

DATA PAPER

Annual biomass spatial data for southern California (2001–2021): Above- and belowground, standing dead, and litter

Charlie C. Schrader-Patton¹ | Emma C. Underwood²  | Quinn M. Sorenson³ 

¹RedCastle Resources, Inc., Contractor to: USDA Forest Service Western Wildlands Environmental Threat Assessment Center (WWETAC), Salt Lake City, Utah, USA

²Department of Environmental Science and Policy, University of California, Davis, California, USA

³Department of Plant Sciences, University of California, Davis, California, USA

Correspondence

Charlie C. Schrader-Patton
Email: charlie.schrader-patton@usda.gov

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Abstract

Biomass estimates for shrub-dominated ecosystems in southern California have been generated at national and statewide extents. However, existing data tend to underestimate biomass in shrub vegetation types are limited to one point in time, or estimate aboveground live biomass only. In this study, we extended our previously developed estimates of aboveground live biomass (AGLBM) based on the empirical relationship of plot-based field biomass measurements to Landsat normalized difference vegetation index (NDVI) and multiple environmental factors to include other vegetative pools of biomass. AGLBM estimates were made by extracting plot values from elevation, solar radiation, aspect, slope, soil type, landform, climatic water deficit, evapotranspiration, and precipitation rasters and then using a random forest model to estimate per-pixel AGLBM across our southern California study area. By substituting year-specific Landsat NDVI and precipitation data, we created a stack of annual AGLBM raster layers for each year from 2001 to 2021. Using these AGLBM data as a foundation, we developed decision rules to estimate belowground, standing dead, and litter biomass pools. These rules were based on relationships between AGLBM and the biomass of the other vegetative pools derived primarily from peer-reviewed literature and an existing spatial data set. For shrub vegetation types (our primary focus), rules were based on literature estimates by the postfire regeneration strategy of each species (obligate seeder, facultative seeder, obligate resprouter). Similarly, for nonshrub vegetation types (grasslands, woodlands) we used literature and existing spatial data sets specific to each vegetation type to define rules to estimate the other pools from AGLBM. Using a Python language script that accessed Environmental Systems Research Institute raster geographic information system utilities, we applied decision rules to create raster layers for each of the non-AGLBM pools for the years 2001–2021. The resulting spatial data archive contains a zipped file for each year; each of these files contains four 32-bit tiff

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files for each of the four biomass pools (AGLBM, standing dead, litter, and belowground). The biomass units are grams per square meter (g/m^2). We estimated the uncertainty of our biomass data by conducting a Monte Carlo analysis of the inputs used to generate the data. Our Monte Carlo technique used randomly generated values for each of the literature-based and spatial inputs based on their expected distribution. We conducted 200 Monte Carlo iterations, which produced percentage uncertainty values for each of the biomass pools. Results showed, using 2010 as an example, mean biomass for the study area and percentage uncertainty for each of the pools as follows: AGLBM (905.4 g/m^2 , 14.4%); standing dead (644.9 g/m^2 , 1.3%); litter (731.2 g/m^2 , 1.2%); and belowground (776.2 g/m^2 , 17.2%). Because our methods are consistently applied across each year, the data produced can be used to inform changes in biomass pools due to disturbance and subsequent recovery. As such, these data provide an important contribution to supporting the management of shrub-dominated ecosystems for monitoring trends in carbon storage and assessing the impacts of wildfire and management activities, such as fuel management and restoration. There are no copyright restrictions on the data set; please cite this paper and the data package when using these data.

KEYWORDS

chaparral, land cover, Landsat, public lands, resource management, shrublands, southern California, vegetation biomass

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data and code are available from Dryad at <https://doi.org/10.5061/dryad.qz612jmjt>.

ORCID

Emma C. Underwood  <https://orcid.org/0000-0003-1879-9247>

Quinn M. Sorenson  <https://orcid.org/0000-0002-2737-6548>

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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