lost will be clear.
- clear cut.** Harvest in which all or most of the merchantable-size trees have been removed in one operation.
- clinometer.** An instrument that measures vertical angles of elevation or depression from level, used to determine landscape slopes, elevations, and tree heights.
- CNDDDB.** California Natural Diversity Database.
- codominant.** Trees with crowns at the level of the highest forest canopy. Codominant trees receive full light from above but little light from the sides.
- commercial forestland.** Land deemed suitable for and capable of producing timber crops, capable of growing 20 cubic feet wood per acre per year.
- community.** In ecology, all of the populations of organisms living in an ecosystem.
- compaction.** An increase in soil density and decrease in porosity resulting from applied loads, vibrations, or pressure, usually due to equipment traffic, operations, or log skidding.
- conk.** The visible fruiting body, or mushroom, of a wood-decaying fungi on a tree trunk, branch or stump; shelf fungus.
- conservation.** Gifford Pinchot, a forester at the turn of the twentieth century closely associated with President Teddy Roosevelt, applied the word to describe a natural resource philosophy. It meant “wise use.” Through the years it has taken on an extended meaning of “wise use over a period of time.”
- consumers.** In ecology, the animals that depend on plants or other animals as their source of food.
- coppice.** Forest stand produced by sprouts from stumps or roots of trees previously cut. Many hardwood species sprout and readily coppice when young. Few conifers will sprout from the stump, with coast redwood being a notable exception.
- cost-share.** Usually, a government grant program to share the cost with forest landowners of maintaining or producing some public benefit such as improving water quality, wildlife habitat, forest productivity, or reforestation following wildfire or insect mortality.
- cover.** The area occupied by vegetation or foliage; vegetation that protects the soil and provides shade to the ground or stream. Usually expressed as a percentage.
- crown.** The live branches and foliage of a tree or shrub.

- crown class.** A category of tree based on its crown position relative to those of adjacent and competing trees. See **dominant**, **codominant**, **intermediate**, and **suppressed**.
- crown fire.** A fire that spreads through the crowns of trees or shrubs independently of a surface fire. Crown fires cannot be effectively or safely fought until the fire drops to the ground.
- cull.** Any log or portion of log rejected by a mill because it does not meet specifications or standards. Often refers to logs that are rejected because of defects such as rot or breakage. Generally used in forestry for seedlings, trees, foresters, or equipment not up to standard.
- culvert.** A metal or plastic pipe set beneath the road surface to drain water from the inside ditch to the outside of the road. Culverts drain ditches, springs, and streams across the road alignment.
- cut bank.** The rock–soil face or slope created along the inside of a road constructed on steep mountainsides.
- cut to length.** Harvest method in which trees are delimbed and cut to log lengths at the stump before they are yarded to the landing; an alternative to whole-tree yarding.
- DBH.** See **diameter at breast height**.
- debris jams.** Collections of logs and other debris in streams and watercourses. Once thought to block fish passage, most debris jams are important in creating stream structure and hiding cover for fish and do not block fish passage.
- deck.** A stack of logs at the mill or on a landing; usually sorted by species and size.
- decomposers.** In ecology, organisms that break down organic material into chemical elements and compounds.
- defensible fuel profile zone (DFPZ).** Shaded fuelbreak from a few hundred feet to a ¼ mile wide, where the canopy and cover of the larger trees has been retained but the ladder and ground fuels have been removed or treated; defensible in the sense that firefighters can safely take a stand in the DFPZ to fight an oncoming fire.
- DFPZ.** See **defensible fuel profile zone**.
- diameter at breast height (DBH).** Diameter of a tree measured 4½ feet above the ground; the standard measure of tree diameter.
- dib.** Diameter inside bark, the diameter of the woody portion of a tree stem.
- diurnal.** Daily, or functional or active during the day.
- diversion.** The withdrawal of water from a natural stream or spring, often into a canal or pipe.
- diversion potential.** A stream crossing on a road has diversion potential if, when the culvert plugs, the stream would back up and flow down the road rather than directly over the road and back into the natural drainage channel.
- dominant trees.** Trees with crowns that extend above the general level of the forest canopy. Dominant trees receive full light from above and partial light from the sides.
- drainage structure.** A device installed to control or divert water from a road, including but not limited to culverts, bridges, ditch drains, fords, water bars, and rolling dips.
- drought tolerance.** Ability of a tree or plant to survive under conditions of limited soil moisture.
- duff.** The partially decomposed organic matter on the forest floor beneath the litter of freshly fallen twigs, needles, and leaves.
- EA.** See **environmental assessment**.
- easement.** An agreement that defines the conditions under which one party may traverse a property owned by someone else. It may also refer to an agreement that restricts the use of property in specific ways.
- ecological dominance.** In ecology, the relative abundance or sizes of plants or animals in a community.

- ecology.** The study of the interactions among living organisms and their environment.
- ecosystem.** A place or system with defined boundaries that includes a biological community and its physical environment.
- ecotone.** The interface between two distinctly different ecosystems.
- EEZ.** Equipment exclusion zone.
- EIR.** See **environmental impact report**.
- EIS.** See **environmental impact statement**.
- ELZ.** Equipment limitation zone.
- endangered species.** Any species of plant or animal defined through the federal or a state Endangered Species Act as being in danger of extinction throughout all or a significant portion of its range.
- endemic.** Native to a particular region or area; restricted to and constantly present in a particular region.
- environmental assessment (EA).** A concise public document containing a federal agency's analysis of the significance of potential environmental consequences of an action; used to determine whether the more-comprehensive EIS is required or a "finding of no significant impact" is warranted. See **National Environmental Policy Act of 1969**.
- environmental impact report.** A full-disclosure documentation of the environmental impacts of a project. An EIR is prepared pursuant to the requirements of the California Environmental Quality Act.
- environmental impact statement (EIS).** A detailed statement of a federal project's environmental consequences, including adverse environmental effects that cannot be avoided, alternatives to the proposed action, the relationship between local short-term uses and long-term productivity, and any irreversible or irretrievable commitment of resources. See **National Environmental Policy Act of 1969**.
- EPA.** See **U.S. Environmental Protection Agency**.
- ephemeral.** A stream or portion of a stream that flows only in direct response to precipitation or snowmelt runoff.
- erosion.** The wearing away of the land surface by rain, running water, wind, ice, gravity, or other natural or management actions.
- ESA.** U.S. Endangered Species Act.
- eutrophication.** Creating lakes or ponds rich in plant nutrients and organisms, which often develop oxygen-deficient conditions.
- even-aged.** A stand of trees composed of a single age class; a tree age range of plus or minus 20 percent of rotation age. For example, a 100-year-rotation even-aged stand would have tree ages within 20 years of each other.
- federally listed species.** A species that has been designated as endangered or threatened pursuant to the federal Endangered Species Act as listed in the Federal Register.
- feller-buncher.** A harvesting machine that cuts a tree with a hydraulic shear or saw, gathering one or more cut trees in hydraulic arms before placing them on the ground. Usually limited to 24-inch DBH or smaller trees.
- felling crew.** One or more tree fallers and the falling boss. They do the felling, limbing, and bucking (cutting logs to specific length). Fellers are also referred to as "cutters" or "choppers."
- fiberboard.** A wood product manufactured from wood fibers and synthetic resins or other binders compressed into panels in a hot press.
- fill.** Rock or soil material placed in low areas, compacted, and built up to form a road bed.
- fire frequency.** The period of time between fires; also known as fire return interval.
- fire intensity.** The rate of heat release from a flaming front.
- fire regime.** The characteristic frequency, extent, intensity, severity, and seasonality of fires in an ecosystem.
- fire return interval.** The period of time between fires; also known as fire frequency.

- fire severity.** The degree to which site conditions (vegetation, soils) have been altered or affected by a fire; a product of fire intensity, duration, and fuel consumption.
- fire tolerance.** The ability of a tree or plant to survive a fire.
- Fish and Wildlife Service (FWS).** An agency of the U.S. Department of the Interior that develops rules for the protection of federally listed threatened and endangered species such as northern spotted owl and bald eagle. Also manages the federal wildlife refuge system and performs many other missions related to fish and wildlife.
- flagging.** Colored plastic ribbon attached to trees, brush, or stakes to mark boundaries or to make these objects visible; also brown, dead branches in an otherwise green crown, standing out because of their color contrast, which is often the result of diseases such as blister rust or Elytroderma needle blight.
- floodplain.** The area adjacent to a stream constructed by the stream in the present climate and inundated during periods of high flow.
- food web.** The network of organisms that supply and consume food (nutrients and energy) in an ecosystem. Also known as food chains.
- forbs.** Any broadleaf nonwoody herbaceous plant other than grasses; wildflowers.
- ford (dry).** A rock, concrete, or other hardened surface built on the bed of a swale, gully, or usually dry stream that allows vehicle passage during periods of low or no flow.
- ford (wet).** A rock, concrete, or other hardened surface built on the bed of a live stream that allows vehicle passage during periods of low flow.
- forest.** An ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, density, age class, and associated processes, and commonly including meadows, streams, fish, and wildlife. Forests include special kinds such as industrial forests, nonindustrial private forests, public forests, urban forests, and parks and wilderness.
- Forest Practice Act (FPA).** The law that regulates private forest management in California. Division 4, Section 8, of the Public Resources Code that declares the policy of the state “to encourage prudent and responsible forest management.” Authorized by the Z’Berg-Nejedly Forest Practice Act of 1973.
- forest practice rules.** Rules and regulations developed and promulgated by the State Board of Forestry pursuant to the Forest Practice Act. Most rules address the protection of water quality, wildlife habitat, and archaeological sites and artifacts.
- Forest Service.** An agency of the U.S. Department of Agriculture that manages 20 million acres in 18 national forests in California for watershed and wildlife habitat protection, recreation, and timber and grazing.
- forest type.** A forest category defined by forest vegetation, particularly the dominant vegetation as based on percentage cover of trees.
- FPA.** See **Forest Practice Act.**
- fry.** Young fish when they first emerge from the embryo stage.
- fuelbreak.** A generally wide (60 to 1,000 feet) strip of land on which native vegetation has been reduced or modified so that a fire burning into it can be reduced in intensity and rate of spread and more readily controlled. See **defensible fuel profile zone.**
- fungus.** A non-photosynthesizing (green) plant composed of hyphae (thin, threadlike filaments) that can be found in the forest floor and duff and in decomposing wood. Some fungi produce fruiting body mushrooms that contain spores for reproduction.
- FWS.** See **Fish and Wildlife Service.**
- generalist.** In ecology, an organism that can tolerate a wide range of habitat conditions.
- genotype.** An individual organism’s genetic makeup.
- germination.** The beginning of growth of a mature seed, spore, or pollen grain; the development of a seedling from a seed.

- girdle.** To make continuous incisions around a living stem, through the bark and cambium, disrupting the flow of water and sap, generally with the object of killing the tree to thin the forest or create snags for wildlife habitat.
- GIS.** Geographic information system.
- GPS.** Global positioning system.
- grading.** In road construction, grading refers to the act of excavating and moving soil along the road alignment to a defined slope and surface. In road maintenance, it refers to scraping the road surface smooth.
- group selection unit.** A small clear cut, usually less than 5 acres, used to regenerate shade-intolerant species in an uneven-aged forest comprised of many small even-aged units. Though the group selection stand is even-aged, at the forest landscape scale the groups would create a mosaic of age classes and thus an all-aged forest. See **selection**.
- gully.** A channel generally larger than 1 square foot in cross-section formed by concentrated surface water runoff.
- habitat.** The combination of shelter, food, and water that is required for the life support of a given species.
- habitat conservation plan (HCP).** An agreement between the U.S. Secretary of the Interior and either a private party or state, specifying the conservation measures that will be implemented in exchange for a permit that would allow taking (harassing or killing) of a threatened or endangered species.
- habitat quality.** The informed value judgment about the ability of a habitat to support a particular species' needs for reproduction, feeding, water supply, and shelter.
- harvest.** The removal of commercial, merchantable products or materials from the forest.
- HCP.** See **habitat conservation plan**.
- heartwood.** The wood that forms in the center or heart of the tree main stem from inactive sapwood as it is overgrown and replaced by new sapwood.
- helicopter logging.** Using a helicopter to yard, or move, logs from the harvest area to a landing. Used where landscape sensitivity, steepness, or landslide threat precludes the use of ground-based yarding equipment or where access roads are not available or desired.
- herbicide.** A pesticide used to kill or control the growth of plants.
- high thinning.** Removal of some dominant and codominant trees in order to favor the best trees of those classes in the reserved stand. Also known as thinning from above or crown thinning.
- home range.** Area covered by the normal annual movement of a wildlife species in carrying out its life cycle.
- industrial forests.** Forestland owned by a company or individual managed primarily for wood products. Owner may or may not operate sawmills or other wood-using plants.
- in-sloped road.** A road design in which the road surface is sloped in towards the cut bank, usually draining water to an inside ditch.
- integrated pest management (IPM).** The management of pest organisms at an acceptable level, rather than trying to eliminate the pest, using a variety of preventive, suppressive, or regulatory tactics that are ecologically and economically efficient and socially acceptable. An alternative to pesticides, which are more direct and usually quicker methods of control.
- intermediate trees.** Trees that are shorter than dominant or codominant trees but have some branches extending into the general crown cover. They receive little light from above and none from the sides. See **crown class**.
- intermittent.** A stream that does not sustain year-round flow in all or most years.
- IPM.** See **Integrated pest management**.
- IWM.** Integrated weed management.

- keystone species.** A species whose presence increases or whose absence decreases the diversity of a system; usually a competitively superior species; a species upon which important ecological processes depend.
- ladder fuels.** Combustible material that provides vertical fuel continuity between vegetation strata and allows fire to climb from the ground into the crowns of trees or shrubs. Ladder fuels help initiate and sustain crown fires.
- landing.** A cleared area in the forest where logs are skidded or yarded for processing and loading on to trucks for transport.
- landing crew.** A loader operator, log processor, and possibly a landing person or knot bumper who trims limbs and knots from the logs before loading.
- large woody debris (LWD).** Logs, stumps, and branches generally larger than several inches in diameter and several feet long that are found in a stream or on the forest floor.
- legacy trees.** Usually, large trees left as examples of the size and characteristics of trees in the original stand. They can also become wildlife trees and snags.
- licensed timber operator (LTO).** A person or firm licensed by the state of California to conduct commercial timber harvests on private forests.
- limiting factor.** An environmental or habitat-related condition (e.g., growing season, climate, food source, soil nutrients, water, etc.) that limits plant growth or population size, animal population size, or ecological productivity.
- litter.** Leaves, twigs, and branches on the forest floor that are still discernible as plant parts.
- log.** The stem of a felled tree, trimmed of limbs, cut to specified lengths for final products, for example, 16.5 feet or 33 feet for lumber that will eventually be sold in 8-foot lengths.
- log decks at the mill.** Logs accumulated during the logging season for winter, when logging is curtailed because of weather.
- low thinning.** The removal of trees from the lower crown classes or understory to favor trees in the upper crown classes; thinning from below.
- LTO.** See **licensed timber operator**.
- lumber.** The sawn wood product from a tree; solid wood, sawn dimension lumber, and boards as opposed to wood peeled for plywood or chipped for reconstituted wood products such as oriented-strand board or fiberboard.
- LWD.** See **large woody debris**.
- macroinvertebrates.** Animals without backbones, such as insects, worms, and mollusks.
- macronutrients.** Elements required in relatively large amounts by plants and other organisms for healthy metabolism and growth, such as nitrogen, phosphorus, calcium, and potassium.
- mast.** The fruit or nuts of trees considered as food for wildlife and livestock. Hard mast is the fruit or nut of trees such as oak, walnut, and chinquapin. Soft mass includes the fruits and berries from plants such as dogwood, elderberry, huckleberry, grape, and blackberry.
- mastication.** Mechanically chewing up trees, wood, brush, and slash to reduce fire hazard, which creates chips that are scattered on the forest floor or soil surface.
- mature tree.** A tree that has reached its maximum growth or height or has reached merchantable product size.
- memorandum of understanding (MOU).** A formal written agreement between two or more organizations or agencies that presents the relationship between the entities for the purposes of planning and management.
- merchantable height.** The marketable length of a tree to a minimum diameter top.
See **merchantable top diameter**.
- merchantable top diameter.** The inside bark diameter above which a stem is considered nonmerchantable for a particular product; usually a diameter inside bark of 6 to 10 inches. Also known as merch top.

- microclimate.** The climatic conditions in a geographically limited area that may be different than the general climate for the landscape, such as the climate beneath a forest canopy, next to a log or topographic feature, on an open hillside, or along a stream.
- micronutrients.** Elements required by plants and other organisms in small or trace amounts for healthy metabolism and growth, such as boron, iron, and magnesium.
- MOU.** See **memorandum of understanding.**
- multiple land use.** The management of land and forests for timber, wildlife, water, recreation, and grazing in an integrated and comprehensive program.
- mycorrhizae.** Fungi that live in symbiotic associations with the roots of many plant species. The fungi receive nutrients from the plant and facilitate movement of water and inorganic nutrients from the soil to the plant.
- National Environmental Policy Act of 1969 (NEPA).** The federal law that ensures that U.S. government agencies consider the National Environmental Policy when making decisions by requiring one (or possibly more) of four classes of documentation: an environmental assessment; an environmental impact statement; a categorical exclusion; or a programmatic environmental impact statement.
- national forest.** A forest, range, or wildland reserve managed by the Forest Service for multiple uses, including timber, water, wildlife, recreation, and grazing. National forests differ from national parks in having multiple-use goals of which recreation is only one. Nationwide, the national forest system administers 154 forests and 19 grasslands.
- National Marine Fisheries Service (NMFS).** An agency of the National Oceanic and Atmospheric Administration. Pronounced “nymphs.” Responsible for the protection of endangered fish such as the coho salmon.
- National Park Service (NPS).** Established by Congress to promote and regulate the use of national parks, monuments, and reservations, and to conserve the scenery and the national and historical objects and wildlife therein for the public in perpetuity. The Park Service administers 295 units, primarily for historical or recreational uses.
- Natural Resources Conservation Service (NRCS).** Formerly the Soil Conservation Service (SCS).
- NEPA.** See **National Environmental Policy Act of 1969.**
- niche.** The ecological role and habitat occupied by a species in an ecosystem.
- NIPF.** See **nonindustrial private forest.**
- nitrogen fixation.** The process by which inert atmospheric nitrogen gas is converted by bacteria into ammonium, which is usable by plants.
- NMFS.** See **National Marine Fisheries Service.**
- NOAA.** National Oceanic and Atmospheric Administration.
- nocturnal.** Nightly, or active and functioning at night.
- nodule.** In reference to nitrogen fixation, the swollen tissue on the roots of some plants (e.g., genus *Ceanothus*) where nitrogen-fixing bacteria reside.
- nonindustrial private forest (NIPF).** Forestland that is privately owned by individuals or companies other than the forest industry and where management usually includes objectives other than timber production.
- nonindustrial timber management plan (NTMP).** A long-term (100-year) timber harvest plan limited to ownerships of 2,500 acres or less.
- nonpoint source pollution.** Water that is polluted by sources that cannot be identified as discrete points or sources, such as areas of timber harvesting, roads, surface mining, agriculture, and urban land use.
- NPS.** See **National Park Service.**
- NRCS.** See **Natural Resources Conservation Service.**
- NTMP.** See **nonindustrial timber management plan.**
- nursery log.** A fallen tree that provides habitat for the regeneration of other plants, including some trees.

nutrient stress. Lack of nutrients indicated by symptoms that appear in a plant when the plant is not supplied with adequate nutrients to sustain normal growth and function. Often characterized by a yellowing of leaves (chlorosis), distortion of buds and leaves, or premature dropping of leaves.

OHP. California Office of Historic Preservation.

old growth forest. The late successional stage of forest development, usually characterized by large, old trees; standing dead trees, or snags; closed or dense canopy conditions; and down logs and coarse, woody debris. Old growth forest is commonly perceived as uncut, virgin forest with very little human-caused disturbance.

out-sloped road. A road in which the road surface is sloped out away from the cut bank so that the road surface drains water directly onto adjacent slopes, dispersing water off the road surface quickly so it will not accumulate and run down the road and erode it.

overstory. In a forest that has more than one layer of trees, the overstory is the highest canopy layer.

Pacific Southwest Research Station (PSW). The research branch of the Forest Service for California, Hawaii, and the Pacific Islands.

partial cut. Removal of only part of a stand for purposes other than regenerating a new age class of trees.

PCT. See **precommercial thinning**.

perennial stream. A stream that flows throughout the year in a well-defined channel.

permanent road. A road that is designed, built, and maintained for all-season, wet weather use. Often surfaced with rock or pavement.

pesticide. A chemical compound used to control animals, insects, diseases, or plants.

phenotype. An individual organism's outward, visible expression of a genetic character or trait.

pheromone. A chemical released into the environment by an individual to influence the behavior of other individuals of the same species, for example, to attract bark beetles to a tree for mating.

PHI. See **preharvest inspection**.

phloem. The conductive tissue found between the wood and the outer bark of a tree that carries carbohydrates (sap) from the leaves to the branches and roots.

photosynthesis. The process by which energy in sunlight, carbon dioxide, and water is converted by green plants into organic compounds, principally carbohydrates.

plane surface. Lumber that has a smooth surface from being run through a planer or surfacing machine. Surfaced lumber is lumber that has been planed. It can be either green (undried) or dried. Dried lumber is often air-dried for a while then placed in a kiln to bring lumber moisture down to a specified amount to stabilize its shrinkage and twisting.

point source pollution. Water and air pollution that can be identified with a specific source such as a pipe, sewage outfall, spill, etc.

pole timber. A small tree that is 3 to 12 inches in DBH, larger than a sapling but smaller than sawtimber.

pool. A low point in a stream where water velocity is reduced and water depth is greatest.

population. A group of organisms usually of the same species or otherwise capable of interbreeding.

precommercial thinning (PCT). Thinning to reduce competition and improve individual tree growth and vigor; cutting small trees that will not make a commercial product or are too costly to process and transport.

preharvest inspection (PHI). Part of the timber harvest plan process.

prescribed burning. To deliberately burn wildland fuels under specified environmental conditions (a burn prescription), which ensures that the fire will be controllable and confined to a predetermined area and intensity.

- prescriptive easement.** An obtained right to enter a property by someone other than the landowner when access is open, continuous, and uninhibited for 5 years in California. Posting “No Trespass” signs and other evidence of active resistance to the use prevent this easement.
- preservation.** Protecting an area from treatment or management. The meaning stems from nineteenth-century land reserves in which areas and resources were set aside for limited or restricted use and development. Preservation often restricts land uses to recreation or scientific study.
- processor head.** A saw and delimiting machine mounted on a tractor or boom that cuts the tree stem and delimits and cuts it into logs, leaving slash at the stump.
- producers.** In ecology, the plants that photosynthesize; also known as primary producers.
- programmatic EIS.** A document that discloses the environmental consequences of a program or plan of actions rather than disclosing the environmental consequences of every site-specific project of that program or plan. See **National Environmental Policy Act of 1969**.
- PSW.** See **Pacific Southwest Research Station**.
- public trust resources.** Natural resources that the federal and state government regulate in the interests of the general public, including air, water, and wildlife. Protection of public trust resources is often a control or limitation on private property rights and activities, and it is the basis of our environmental protection laws and regulations.
- Quincy Library Group (QLG).** A broad-based community forestry group (loggers, environmentalists, businesses, educators, and concerned citizens) in Quincy, Lassen, Plumas, and Sierra Counties that developed and proposed a shaded fuel break program to protect communities from wildfire, improve the condition of the forest, produce economic return to the community, and minimize the extent and intensity of wildfire. See **defensible fuel profile zone**.
- QLG.** See **Quincy Library Group**.
- RCD.** Resource Conservation District.
- recovery.** In conservation biology and legal terms, the process by which a species legally defined as threatened or endangered achieves a status of population size or stability such that it is no longer in danger of extinction.
- redd.** A depression excavated in stream bottom gravel by salmonid fish where they deposit their eggs.
- regeneration method.** A method of harvesting to regenerate trees, a new stand or forest.
- registered professional forester (RPF).** A person licensed by the State of California to practice forestry; requires 7 years of education and professional experience to take the qualifying examination.
- reproduction.** Tree seedlings or sprouts 0 to 1 inch DBH.
- residual stand.** The portion of trees remaining after any partial cut or thinning.
- respiration.** The process of converting food molecules such as sugar into energy, carbon dioxide, and water; the energy released powers the activities of the cells and ultimately the organism.
- response reach.** In hydrology and geomorphology, stream segments where sediment, large wood, and other materials tend to collect. They tend to be the most “responsive” to land use impacts.
- riffle.** A high point in a stream over which stream flow is accelerated, creating waves, broken water surface, and white water.
- rill.** A channel varying in size from a rivulet up to about 1 square foot in cross-section that typically forms where rainfall and runoff is concentrated on a slope.
- riparian.** Relating to the land area parallel and immediately adjacent to a river or stream.
- riparian buffer.** A zone adjacent to a stream or other water body where land use is restricted to minimize impacts.

- riparian vegetation.** Vegetation found adjacent to a stream and which depends on it for water or other life support.
- riprap.** A generic term for rock or other material placed on stream banks or other exposed surfaces to prevent or reduce erosion.
- road runoff.** Precipitation or snowmelt that is intercepted by a road and flows off it.
- rock armor.** Coarse rock placed to protect a soil surface from erosion caused by flowing or falling water. It is commonly placed at culvert outlets, on exposed slopes, or on stream banks.
- rolling dip.** A shallow, gradual dip in a road where the road grade reverses for a short distance and surface water runoff is directed in the dip or trough to the outside of the road.
- roots.** Belowground plant parts that anchor a tree or plant and absorb water and nutrients for plant growth.
- rough surfaced.** Lumber surface resulting from the saw cut alone, without planing or sanding.
- RPF.** See **registered professional forester.**
- RWQCB.** Regional Water Quality Control Board.
- salmonid.** Fish of the family *Salmonidae*, including salmon, trout, chars, whitefish, ciscoes, and graylings.
- sanitation cutting.** The removal of dead, damaged, or insect- or disease-susceptible trees to prevent the spread of pests or pathogens and to promote forest health.
- sapling.** A young tree less than 3 inches DBH. The minimum size is usually placed at 1 inch DBH.
- sapwood.** The part of a tree that carries water and nutrients from the roots to the leaves or needles; also called the xylem. The outermost rings of wood in a tree stem.
- seasonal road.** A road designed and intended for use only during part of the year, typically the summer or dry season. See also **permanent road** and **temporary road.**
- seedling.** A tree grown from seed that is less than 3 feet tall or 1 inch DBH.
- seed tree.** A tree left after a timber harvest to produce seed for natural regeneration.
- seed zone.** A designated geographic area containing trees with relatively uniform genetic composition. Seed gathered from a seed zone is adapted to growing there.
- seep.** A surfacing of groundwater such as a spring.
- selection.** A silvicultural system in which individual trees of all size (age) classes are removed more or less uniformly throughout the stand to promote the growth of the remaining trees and to create space for regeneration. Shade-tolerant species like true firs do well under this method, but shade-intolerant species like pine may require larger openings. See **group selection.**
- self-pruning.** The process by which a tree sheds its lower branches.
- SFI.** See **Sustainable Forestry Initiative.**
- shade tolerance.** The ability of a tree or plant to grow in partial or full shade.
- shelterwood.** A silvicultural system in which residual trees are left to produce seed for regeneration and some “shelter” or shade for the seedlings.
- silviculture.** The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands to meet the needs and values of landowners and society on a sustainable basis.
- single tree selection.** See **selection.**
- site.** The area in which a plant or stand grows, considered in terms of its environment, particularly as this determines the type and amount of the vegetation the area can support.
- site class.** A classification of site quality and productivity for timber production usually expressed as dominant tree heights at a standard reference age (50 or 100 years).
- site index.** A classification of site productivity for timber production, expressed as dominant tree height at a reference age (50 or 100 years). For example, Site Index 80 (50) is a site that can grow trees 80 feet in height in 50 years.

- site preparation.** Preparing a forest area for regeneration, which usually entails removing competing grass and brush and debris that would hamper planting, or disturbing the forest floor to create a suitable seedbed for seed germination during natural regeneration.
- skidder.** Usually, a rubber-tired machine that moves logs from the felling site to the landing or deck. A track machine (cat) may sometimes be referred to as a skidder in that both are used to skid logs to the landing.
- slash.** The branches, bark, tree tops, wood chunks, cull logs, uprooted stumps, and broken or uprooted trees left on the ground after logging; also, large accumulations of debris after wind-throw or fire.
- slope position.** A particular location on a slope as upper, middle, or lower slope; also ridge top or bottom land.
- SMZ.** See **streamside management zone.**
- snag.** Standing dead tree that provides wildlife habitat and may also provide large organic debris or large woody debris input to nearby streams.
- snow load tolerance.** The ability of a tree to shed snow from its crown and have sufficient flexibility to not break under a snow load.
- SOD.** Sudden oak death.
- solarization.** A method using solar heating to kill insects and disease organisms.
- source reach.** In stream systems, areas or segments where most sediment and large woody debris recruitment is occurring.
- specialist.** In ecology, an organism that requires specific habitat conditions that may be unusual or uncommon, such as plant species confined to serpentine soils.
- spoil.** Excess soil, rock, and organic debris generated during road construction, reconstruction, and maintenance.
- spoil disposal site.** A place where excess material generated during road work can be safely placed or stored without creating an erosion or slope stability hazard.
- sprout.** A tree originating from a root or stump.
- stand.** A contiguous group of trees sufficiently uniform in composition, structure, and site productivity to be distinguished as a unit.
- stocking.** A measure of the proportion of an area occupied by trees.
- stomata.** Small pores in leaves or needles that when open allow gas exchange, carbon dioxide to enter for photosynthesis, and water to transpire.
- streambed alteration agreement.** A legally binding agreement between the California Department of Fish and Game and a project proponent or landowner regarding a land use activity affecting a natural stream.
- stream classes.** Four California state classifications for regulatory purposes. See **Class 1 stream**, **Class 2 stream**, **Class 3 stream**, and **Class 4 stream**.
- stream crossing.** The place where a road, trail, pipeline, or other structure crosses a stream, such as a bridge, ford, culvert, etc.
- streamside management zone (SMZ).** A strip of land adjacent to a water body or stream channel where soils, organic matter and vegetation are managed to protect the physical, chemical, and biological integrity of surface water adjacent to and downstream from forestry operations; also called a “filter strip” or “buffer zone.”
- succession.** In ecology, the process by which a plant community changes in species composition and structure over time, generally from simple to more complex communities.
- suppressed trees.** Trees found below the general prevailing height of a forest canopy. They receive little or no direct sunlight, and as a result, their growth is inhibited.
- surface fuels.** The loose surface litter on the soil surface such as fallen leaves or needles, twigs, bark, cones, branches, grasses, shrub and tree reproduction, downed logs, stumps, seedlings, and forbs interspersed with or partially replacing the litter.

sustainable forestry. Forest management that meets the forest resource needs and values of the present without compromising the similar capability of future generations; the stewardship and use of forests and forestlands in a way and at a rate that maintains their biodiversity, productivity, regeneration capacity, and vitality now and in the future.

Sustainable Forestry Initiative (SFI). A comprehensive set of forestry and conservation practices sponsored by the American Forest and Paper Association that are designed to ensure that future generations of Americans will have the same abundant forests and wildlife that we enjoy today.

sustainability. The capacity of forests to maintain their health, productivity, diversity, and overall integrity in the long run.

sustained yield. Management of a forest stand to provide a continuing supply of timber and revenue while protecting public trust resources of water, watersheds, wildlife, air quality, and soil productivity.

SWRCB. California State Water Resources Control Board.

symbiosis. In ecology, a relationship between two organisms that is beneficial and necessary to both.

take. In conservation biology and law, to conduct activities that will harass, harm (including significant habitat modification or degradation), pursue, hunt, shoot, wound, kill, trap, or capture an endangered species.

temporary road. A road that is used only for the duration of a management activity such as timber harvest, thinning, site preparation, or controlled burn. It is neither designed nor intended for all-season use. See also **permanent road** and **seasonal road**.

thinning. In forestry, removing trees or other vegetation to decrease competition among remaining trees for light, nutrients, and water.

THP. See **timber harvest plan**.

threatened species. A plant or animal species likely to become endangered throughout all or a significant portion of its range within the foreseeable future.

timber. Forests and stands containing timber; wood, other than fuelwood, potentially usable for lumber.

timber harvest plan (THP). An environmental review document required by the California Forest Practice Act laying out the conditions of a logging operation. The functional equivalent of a CEQA environmental impact report.

timber production zone (TPZ). Zoning that assesses property tax rates based upon value as forestland, not “highest and best use” or development values.

timber stand improvement (TSI). An intermediate treatment made to improve the composition, structure, condition, health, and growth of a stand; usually a thinning of competing trees or release from competing shrubs and plants.

TMDL. See **total maximum daily load**.

total maximum daily load (TMDL). An estimate of the total quantity of pollutants from all sources in a watershed, including point, nonpoint, and natural, that may be allowed into waters without exceeding water quality criteria.

TPZ. See **timber production zone**.

transpiration. In biology, the process by which water vapor is lost to the atmosphere when the stomata on the leaves or needles of plants are open.

transport reach. In hydrology and geomorphology, stream segments that predominantly function to move sediment, water, and wood rather than supply (source) or accumulate (response) them.

tree. A woody perennial plant that typically is large with a well-defined stem or stems carrying a definite crown of branches and leaves.

trophic level. A position in a food or energy chain. In ecology, trophic levels correspond to producers (plants), consumers (herbivores), and top consumers (carnivores and omnivores) in food chains.

- TSI.** See **timber stand improvement**.
- turbidity.** The optical condition of water as determined by suspended solids, dissolved solids, algae, and human or natural chemicals; commonly observed as cloudiness.
- understory.** The vegetation layer formed by grasses, shrubs, and small trees under the canopy of larger trees and plants.
- uneven-aged.** A stand with trees of three or more distinct age classes, either mixed together or in small groups.
- USDA.** See **U.S. Department of Agriculture**.
- USDI.** See **U.S. Department of the Interior**.
- USEPA.** See **U.S. Environmental Protection Agency**.
- USFS.** See **Forest Service**.
- U.S. Department of Agriculture (USDA).** Agency that administers the Forest Service and the Natural Resources Conservation Service.
- U.S. Department of the Interior.** Administers the National Park Service, Bureau of Land Management, Bureau of Indian Affairs and the Fish and Wildlife Service.
- U.S. Environmental Protection Agency (EPA or USEPA).** The federal agency charged with developing and enforcing regulations on uses of pesticides, controlled disposal of other toxic materials, and other aspects of environmental protection.
- vernal pools.** Shallow, ephemeral pools that form during the rainy season in winter and spring.
- water bar (waterbreak).** A shallow ditch and speed bump placed at an angle across a road or trail to capture and drain surface runoff, preventing it from eroding the surface.
- water course and lake protection zone (WLPZ).** Stream or lakeside area specified for protection measures by the California Forest Practice Rules.
- watercourse class.** See **stream classes**.
- water quality.** The quality of water for different uses based on its chemical, thermal, bacterial, and physical properties.
- Water Quality Control Board (WQCB).** California regulatory agencies whose staff review timber harvest plans for compliance with the Clean Water Act and Porter-Cologne Water Act.
- WHRS.** See **Wildlife Habitat Relationship System**.
- wildfire.** Fires burning out of control regardless of how or why they were started.
- wilderness.** In the strictest sense, an area that has never been developed by man. The 1964 Wilderness Act defined it as “A Wilderness, in contrast with those areas where man and his own works dominated landscape, is hereby recognized as an area where the earth and its community of life are untrammelled by man, where man himself is a visitor and does not remain.” In common usage, the word is associated with these undeveloped areas and other areas set aside with little development. In some cases man-made items are dismantled to reduce the area to a primitive state. Under these broader definitions, some roadless areas are considered to be wilderness when the access is limited to hiking, canoeing, or horseback riding and the use is set aside for recreation.
- Wildlife Habitat Relationship System (WHRS).** Lists species likely to be found in specific vegetation types and habitat conditions. Can be used to predict the effects of timber harvest and other actions on wildlife habitat.
- wind-throw.** Tree or trees downed or broken off by wind; also known as blowdown.
- winterize.** Perform erosion prevention and control work on a road in preparation for winter rains and flood flows. Winterizing activities may include installing water bars, ditch cleaning, culvert cleaning, resurfacing, etc.
- winter operating period.** In forest practice regulation, the period generally between October 1 and April 1 when regulated forestry operations are restricted and subject to special rules.

WLPZ. See **water course and lake protection zone.**

WMA. Weed management area.

wolf tree. A dominant tree with a broad, spreading crown that occupies more growing space than its neighbors.

WQCB. See **Water Quality Control Board.**

xylem. The outermost wood rings; conducting tissue in a tree that carries water and nutrients from the roots to the needles, also known as sapwood.

yard. To drag logs or move them about.

yarder. Machine equipped with a tower and cable wound on winches that is used to yard logs from the felling site to the landing.

yarding crew. Two or more choker setters, yarder operator, or skidder operators; depending on the crew size, there may be a separate side rod or crew foreman.

FOR FURTHER INFORMATION

To order or obtain printed ANR publications and other products, visit the ANR Communication Services online catalog at <http://anrcatalog.ucdavis.edu>. You can also place orders by mail, phone, or FAX, or request a printed catalog of our products from:

University of California
Agriculture and Natural Resources
Communication Services
6701 San Pablo Avenue, 2nd Floor
Oakland, California 94608-1239
Telephone: (800) 994-8849 or (510) 642-2431
FAX: (510) 643-5470
E-mail inquiries: danrcs@ucdavis.edu

An electronic version of this publication is available on the ANR Communication Services Web site at <http://anrcatalog.ucdavis.edu>.

Publication 8231

ISBN-13: 978-1-60107-451-5

© 2007 by the Regents of the University of California, Division of Agriculture and Natural Resources. All rights reserved.

The University of California prohibits discrimination or harassment of any person on the basis of race, color, national origin, religion, sex, gender identity, pregnancy (including childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (covered veterans are special disabled veterans, recently separated veterans, Vietnam era veterans, or any other veterans who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized) in any of its programs or activities. University policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 300 Lakeside Drive, 6th Floor, Oakland, CA 94612-3550 (510) 987-0096. For a free catalog of other publications, call (800) 994-8849. For help downloading this publication, call (530) 297-4445.

This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Natural Resources.

pr-12/07-SB/CM

