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Stereo Photo Series for Quantifying Natural Fuels

Volume XIII: Grasslands, Shrublands, Oak-Bay Woodlands, and Eucalyptus Forests in the East Bay of California

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ABSTRACT

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Four series of photographs display a range of natural conditions and fuel loadings for grassland, shrubland, oak-bay woodland, and eucalyptus forest ecosystems on the eastern slopes of the San Francisco Bay area of California. Each group of photos includes inventory information summarizing vegetation composition, structure, and loading; woody material loading and density by size class; forest floor depth and loading; and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, East Bay Regional Park District, Tasmanian bluegum, *Eucalyptus globulus*, California laurel, California bay, *Umbellularia californica*, California live oak, coast live oak, *Quercus agrifolia*, coyotebrush, *Baccharis pilularis*.

COOPERATORS

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WHAT IS THE NATURAL FUELS PHOTO SERIES?

The Natural Fuels Photo Series are a set of photographs with accompanying fuel bed characteristics data from sites where no recent management activity has occurred for ecosystem types in various regions of the United States. Generally, sites include wide-angle and stereo-pair photographs supplemented with information on living and dead fuels and vegetation, and, where appropriate, stand structure and composition within the area visible in the photographs (fig. 1). This volume (volume XIII) continues the Natural Fuels Photo Series and includes four series documenting grassland, shrubland, oak-bay woodland, and eucalyptus forest types. Some of the sites in this volume are intended to broaden the range of conditions presented in volume IV (Ottmar et al. 2000) and volume VII (Ottmar et al. 2004), and provide a basis for appraising and describing vegetation amount and composition, and, where appropriate, woody material and stand conditions that occur commonly throughout California.

The first phase of the Natural Fuels Photo Series was a collection of six volumes, each representing a region of the United States (Volumes I-VI). Additional phases included new volumes (Volumes VII-XII) and supplemental volumes (Volumes IIa, Va, VIa). Volume I included sites in mixed-conifer, western juniper, sagebrush, and grassland ecosystems, and volume XI included sites in sagebrush-steppe and old-growth forest suitable for spotted owl nesting in the Pacific Northwest. Volume II included sites in black and white spruce ecosystems and volume IIa included sites in hardwood ecosystems undergoing succession to spruce in Alaska. Volume III included sites in lodgepole pine, quaking aspen, and gambel oak ecosystems in the Rocky Mountains. Volume IV included sites in pinyon-juniper, sagebrush, and chaparral ecosystems in the Southwest. Volume V included sites in red and white pine, northern tallgrass prairie, and mixed-oak ecosystems and volume Va included sites in jack pine ecosystems in the Midwest. Volume VI included sites in longleaf pine, pocosin, and marsh grass ecosystems, volume VIa included sites in sand hill, sand pine scrub, and white pine-invaded hardwood ecosystems, and volume XII included sites in posthurricane fuels in the Southeast. Volume VII included sites in Oregon white oak, California deciduous oak, and mixed conifer with shrub ecosystems in Washington, Oregon, and

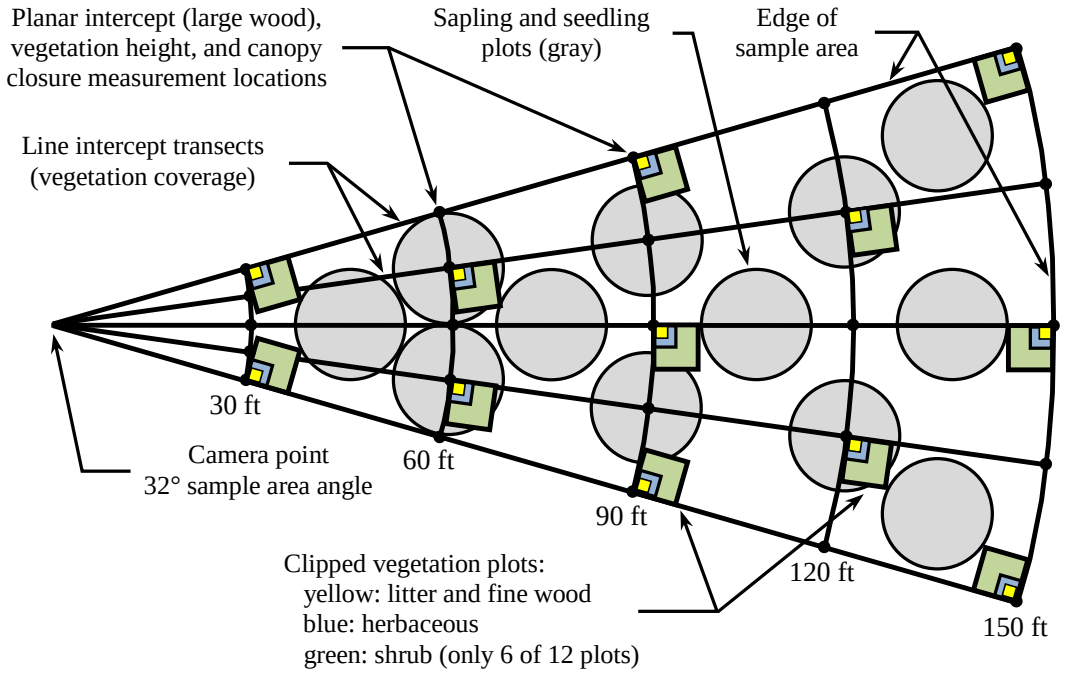

Figure 1—Photo series sample area layout. The sample area extended 150 ft from the camera. Forty-five random azimuth planar intercept transects for measuring dead and down woody fuels and 6 to 12 clipped vegetation plots (1 to 3 per arc) were located within the sample area. Vegetation coverage was measured along each of the five sample area layout lines between the 30- and 150-ft arcs by using the line intercept method. Where present, trees were inventoried in the entire sample area, and seedlings and saplings were inventoried in 12 systematically located sample plots.

California. Volume VIII included sites in hardwood, pitch pine, and red spruce/balsam fir ecosystems in the Northeast. Volume IX included sites in oak-juniper ecosystems in Arizona and New Mexico. Volume X included sites in sagebrush with grass and ponderosa pine-juniper ecosystems in central Montana. An unnumbered volume included grassland, shrubland, woodland, and forest ecosystems in Hawaii. The aforementioned volumes build on older photo series in natural fuels in common forest types in the Cascade Range (Maxwell and Ward 1980b) and Sierra Nevada (Blonski and Schramel 1981, Maxwell and Ward 1979,Weise et al. 1997).

WHY IS THE PHOTO SERIES NEEDED?

The photo series are land management tools that can be used to assess landscapes through appraisal of living and dead woody material and vegetation (i.e., fuels) and stand characteristics. Once an assessment has been completed, stand treatment options, such as prescribed fire, mechanical or hand fuel reduction, or harvesting, can be planned and implemented with greater detail and precision to better achieve desired effects while minimizing negative impacts on other resources.

The photo series has application in several branches of natural resource science and management. Inventory data such as these can be used as inputs for evaluating animal habitat, nutrient cycling, and microclimate, for example. Fire managers will find these data useful for predicting fuel consumption, smoke production, fire behavior, and fire effects during wildfires and prescribed fires. In addition, the photo series can be used to appraise carbon sequestration, an important factor in predictions of future climate, and to link remotely sensed signatures to live and dead fuels on the ground. The photos have proved useful in discussions of proposed treatment options with citizens, public officials, and agency administrators. They are also a practical communication tool in the preparation, advertisement, and administration of fuel treatment contracts.

Ground-based inventory procedures that directly measure site conditions (e.g., fuel loading and arrangement, vegetation structure and composition, etc.) exist for most ecosystem types and are useful when a high degree of accuracy is required. Ground-based inventory is time consuming and expensive, however. Photo series can be used to make quick, easy, and inexpensive determinations of fuel quantities and stand conditions when less precise estimates are acceptable.

HOW WAS THE PHOTO SERIES DEVELOPED?

Sites photographed for the series in this volume were selected to represent a range of conditions in ecosystem types that are common throughout the East Bay area of California. They are also characteristic of sites in similar ecosystem types through the greater San Francisco Bay area, as well as adjoining lands to the north and south. The sites are organized into four series: grassland, shrubland, oak-bay woodland, and eucalyptus forest. Photographs were taken, and fuel loading, stand structure, and composition data were collected by using the procedures of Maxwell and Ward (1980a) as a guide.

PHOTOGRAPHS

A large, wide-angle photograph and stereo-pair photographs are included with all series to help land managers appraise natural fuel, vegetation, and stand structure conditions. The three-dimensional image obtained by viewing the stereo-pair photographs with a stereoscope will improve the ability of the land manager to make assessments in the field. The marker in all of the photographs is a 1-ft square, and the pole is painted in contrasting colors at 1-ft intervals to provide scale. The pole is 6-ft tall and 30 ft from the camera. The summary data relate to the field of view of the stereo-pair photographs. Note that no sampling occurs in the foreground between the camera and the sign.

PHOTOGRAPH AND INFORMATION ARRANGEMENT

The photographs and accompanying data summaries are presented as single sites organized into four series. Each site in the grassland and shrubland series is shown on a single page, and includes wide-angle (16-24mm) and stereo-pair photographs and summaries of vegetation composition and structure. The shrubland series also includes general site information and summary vegetation information, as well as data describing the shrub, litter, and dead and down woody fuel components. Each oak-bay woodland and eucalyptus forest site is arranged to occupy two facing pages. The upper page contains a wide-angle (16-24mm) photograph and general site and stand information. The lower page includes the stereo-pair photographs and summaries of overstory structure and composition; understory vegetation structure and composition; and downed woody material loading and density by size class.

SITE AND STAND INFORMATION

The camera point of each site was located with a global positioning system receiver, and aspect and slope were measured with a compass and clinometer, respectively. Fuel type (LSA Associates 2009), an aggregation of many vegetation types determined from vegetation mapping done by the East Bay Regional Park District, and ecological community classification to the association level (Buck-Diaz et al. 2012, NatureServe 2013), based on the potential natural vegetation concept, were assigned for all sites. A list of the most common grass, forb, and shrub species is included.[1] The listing of species was not meant to be a complete vegetation inventory and represents only a portion of the species richness of the sampled areas.

For the two series with a tree component, crown closure at each site was measured with a forest densitometer (95 systematically located points). Tree composition and density were determined by a total inventory of the sample area for all trees greater than 4 in diameter at breast height (d.b.h.[2]) and on twelve 0.005-ac (oak-bay woodlands and mature eucalyptus forest sites) or 0.002-ac (young eucalyptus forest sites) circular plots for all trees greater than 4.5 ft tall and less than or equal to 4 in d.b.h. (fig. 1); trees less than 4.5 ft tall were considered seedlings. Seedling composition and density were also measured on twelve 0.005-ac circular plots.

VEGETATION

Shrub, forb, and graminoid species coverage (along with litter coverage and mineral soil exposure) were estimated by using line intercept transects (Canfield 1941). Vegetation heights were measured at 25 points located systematically throughout the sample area. Vegetation biomass was determined by sampling square, clipped vegetation plots (twelve 10.76-ft^2 plots for herbaceous species and six 43.06-ft^2 plots for shrubs) located systematically throughout the sample area (fig. 1). All live and dead vegetation rooted within each square plot was clipped at ground level, sorted by lifeform, and returned to the laboratory for oven drying. Vegetation was oven dried at a minimum of 158 °F for at least 48 hours before weighing and determination of area loading.

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[1] A list of scientific and common species names used in this volume appears on page 7.

[2] D.b.h. is measured 4.5 ft above the ground.

SHRUB BIOMASS

Six shrub clip plots, as referenced above, were selected for sampling that were completely covered by shrub vegetation. A list of more than six sampling point locations was developed *a priori* and each point was evaluated in order until six suitable points were located. Shrub vegetation was separated into live and dead fractions for all six shrub clip plots and further separated into size classes (less than or equal to 0.25 in + foliage, 0.25 to 1.0 in, and greater than 1.0 in) for three of six shrub clip plots. After clipping and separation, each shrub category was weighed in the field. Three moisture content subsamples that were representative of the material in each field-weighed sample were collected in airtight containers, returned to the laboratory, and oven dried to determine moisture content. Adjustment to an oven-dry basis for each field-weighed shrub sample for each plot was made by multiplying the field-measured weight by the mean of the ratio of oven-dry weight:wet weight of the three moisture content subsamples from that plot. The dry weight average proportion of each status and size class category of the three fully separated samples was applied to the gross dry weight of the unseparated samples and multiplied by the proportion of the site that was covered with shrubs to estimate site loading by status and size class.

LITTER

Litter coverage (and mineral soil exposure) was measured by using the line intercept method (Canfield 1941), and is reported with site information for all but the shrubland series. Litter loading was estimated by collecting surface material in 12 systematically located 2.69-ft^2 plots (except eucalyptus forest sites). Collected material was oven dried at a minimum of 158 °F for at least 48 hours before weighing and determination of area loading. Litter depth was calculated as the average of measurements taken every 5 ft between the 30- and 150-ft arcs on the five sample area layout lines (see fig. 1) for all sites. For eucalyptus forest sites, litter loading was estimated by multiplying the depth by a site-specific bulk density.[3] Litter depth was calculated as an average of the depth only where litter was encountered during sampling (null values, or points where litter was absent, are not included in the average).

For the eucalyptus series, the loading of litter, bark, and branch material that had accumulated at the base of some trees or groups of trees was estimated by measuring the gross volume of the basal accumulation, subtracting the portion of the bole volume of the trees growing out of the accumulation that was encapsulated by the volume of the accumulation to derive net volume, and applying an allometric relationship for predicting loading from net volume. Material in basal accumulations is in addition to woody material and litter measured on transects. The allometric relationship was generated by measuring and weighing 25 basal accumulations in areas adjacent to several of the sites sampled in this photo series.

WOODY MATERIAL

Measurement techniques used for inventorying dead and down woody material were patterned after the planar intersect method outlined by Brown (1974) and described by Maxwell and Ward (1980a). Transects of random azimuth starting at 45 systematically located points within the sample area were used to determine woody material loading and density (fig. 1). Woody material data are reported by size classes that correspond to timelag fuel classes used in fire behavior modeling (see, for example, Burgan and Rothermel 1984).[4] Woody material in 1-, 10-, and 100-hour-and-larger size classes was tallied on transects that were 3, 10, and 30 ft long, respectively. The decay class and the actual diameter at the point of intersection were measured for all pieces greater than 3 inches in diameter. All woody material less than or equal to 3 inches in diameter was

[3] The forest floor bulk density value used for eucalyptus litter appears under "Notes to Users."

[4] 1-, 10-, 100-, and 1,000-hour timelag fuels are defined as woody material ≤0.25 in, 0.26 to 1.0 in, 1.1 to 3.0 in, and >3.0 inches in diameter, respectively.

considered sound. Woody material loading and woody material density were calculated from relationships that use number of pieces intersected and transect length (and wood specific gravity for loading) developed by Brown (1974) and Safranyik and Linton (1987), respectively. Woody material in the shrubland series was measured by collecting all 1- and 10-hour pieces in twelve 2.69-ft^2 plots nested within the larger clipped vegetation plots. Collected woody material was oven dried at a minimum of 158 °F for at least 48 hours before weighing and determination of area loading.

SAPLINGS AND TREES

Overstory tree (i.e., trees greater than 4 in d.b.h.) composition and density were determined by a total inventory of the sample area. Sapling (i.e., trees less than or equal to 4 in d.b.h. and greater than 4.5 ft tall) composition and density were estimated by using twelve 0.005-ac circular plots located systematically throughout the sample area (fig. 1). Tree measurement data were summarized by d.b.h. size class and by tree status (all, live, or dead). Each stem was measured in cases where trees forked below 4.5 ft. The two most abundant tree species for each size class are listed with their relative density. Height to crown base (reported as ladder fuel height in previous photo series volumes) was defined as the height of the lowest, continuous live or dead branch material of the tree canopy, and height to live crown was defined as the height of the lowest continuous live branches of the tree canopy. All height measurements were made by using a graduated pole (measurements less than 25 ft) or a laser rangefinder with an inclinometer.

USING THE PHOTO SERIES

The natural fuels photo series is a tool for quickly and inexpensively evaluating a variety of fuel and vegetation conditions. Because of its ease of use, care must be taken when evaluating field sites to compare only with photo series sites that are appropriate matches. It is acceptable, however, to use the data from more than one site from the photo series when evaluating a site in the field (e.g., woody material loading from one site in the photo series and tree density from another site in the photo series to best match the conditions of a given field site).

Make a visual inventory of the site by observing fuel and stand conditions within the field of view and comparing them with the photographs as follows, remembering that the data tables relate to the area behind the sign in the photographs:

- Observe each fuel and vegetation characteristic (e.g., 1.1- to 3.0-in woody material loading).
- Select a photo series site (or sites) that nearly matches (or brackets) the observed characteristics.
- Obtain the quantitative value for the characteristic being estimated from the data summary accompanying the selected photo series site, or interpolate a value between sites.
- Repeat these steps for each characteristic of interest.

The total biomass or stand condition can then be calculated by summing the estimates. If the site being inventoried has areas with obvious differences in composition, structure, or condition, the user should make separate determinations for each area and then weight and sum the characteristics for the whole site.

Characteristics not distinguishable in the photographs are litter or forest floor depth, loading, and bulk density. If values for these characteristics are desired in the inventory, they must be derived from independent sampling or observations.

The 20 National Fire-Danger Rating System fuel models (Burgan 1988, Deeming et al. 1977) and the 13 original (Albini 1976) or 40 new (Scott and Burgan 2005) fire behavior fuel models are very general and broadly applied. Each photo series encompasses a wider range of conditions, and individual sites represent fuel characteristics at greater resolution than can be gained by using fuel models; consequently, we chose not to assign one of these existing fuel models to individual sites in this photo series. The photo series was designed to provide sufficient fuel and vegetation data from which managers could generate their own customized fuel models.

SPECIES LIST

Scientific and common species names are from U.S. Department of Agriculture, Natural Resources Conservation Service (2013). Common species names and scientific names in regular usage that differ from those found in the PLANTS database are also noted.

SCIENTIFIC NAME	COMMON NAME
TREES:	
Acacia melanoxylon R. Br.	Blackwood or black acacia
Cretaegus monogyna Jacq.	Oneseed hawthorn
Eucalyptus globulus Labill.	Tasmanian bluegum
Quercus agrifolia Née	California live oak or coast live oak
Umbellularia californica (Hook. & Arn.) Nutt.	California laurel or California bay
SHRUBS:	
Baccharis pilularis DC.	Coyotebrush
Toxicodendron diversilobum (Torr. & A. Gray) Greene	Pacific poison oak
GRASSES:	
Avena fatua L.	Wild oat
Bromus diandrus Roth	Ripgut brome
Festuca spp.	Fescue
FORBS:	
Centaurea solstitialis L.	Yellow star-thistle
Cirsium vulgare (Savi) Ten.	Bull thistle
Rubus armeniacus Focke (formerly *Rubus discolor* Weihe & Nees)	Himalayan blackberry

METRIC CONVERSIONS

1 inch (in) = 2.54 centimeters (cm)
1 foot (ft) = 0.3048 meter (m)
1 square foot (ft^2) = 0.0929 square meter (m^2)
1 acre (ac) = 4046.9 square meters (m^2)
1 acre (ac) = 0.4047 hectare (ha)
(Degrees Fahrenheit – 32) × (5/9) = Degrees Celsius

1 ton = 907.2 kilograms (kg)
1 ton/acre (ton/ac) = 0.2242 kilogram/square meter (kg/m^2)
1 ton/acre(ton/ac) = 2241.7023 kilograms/hectare (kg/ha)
1 $ton \cdot acre^{-1} \cdot inch^{-1}$ ($ton \cdot ac^{-1} \cdot in^{-1}$) = 8.8256E-03 grams/cubic centimeter (g/cm^3)
1 $ton \cdot acre^{-1} \cdot inch^{-1}$ ($ton \cdot ac^{-1} \cdot in^{-1}$) = 8825.6 grams/cubic meter (g/m^3)
1 $ton \cdot acre^{-1} \cdot inch^{-1}$ ($ton \cdot ac^{-1} \cdot in^{-1}$) = 8.8256 kilograms/cubic meter (kg/m^3)

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EAST BAY GRASSLAND PHOTO SERIES

A SERIES OF THREE SITES

EBG 01 THROUGH EBG 03

NOTES TO USERS:

1. The sites in this series are arranged in order of increasing total aboveground biomass.
2. This series represents some grassland types in the East Bay area. Sites with similar vegetation and fuel attributes from other Natural Fuels Photo Series publications can be referenced to supplement the sites reported here. Figure 2 shows where sites from this series fit relative to sites of similar fuel type in volume VII (Ottmar et al. 2004).
3. A list of scientific and common species names can be found on page 7.
4. Photographs were taken in September 2010. Sampling was performed in October 2010.
5. The marker in these photographs is a 1-ft square, and the pole is painted in contrasting colors at 1-ft intervals. The pole is 30 ft from the camera and is 6 ft tall. Note that no sampling occurs in the foreground between the camera and the sign.
6. Trace coverage is coverage <0.5 percent. The designation of "na" indicates cases where data are missing or "not available."

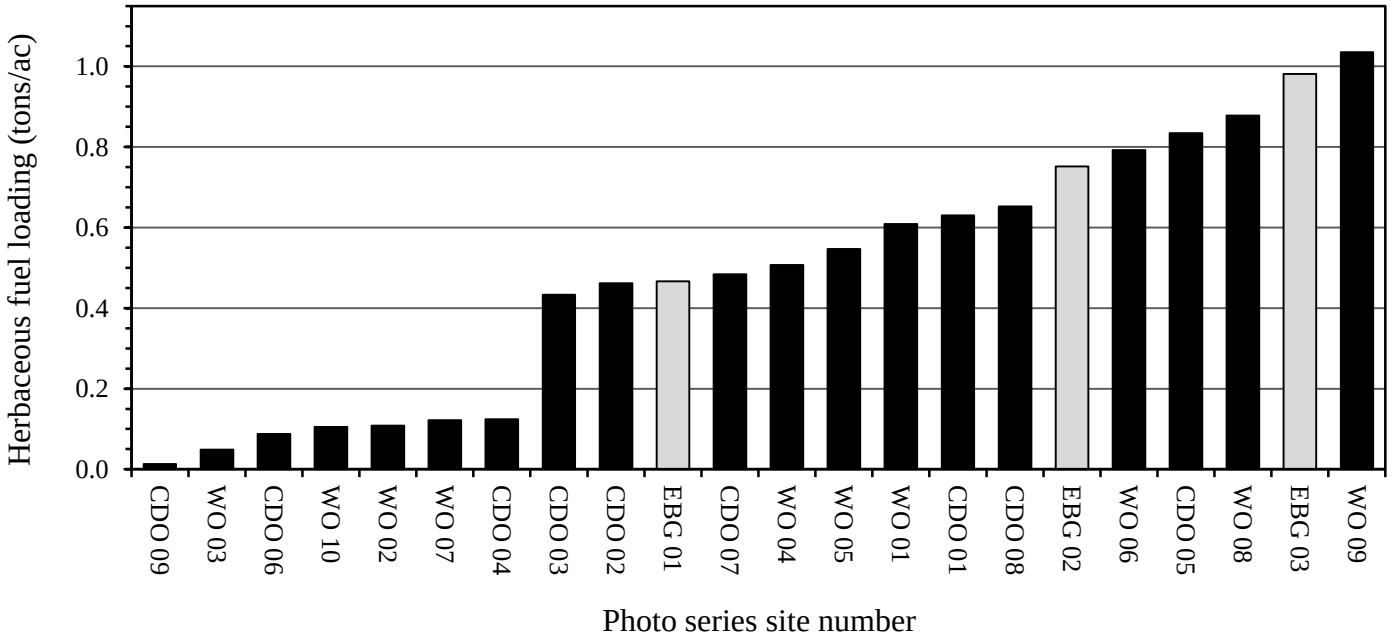


Figure 2—East Bay grassland (EBG) photo series site biomass in relation to sites with similar fuels in other parts of the Western United States. Comparative data come from the California Deciduous Oak (CDO) and Oregon White Oak (WO) series in Ottmar et al. (2004).

EBG 01 EAST BAY GRASSLAND

SITE INFORMATION

Site location: N 37° 34′ 29.9″ W 121° 56′ 05.9″
Elevation: 900 ft Aspect: 260° Slope: 18%
Administrative unit: Vargas Plateau Regional Park

Ecological association: *Bromus diandrus* herbaceous vegetation
Fuel type: California annual grassland

Litter loading: 0.45 tons/ac
Litter depth: 0.5 in
Litter coverage: 80%
Mineral soil exposure: 20%

Species: *Avena fatua, Bromus diandrus, Centaurea solstitialis, Cirsium vulgare, Festuca* spp.

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	--	*Centaurea solstitialis*	*Bromus diandrus*
Coverage (%)	0	trace	80
Avg height (ft)	--	1.0	0.6
Biomass (tons/ac)	0	trace	0.47

EBG 02 EAST BAY GRASSLAND

SITE INFORMATION

Site location: N 37° 43′ 03.0″ W 122° 05′ 54.6″
Elevation: 450 ft Aspect: 200° Slope: 10%
Administrative unit: Lake Chabot Regional Park

Plant association: *Bromus diandrus* herbaceous vegetation
Fuel type: California annual grassland

Litter loading: 0.25 tons/ac
Litter depth: na
Litter coverage: 91%
Mineral soil exposure: 9%

Species: *Avena fatua*, *Bromus diandrus*, *Cirsium vulgare*, *Festuca* spp.

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	--	*Cirsium vulgare*	*Bromus diandrus*
Coverage (%)	0	trace	91
Avg height (ft)	--	0.7	0.7
Biomass (tons/ac)	0	0.01	0.75

EBG 03 EAST BAY GRASSLAND

SITE INFORMATION

Site location: N 38° 00′ 19.6″ W 122° 21′ 24.0″
Elevation: 5 ft Aspect: -- Slope: 0%
Administrative unit: Point Pinole Regional Shoreline

Plant association: *Bromus diandrus* herbaceous vegetation
Fuel type: California annual grassland

Litter loading: 0.30 tons/ac
Litter depth: 0.5 in
Litter coverage: 96%
Mineral soil exposure: 1%

Species: *Avena fatua*, *Bromus diandrus*, *Centaurea solstitialis*, *Festuca* spp.

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	--	*Centaurea solstitialis*	*Avena fatua*
Coverage (%)	0	1	98
Avg height (ft)	--	1.5	2.5
Biomass (tons/ac)	0	0.03	0.95

EAST BAY
SHRUBLAND
PHOTO SERIES

A SERIES OF TWO SITES

EBS 01 THROUGH EBS 02

NOTES TO USERS:

1. The sites in this series are arranged in order of increasing total aboveground biomass.
2. This series represents some shrubland types in the East Bay area. Sites with similar vegetation and fuel attributes from other Natural Fuels Photo Series publications can be referenced to supplement the sites reported here. Figure 3 shows where sites from this series fit relative to sites of similar fuel type in volume IV (Ottmar et al. 2000) and volume VII (Ottmar et al. 2004).
3. A list of scientific and common species names can be found on page 7.
4. Photographs were taken in September 2010. Sampling was performed in October 2010.
5. The marker in these photographs is a 1-ft square, and the pole is painted in contrasting colors at 1-ft intervals. The pole is 30 ft from the camera and is 6 ft tall. Note that no sampling occurs in the foreground between the camera and the sign.
6. Trace coverage is coverage <0.5 percent. Trace biomass indicates biomass <0.005 tons/ac. The designation of "na" indicates cases where data are missing or "not available."

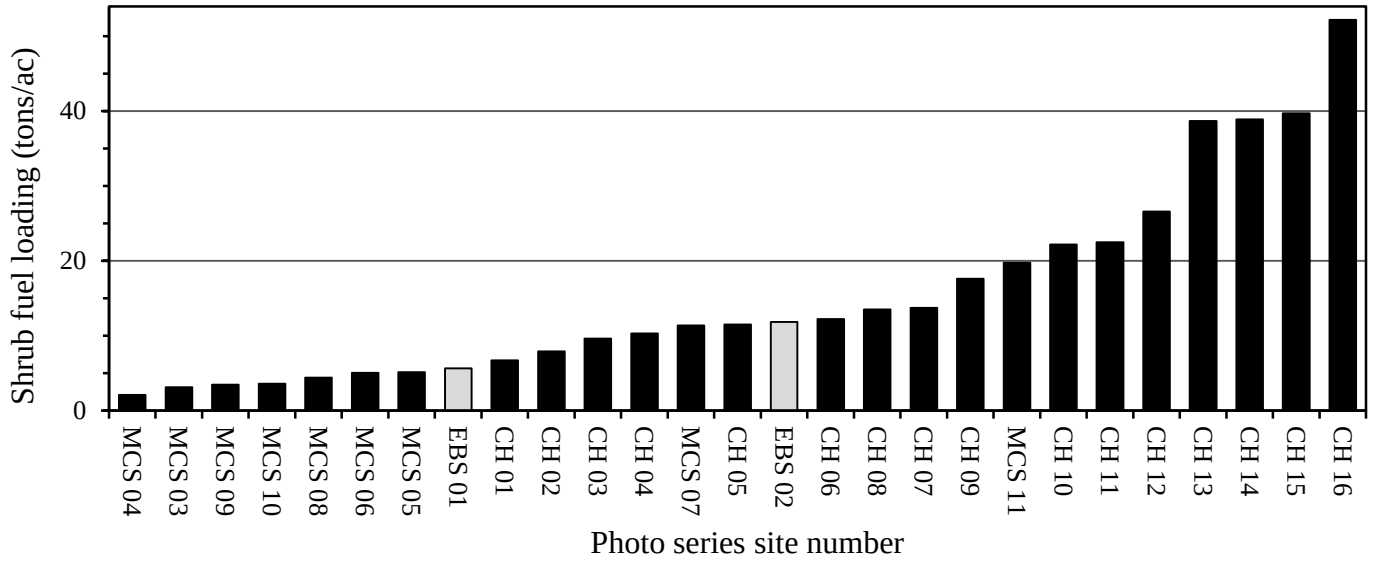


Figure 3—East Bay shrubland (EBS) photo series site biomass in relation to sites with similar fuels in other parts of the Western United States. Comparative data come from the Mixed-Conifer with Shrub (MCS) and Chaparral (CH) series in Ottmar et al. (2004) and Ottmar et al. (2000), respectively.

EBS 01 EAST BAY SHRUBLAND

SITE INFORMATION

Site location: N 37° 44′ 28.0″ W 122° 05′ 44.4″
Elevation: 800 ft Aspect: 30° Slope: 25%
Administrative unit: Anthony Chabot Regional Park

Ecological association: *Baccharis pilularis-Toxicodendron diversilobum* shrubland
Fuel type: Coyotebrush scrub

Mineral soil exposure: 1%

Species: *Avena fatua*, *Baccharis pilularis*, *Bromus diandrus*, *Festuca* spp.

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Baccharis pilularis*	na	*Bromus diandrus*
Coverage (%)	35	trace	64
Avg height (ft)	4.3	0.5	1.9
Biomass (tons/ac)	5.65	0.01	0.71

LITTER AND WOODY MATERIAL

Litter loading: 0.70 tons/ac
Litter depth: 0.9 in
Litter coverage: 28%

≤ 0.25in woody loading: 0.09 tons/ac
0.26 - 1.0 in woody loading: 0.14 tons/ac

SHRUB BIOMASS

Baccharis pilularis	Loading (tons/ac)
Live: Foliage + ≤ 0.25 in	1.41
0.26 - 1.0 in	2.92
>1.0 in	0.99
Dead: Foliage + ≤ 0.25 in	0.12
0.26-1.0 in	0.18
>1.0 in	0.03
All: Foliage + ≤ 0.25 in	1.53
0.26-1.0 in	3.10
>1.0 in	1.02
Grand total	5.65

EBS 02 EAST BAY SHRUBLAND

SITE INFORMATION

Site location: N 37° 44′ 16.8″ W 122° 05′ 42.7″
Elevation: 715 ft Aspect: 76° Slope: 12%
Administrative unit: Anthony Chabot Regional Park

Ecological association: *Baccharis pilularis-Toxicodendron diversilobum* shrubland
Fuel type: Coyotebrush scrub

Mineral soil exposure: 4%

Species: *Avena fatua*, *Baccharis pilularis*, *Bromus diandrus*, *Festuca* spp., *Toxicodendron diversilobum*

VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Baccharis pilularis*	na	*Bromus diandrus*
Coverage (%)	68	trace	23
Avg height (ft)	6.6	1.4	1.1
Biomass (tons/ac)	11.85	trace	0.26

LITTER AND WOODY MATERIAL

Litter loading: 0.45 tons/ac
Litter depth: 0.6 in
Litter coverage: 5%

≤ 0.25 in woody loading: 0.11 tons/ac
0.26 - 1.0 in woody loading: 0.14 tons/ac

SHRUB BIOMASS

Baccharis pilularis	Loading (tons/ac)
Live: Foliage + ≤ 0.25 in	2.50
0.26 - 1.0 in	3.76
>1.0 in	2.42
Dead: Foliage + ≤ 0.25 in	0.32
0.26-1.0 in	1.43
>1.0 in	1.42
All: Foliage + ≤ 0.25 in	2.82
0.26-1.0 in	5.19
>1.0 in	3.84
Grand total	11.85

EAST BAY
OAK/BAY WOODLAND
PHOTO SERIES

A SERIES OF TWO SITES

EBW 01 THROUGH EBW 02

NOTES TO USERS:

1. The sites in this series are arranged in order of increasing tree density.
2. This series represents some woodland types in the East Bay area. Sites with similar vegetation and fuel attributes from other Natural Fuels Photo Series publications can be referenced to supplement the sites reported here. Figure 4 shows where sites from this series fit relative to sites of similar fuel type in volume VII (Ottmar et al. 2004).
3. Although referred to as "woodlands," the sites dominated by *Quercus agrifolia* and *Umbellularia californica* in this series are quite dense and do not meet the typical definition of woodlands for which canopy coverage is generally considered to be between 25 and 60 percent.
4. A list of scientific and common species names can be found on page 7.
5. Photographs were taken in September 2010. Sampling was performed in October 2010.
6. The marker in these photographs is a 1-ft square, and the pole is painted in contrasting colors at 1-ft intervals. The pole is 30 ft from the camera and is 6 ft tall. Note that no sampling occurs in the foreground between the camera and the sign.
7. A distinction is made between rotten and sound woody material for pieces larger than 3 inches in diameter.

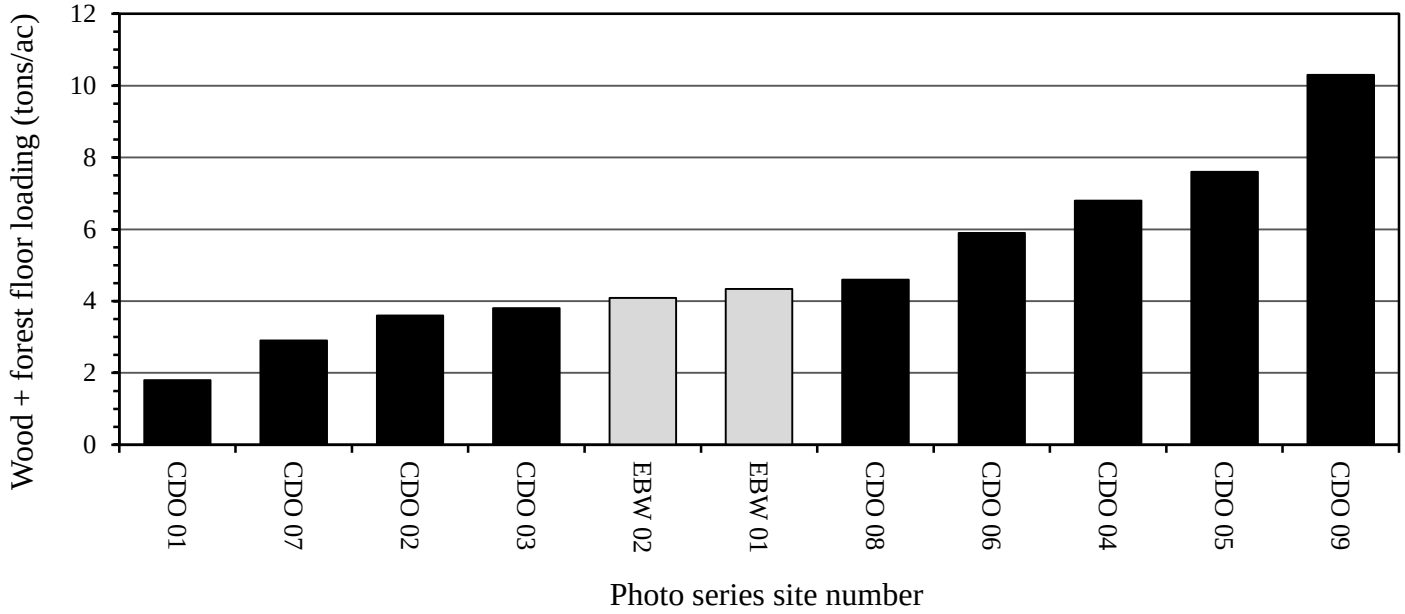


Figure 4—Oak-bay woodland (EBW) photo series dead and down woody fuel and forest floor (i.e., litter and duff) biomass in relation to sites with similar fuels in other parts of the Western United States as reported by Ottmar et al. (2004). Comparative data come from the California Deciduous Oak (CDO) series in Ottmar et al. (2004).

EBW 01 EAST BAY OAK/BAY WOODLAND

SITE AND STAND INFORMATION

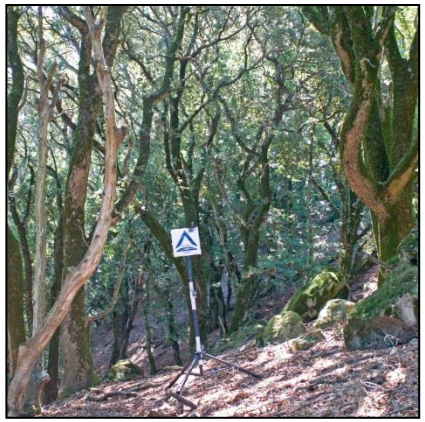
Site location: N 37° 49′ 08.6″ W 122° 04′ 08.6″
Elevation: 1,900 ft Aspect: -- Slope: 0%
Administrative unit: Las Trampas Regional Wilderness

Ecological association: *Quercus agrifolia-Umbellularia californica* woodland
Fuel type: Oak-bay woodland

Litter loading: 1.71 tons/ac
Litter depth: 0.9 in
Litter coverage: 77%
Mineral soil exposure: 14%

Trees (% of stems): *Quercus agrifolia* (57), *Umbellularia californica* (43)
Crown closure: 97%

Seedlings (% of stems): *Quercus agrifolia* (79), *Umbellularia californica* (21)
Density: 956/ac



SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	--	*Umbellularia californica* (64)	*Quercus agrifolia* (71)	*Quercus agrifolia* (100)	*Quercus agrifolia* (57)
Second most common species (percentage of stems)	--	*Quercus agrifolia* (36)	*Umbellularia californica* (29)	--	*Umbellularia californica* (43)
Tree density (stems/ac)	0	159	224	7	390
Live	0	137	209	7	353
Dead	0	22	15	0	37
Avg d.b.h. (in)	--	7.1	13.2	22.4	10.8
Live	--	7.1	13.3	22.4	11.1
Dead	--	6.7	10.4	--	8.2
Avg height (ft)	--	32.9	44.6	52.4	40.0
Live	--	34.0	45.2	52.4	41.0
Dead	--	26.0	35.0	--	29.6
Avg height to crown base (ft)	--	9.1	17.8	30.3	14.7
Live	--	9.1	17.8	30.3	14.7
Dead	--	--	--	--	--
Avg height to live crown (ft)	--	9.1	17.8	30.3	14.7

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	--	--	--
Second most common species	--	--	--
Coverage (%)	0	0	0
Avg height (ft)	--	--	--
Biomass (tons/ac)	0	0	0

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.23	--	0.23	--	--	--
0.26 - 1.0	0.50	--	0.50	--	--	--
1.1 - 3.0	0.52	--	0.52	--	--	--
3.1 - 9.0	0.00	1.13	1.13	0	48	48
>9.0	0.00	0.25	0.25	0	4	4
Total	1.25	1.38	2.63	0	52	52

EBW 02 EAST BAY OAK/BAY WOODLAND

SITE AND STAND INFORMATION

Site location: N 37° 45′ 32.9″ W 121° 59′ 14.5″
Elevation: 620 ft Aspect: 22° Slope: 22%
Administrative unit: Bishop Ranch Regional Preserve

Ecological association: *Quercus agrifolia-Umbellularia californica* woodland
Fuel type: Oak-bay woodland

Litter loading: 2.70 tons/ac
Litter depth: 1.1 in
Litter coverage: 95%
Mineral soil exposure: 5%

Trees (% of stems): *Umbellularia californica* (94), *Quercus agrifolia* (6)
Crown closure: 98%

Seedlings (% of stems): *Umbellularia californica* (100)
Density: 3,388/ac

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Umbellularia californica* (100)	*Umbellularia californica* (78)	*Quercus agrifolia* (67)	*Quercus agrifolia* (100)	*Umbellularia californica* (62)
Second most common species (percentage of stems)	--	*Quercus agrifolia* (22)	*Umbellularia californica* (33)	--	*Quercus agrifolia* (38)
Tree density (stems/ac)	1,107	130	43	14	187
Live	1,107	123	36	14	173
Dead	0	7	7	0	14
Avg d.b.h. (in)	1.3	6.2	11.8	25.1	8.9
Live	1.3	6.1	12.3	25.1	8.9
Dead	--	8.6	9.3	--	9.0
Avg height (ft)	12.7	27.3	34.2	32.2	29.3
Live	12.7	27.4	36.5	32.2	29.7
Dead	--	24.9	22.8	--	23.9
Avg height to crown base (ft)	6.6	14.6	16.9	15.3	15.2
Live	6.6	14.6	17.7	15.3	15.3
Dead	--	14.8	12.5	--	13.7
Avg height to live crown (ft)	6.6	14.6	17.7	15.3	15.3

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	--	--	--
Second most common species	--	--	--
Coverage (%)	0	0	0
Avg height (ft)	--	--	--
Biomass (tons/ac)	0	0	0

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.29	--	0.29	--	--	--
0.26 - 1.0	0.50	--	0.50	--	--	--
1.1 - 3.0	0.27	--	0.27	--	--	--
3.1 - 9.0	0.09	0.24	0.33	9	22	31
>9.0	0.00	0.00	0.00	0	0	0
Total	1.15	0.24	1.39	9	22	31

EAST BAY
EUCALYPTUS FOREST
PHOTO SERIES

A SERIES OF SIX SITES

EBE 01 THROUGH EBE 06

NOTES TO USERS:

1. The sites in this series are arranged in order of increasing surface fuel (i.e., dead and down woody fuel, litter, and understory vegetation) loading.
2. A list of scientific and common species names can be found on page 7.
3. The bulk density value used for calculating eucalyptus litter loading from depth measurements was 3.61 tons·ac^{-1}·in^{-1} based on 24 samples collected from three of the six eucalyptus sites.
4. Eucalyptus litter, bark, and branch material can accumulate at the bases of some trees or groups of trees creating areas of relatively deep litter and woody fuels, particularly in eucalyptus forests regenerated through coppicing (fig. 5). Basal accumulations were inventoried and measured within the sample area (fig. 1) to estimate their abundance and biomass or loading. The density of basal accumulations refers to the total number of accumulations, not the number of stems with accumulations (i.e., an individual accumulation can be associated with more than one tree stem). See page 5 for a more detailed description of the methods used to quantify basal accumulations. No basal accumulations were observed within the sample area for EBE 06; the basal accumulation visible on the right side of the wide-angle photograph was outside of the sample area.
5. Photographs were taken in September 2010. Sampling was performed in October 2010.
6. The marker in these photographs is a 1-ft square, and the pole is painted in contrasting colors at 1-ft intervals. The pole is 30 ft from the camera and is 6 ft tall. Note that no sampling occurs in the foreground between the camera and the sign.
7. Trace coverage is coverage <0.5 percent. Trace biomass indicates biomass <0.005 tons/ac. The designation of "na" indicates cases where data are missing or "not available."
8. A distinction is made between rotten and sound woody material for pieces larger than 3 inches in diameter.
9. Eucalyptus bark partially separates from the bole, potentially creating a flammable fuel ladder by which fire could spread vertically from the ground surface to the tree crowns. No attempt was made to quantify eucalyptus bark that is still attached to the trees as a "ladder fuel" in this series, although fire and fuel managers should take note of it when assessing eucalyptus-dominated stands.

Figure 5—Example of accumulated litter, bark, and woody material at the base of a eucalyptus coppice.

EBE 01 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 38° 00′ 17.8″ W 122° 21′ 24.2″
Elevation: 20 ft Aspect: -- Slope: 0%
Administrative unit: Point Pinole Regional Shoreline

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Young eucalyptus forest

Litter loading: 5.27 tons/ac
Litter depth: 1.5 in
Litter coverage: 28%
Mineral soil exposure: 1%

Basal accumulation* density: 7/ac
Basal accumulation loading: 0.04 tons/ac
Basal accumulation coverage: <1%

Trees (% of stems): *Eucalyptus globulus* (100)
Crown closure: 47%

Seedlings (% of stems): None
Density: 0/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	--	--	*Eucalyptus globulus* (100)	--	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	0	--	58	0	58
Live	0	--	58	0	58
Dead	0	--	0	0	0
Avg d.b.h. (in)	--	--	15.7	--	15.7
Live	--	--	15.7	--	15.7
Dead	--	--	--	--	--
Avg height (ft)	--	--	85.1	--	85.1
Live	--	--	85.1	--	85.1
Dead	--	--	--	--	--
Avg height to crown base (ft)	--	--	22.1	--	22.1
Live	--	--	22.1	--	22.1
Dead	--	--	--	--	--
Avg height to live crown (ft)	--	--	22.1	--	22.1

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Baccharis pilularis*	*Centaurea solstitialis*	*Bromus* spp.
Second most common species	*Toxicodendron diversilobum*	*Cirsium vulgare*	*Avena fatua*
Coverage (%)	trace	2	69
Avg height (ft)	1.6	1.7	1.4
Biomass (tons/ac)	0.03*	0.02	0.21

*Poison oak was not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.10	--	0.10	--	--	--
0.26 - 1.0	0.28	--	0.28	--	--	--
1.1 - 3.0	0.15	--	0.15	--	--	--
3.1 - 9.0	0.30	0.71	1.01	9	35	44
>9.0	0.00	0.23	0.23	0	4	4
Total	0.83	0.94	1.77	9	39	48

EBE 02 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 37° 54′ 25.2″ W 122° 15′ 41.9″
Elevation: 615 ft Aspect: 208° Slope: 20%
Administrative unit: Tilden Regional Park

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Mature eucalyptus forest

Litter loading: 8.23 tons/ac
Litter depth: 2.4 in
Litter coverage: 84%
Mineral soil exposure: 0%

Basal accumulation* density: 0/ac
Basal accumulation loading: 0.00 tons/ac
Basal accumulation coverage: 0%

Trees (% of stems): *Umbellularia californica* (62), *Eucalyptus globulus* (21), *Quercus agrifolia* (17)
Crown closure: 84%

Seedlings (% of stems): *Umbellularia californica* (56), *Quercus agrifolia* (42), *Eucalyptus globulus* (2)
Density: 1,040/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Umbellularia californica* (73)	--	--	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	*Quercus agrifolia* (20)	--	--	--	--
Tree density (stems/ac)	252	0	0	43	43
Live	252	0	0	43	43
Dead	0	0	0	0	0
Avg d.b.h. (in)	0.7	--	--	28.5	28.5
Live	0.7	--	--	28.5	28.5
Dead	--	--	--	--	--
Avg height (ft)	7.7	--	--	131.5	131.5
Live	7.7	--	--	131.5	131.5
Dead	--	--	--	--	--
Avg height to crown base (ft)	1.8	--	--	68.4	68.4
Live	1.8	--	--	68.4	68.4
Dead	--	--	--	--	--
Avg height to live crown (ft)	1.8	--	--	68.0	68.0

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Toxicodendron diversilobum*	*Centaurea solstitialis*	*Bromus* spp.
Second most common species	--	--	*Avena fatua*
Coverage (%)	2	4	11
Avg height (ft)	0.9	1.0	1.4
Biomass (tons/ac)	na*	0.06	0.07

*Poison oak was not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.19	--	0.19	--	--	--
0.26 - 1.0	0.63	--	0.63	--	--	--
1.1 - 3.0	0.81	--	0.81	--	--	--
3.1 - 9.0	0.42	0.44	0.86	13	17	30
>9.0	0.00	0.00	0.00	0	0	0
Total	2.05	0.44	2.49	13	17	30

EBE 03 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 38° 00′ 12.5″ W 122° 21′ 11.7″
Elevation: 100 ft Aspect: -- Slope: 0%
Administrative unit: Point Pinole Regional Shoreline

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Young eucalyptus forest

Litter loading: 9.79 tons/ac
Litter depth: 2.7 in
Litter coverage: 59%
Mineral soil exposure: 1%

Basal accumulation* density: 43/ac
Basal accumulation loading: 0.59 tons/ac
Basal accumulation coverage: 2%

Trees (% of stems): *Eucalyptus globulus* (97), *Acacia melanoxylon* (3)
Crown closure: 66%

Seedlings (% of stems): *Acacia melanoxylon* (66), *Eucalyptus globulus* (34)
Density: 1,476/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Eucalyptus globulus* (96)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	*Acacia melanoxylon* (4)	--	--	--	--
Tree density (stems/ac)	1,426	267	108	22	397
Live	1,292	267	108	22	397
Dead	134	0	0	0	0
Avg d.b.h. (in)	1.3	6.6	11.7	28.5	9.2
Live	1.2	6.6	11.7	28.5	9.2
Dead	1.7	--	--	--	--
Avg height (ft)	18.6	76.2	104.7	109.6	85.8
Live	18.9	76.2	104.7	109.6	85.8
Dead	15.9	--	--	--	--
Avg height to crown base (ft)	12.9	55.5	69.2	63.8	59.7
Live	12.9	55.5	69.2	63.8	59.7
Dead	--	--	--	--	--
Avg height to live crown (ft)	12.9	55.5	69.2	63.8	59.7

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Toxicodendron diversilobum*	*Centaurea solstitialis*	*Bromus* spp.
Second most common species	*Baccharis pilularis*	*Cirsium vulgare*	*Avena fatua*
Coverage (%)	2	trace	39
Avg height (ft)	1.6	1.2	0.7
Biomass (tons/ac)	na*	trace	0.07

*Poison oak was not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.23	--	0.23	--	--	--
0.26 - 1.0	0.54	--	0.54	--	--	--
1.1 - 3.0	1.07	--	1.07	--	--	--
3.1 - 9.0	0.46	3.58	4.04	16	254	270
>9.0	0.89	0.70	1.59	5	11	16
Total	3.19	4.28	7.47	21	265	286

EBE 04 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 38° 00′ 07.8″ W 122° 21′ 12.2″
Elevation: 55 ft Aspect: -- Slope: 0%
Administrative unit: Point Pinole Regional Shoreline

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Mature eucalyptus forest

Litter loading: 13.43 tons/ac
Litter depth: 3.8 in
Litter coverage: 98%
Mineral soil exposure: 2%

Basal accumulation* density: 43/ac
Basal accumulation loading: 0.31 tons/ac
Basal accumulation coverage: 1%

Trees (% of stems): *Eucalyptus globulus* (100)
Crown closure: 90%

Seedlings (% of stems): *Eucalyptus globulus* (100)
Density: 1,234/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	4,157	166	65	29	260
Live	3,540	166	65	29	260
Dead	617	0	0	0	0
Avg d.b.h. (in)	0.8	6.0	11.4	33.6	10.4
Live	0.8	6.0	11.4	33.6	10.4
Dead	0.5	--	--	--	--
Avg height (ft)	14.8	75.7	103.8	151.5	91.1
Live	15.7	75.7	103.8	151.5	91.1
Dead	10.2	--	--	--	--
Avg height to crown base (ft)	10.2	53.0	67.4	62.0	57.6
Live	10.2	53.0	67.4	62.0	57.6
Dead	--	--	--	--	--
Avg height to live crown (ft)	10.2	53.0	67.4	62.0	57.6

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Toxicodendron diversilobum*	*Centaurea solstitialis*	*Avena fatua*
Second most common species	--	*Cirsium vulgare*	*Bromus* spp.
Coverage (%)	trace	trace	2
Avg height (ft)	0.9	0.9	0.7
Biomass (tons/ac)	na*	0.01	0.03

*Poison oak not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.38	--	0.38	--	--	--
0.26 - 1.0	0.53	--	0.53	--	--	--
1.1 - 3.0	0.69	--	0.69	--	--	--
3.1 - 9.0	0.41	0.92	1.33	26	52	78
>9.0	0.00	3.36	3.36	0	22	22
Total	2.01	4.28	6.29	26	74	100

EBE 05 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 37° 45′ 32.1″ W 122° 06′ 52.3″
Elevation: 595 ft Aspect: 152° Slope: 17%
Administrative unit: Anthony Chabot Regional Park

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Young eucalyptus forest

Litter loading: 16.35 tons/ac
Litter depth: 4.5 in
Litter coverage: 100%
Mineral soil exposure: 0%

Basal accumulation* density: 108/ac
Basal accumulation loading: 1.64 tons/ac
Basal accumulation coverage: 5%

Trees (% of stems): *Eucalyptus globulus* (100)
Crown closure: 66%

Seedlings (% of stems): *Umbellularia californica* (75), *Eucalyptus globulus* (25)
Density: 67/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	--	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	--	--	--	--	--
Tree density (stems/ac)	721	506	29	0	535
Live	503	506	29	0	535
Dead	218	0	0	0	0
Avg d.b.h. (in)	2.2	5.8	9.7	--	6.0
Live	2.6	5.8	9.7	--	6.0
Dead	1.3	--	--	--	--
Avg height (ft)	33.0	62.4	79.0	--	63.3
Live	37.4	62.4	79.0	--	63.3
Dead	23.0	--	--	--	--
Avg height to crown base (ft)	27.0	43.1	64.2	--	44.2
Live	27.0	43.1	64.2	--	44.2
Dead	--	--	--	--	--
Avg height to live crown (ft)	27.0	43.1	64.2	--	44.2

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Toxicodendron diversilobum*	na	na
Second most common species	--	--	--
Coverage (%)	na*	trace	trace
Avg height (ft)	5.3	1.5	0.7
Biomass (tons/ac)	na*	trace	trace

*Poison oak was not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.33	--	0.33	--	--	--
0.26 - 1.0	0.91	--	0.91	--	--	--
1.1 - 3.0	1.39	--	1.39	--	--	--
3.1 - 9.0	0.43	3.62	4.05	27	354	381
>9.0	0.00	0.00	0.00	0	0	0
Total	3.06	3.62	6.68	27	354	381

EBE 06 EAST BAY EUCALYPTUS FOREST

SITE AND STAND INFORMATION

Site location: N 37° 54′ 29.8″ W 122° 15′ 42.2″
Elevation: 660 ft Aspect: 208° Slope: 10%
Administrative unit: Tilden Regional Park

Ecological association: *Eucalyptus globulus* semi-natural stands
Fuel type: Mature eucalyptus forest

Litter loading: 13.91 tons/ac
Litter depth: 3.9 in
Litter coverage: 93%
Mineral soil exposure: 3%

Basal accumulation* density: 0/ac
Basal accumulation loading: 0.00 tons/ac
Basal accumulation coverage: 0%

Trees (% of stems): *Eucalyptus globulus* (64), *Umbellularia californica* (32), *Quercus agrifolia* (2), *Cretaegus monogyna* (2)
Crown closure: 96%

Seedlings (% of stems): *Umbellularia californica* (54), *Quercus agrifolia* (35), *Eucalyptus globulus* (11)
Density: 2,345/ac

*Accumulated leaf, branch, and bark material piled around the bases of some trees.

SAPLINGS AND TREES

	Size class (diameter at breast height)				
	≤4 in	4 - 9 in	9 - 20 in	>20 in	>4 in
Most common species (percentage of stems)	*Eucalyptus globulus* (58)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)	*Eucalyptus globulus* (100)
Second most common species (percentage of stems)	*Umbellularia californica* (37)	--	--	--	--
Tree density (stems/ac)	1,191	108	72	29	209
Live	990	108	65	29	202
Dead	201	0	7	0	7
Avg d.b.h. (in)	0.9	6.5	13.8	22.6	11.2
Live	1.0	6.5	14.0	22.6	11.2
Dead	0.5	--	12.2	--	12.2
Avg height (ft)	13.4	59.1	66.1	78.8	64.2
Live	14.2	59.1	72.2	78.8	66.1
Dead	9.6	--	11.8	--	11.8
Avg height to crown base (ft)	6.4	24.6	38.7	42.5	31.7
Live	6.4	24.6	38.7	42.5	31.7
Dead	--	--	--	--	--
Avg height to live crown (ft)	6.4	24.6	38.7	42.5	31.7

UNDERSTORY VEGETATION

	Lifeform		
	Shrub	Forb	Graminoid
Most common species	*Toxicodendron diversilobum*	*Rubus armeniacus*	*Bromus* spp.
Second most common species	--	--	*Avena fatua*
Coverage (%)	4	trace	trace
Avg height (ft)	1.1	0.8	na
Biomass (tons/ac)	na*	trace	trace

*Poison oak was not collected for biomass estimation.

WOODY MATERIAL

	Loading (tons/ac)			Density (pieces/ac)		
Diameter (in)	Sound	Rotten	Total	Sound	Rotten	Total
≤0.25	0.46	--	0.46	--	--	--
0.26 - 1.0	0.93	--	0.93	--	--	--
1.1 - 3.0	0.75	--	0.75	--	--	--
3.1 - 9.0	1.28	1.50	2.78	39	86	125
>9.0	4.53	4.20	8.73	30	56	86
Total	7.95	5.70	13.65	69	142	211

Wright, Clinton S.; Vihnanek, Robert E. 2014. Stereo photo series for quantifying natural fuels. Volume XIII: grasslands, shrublands, oak-bay woodlands, and eucalyptus forests in the East Bay of California. Gen. Tech. Rep. PNW-GTR-893. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 39 p.

Four series of photographs display a range of natural conditions and fuel loadings for grassland, shrubland, oak-bay woodland, and eucalyptus forest ecosystems on the eastern slopes of the San Francisco Bay area of California. Each group of photos includes inventory information summarizing vegetation composition, structure, and loading; woody material loading and density by size class; forest floor depth and loading; and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

Keywords: Woody material, biomass, fuel loading, natural fuels, East Bay Regional Park District, Tasmanian bluegum, *Eucalyptus globulus*, California laurel, California bay, *Umbellularia californica*, California live oak, coast live oak, *Quercus agrifolia*, coyotebrush, *Baccharis pilularis*.