Santa Barbara County

Oak Woodland Inventory and Monitoring Program

Pilot Mapping and Modeling Study

Final Report to the County of Santa Barbara Department of Planning and Development

Principal Investigator

Frank W. Davis

Donald Bren School of Environmental Science and Management

Research Assistants

William Kuhn

Peter Alagona

Department of Geography

Marc Campopiano

Donald Bren School of Environmental Science and Management

Rodney Brown

Map and Imagery Laboratory

University of California at Santa Barbara

Final Report Submitted May 1, 2000

SUMMARY

This report summarizes the findings of the Santa Barbara County Oak Woodland Inventory and Monitoring Program. Program objectives included the following:

1) Develop a mapping strategy for County-wide inventory and monitoring of oak savanna, woodland and forest ecosystems that could provide consistent, accurate, and repeatable information at an adequate level of detail to support environmental assessment and impact analyses by the County of Santa Barbara.

2) Develop a predictive site suitability model based on mapped environmental parameters and historical information that can be used to map areas in Santa Barbara County that offer opportunities for oak woodland restoration.

3) Apply these mapping and modeling approaches developed to develop a spatial database of present and potential oak habitats in the Santa Antonio Creek Watershed east of Vandenberg Air Force Base, as well as in adjacent areas east of the watershed extending to UCSB's Sedgwick Ranch Reserve.

Project deliverables include this written final report; electronic copies of all tabular, and image and Geographic Information System (GIS) data and associated metadata..

In Section 1 we review current status and trends of the valley oak (*Quercus lobata*).

We conclude that despite recent, ambitious and well-designed efforts to inventory California's hardwood rangelands, we lack complete statewide estimates of Valley oak distribution, status and trend in all except perhaps the upland woodland types. Despite their limitations, existing surveys indicate the highly threatened nature of valley oak ecosystems. Between 1973 and 1987 over 200,000 acres of oak woodland were converted to nonforest, and predictions of future loss run as high as another quarter million acres by the year 2010. Valley oak habitat may be especially vulnerable because it is not well represented on public lands or in existing reserves, and the remaining distribution coincides with areas that are predicted to undergo rapid development in the future.

In spite of ample acorn and seedling production, tree cover and density in remaining Valley oak populations are declining in Santa Barbara County. The County has been included in statewide hardwood mapping efforts, but these sources disagree considerably on the location and extent of remaining Valley oak woodland and savanna. This disagreement arises from the use of different lines of evidence and classification systems for mapping and inventory. The current study is the first to achieve a relatively detailed view of the species over a significant portion of the County.

In Section 2 we describe the project study area and methods.

The study area was defined as the San Antonio Creek watershed exclusive of Vandenberg Air Force Base. We adopted soil units as mapped in the *Soil Survey for Northern Santa Barbara County* as the basis for inventorying oaks, land use, and land cover. Soil mapping units were rectified and co-registered to a geographic base map and large, heterogeneous units were divided based on topography and land use. After editing, the study area was divided into 1990 assessment units with a mean size of 22.1 hectares (54.6 acres).

Oak species composition, cover and density were inventoried using true-color aerial photography acquired in July 1997 by Pacific Western Aerial Surveys. For each assessment unit the following data were recorded:

Dominant land use type

Soil series

Dominant plant communities

Historical land use/land cover based on Vegetation Type Mapping Survey maps

Dominant land form or terrain type

Oak counts and/or density using one of two counting methods for each oak species

Visually estimated percentage canopy cover of each oak species

Photograph ID number.

Transparencies of the aerial photographs were scanned at 600 dots per inch (dpi) resolution and co-registered to the base GIS layer. The digital photos are an extremely valuable resource, especially when used in conjunction with the oak inventory database and other geographic information.

Although we did extensive roadside reconnaissance to support our photo interpretation and mapping, with only limited resources and access to private lands we could not conduct quantitative field surveys to estimate the accuracy of the oak inventory data. However, we did test for inconsistency among photo interpreters in order to provide an indication of potential error and bias in the final database. The comparison of interpreters indicates that there is relatively low uncertainty in estimating the density and cover of coast live oak and valley oak. There was greater uncertainty in inventorying blue oak, which tends to occur as smaller trees in denser woodlands and forest where density is more difficult to estimate. However, valley oaks may still be missed in large polygons dominated by other cover types. The largest uncertainty is associated with the assignment of dominant land use/land cover class and vegetation type, mainly because of ambiguities in the definitions of the types.

In Section 3 we summarize the statistical characteristics of the three oak species in the pilot study area based on the oak database.

Of the 1990 assessment units in the study area, 666 or 33% contain valley oaks. Over the entire study area, approximately 22,650 tree-sized individuals were recorded. In map units where they occur, valley oaks are generally sparse, with mean density and cover of 0.7 trees/ac and 4% cover, respectively. Based on comparisons with survey maps from the 1930's, valley oak was entirely lost from at least 99 mapped polygons. Major areas of change include sites east of Los Alamos along Highway 101 that have been recently cleared for vineyards, as well as vineyard areas along Foxen Canyon Road.

In the study area, 1515 or 76% map units contained coast live oaks. Within these 1488 polygons, the species has an average tree density of 5.1 trees/ac and an average tree canopy cover of 15%, considerably higher than those for valley oak. Coast live oak generally displays densities of less than 4.0 trees/ac and less than 10 percent canopy cover. However, a substantial fraction of assessment units support higher densities and cover of this species, especially on steep north-facing slopes. Since the 1930's coast live oak has disappeared from at least 181 assessment units that are scattered throughout the study area.

Of the 1990 assessment units in the study area, 186 or nine percent contained blue oaks. Blue oak is found in relatively low densities (mean of 3.2 trees/ac) and low canopy cover (9.2% cover). The species is confined to a small area in the eastern portion of the study area on the western and southern flanks of Figueroa Mountain. Within this area, monospecific blue oak stands attain up to 56% canopy cover. Since the 1930's blue oak has been lost from at least 45 assessment units, most of this area in rangeland and cropland between Figueroa Mountain Road and Zaca Ranch Road.

All three oak species show strongly non-random patterns of association with soils. Valley oaks preferentially occur on loamy escarpments and shaly loam. Land conversion has occurred primarily on the same soil types preferred by valley oaks, such as loam, clay loam, sandy loam, and shale loam. Coast live oak occurs on a wide range of soil types, but is negatively associated with shale clay loams, rocky clay loams, and the Climara-Toomes Series (shallow clay and clay loams on top of bedrock). Blue oak preferentially occurs on silty clay loams, shale loams, and Climara-Toomes soils.

In Section 4 we describe a computerized knowledge base that can be used to evaluate site suitability for valley oak restoration.

This knowledge base is linked to the Geographic Information System (GIS) database, allowing the user to map site restoration potential across the entire study area. We have not tested the accuracy of the model in the field, and consider it to be a "work in progress." Our aim is to continue collecting information and refining the model through time. In the meantime, we will work with staff at Santa Barbara County's Department of Planning and Development to train them in the use of the oak inventory database and associated oak restoration knowledge base.

Appendix A provides a technical description of the various data fields in the oak inventory database.

Acknowledgements

This project was funded by the Santa Barbara County Department of Planning and Development. Several individuals from the Department of Planning and Development were deeply involved in developing project goals and objectives and in reviewing draft procedures and data products, notably Brett Buyan, Mark Bright, Elihu Gevirtz, Abe Leider, and Dan Gira. We greatly appreciate their guidance and active participation in many aspects of the project. We also gratefully acknowledge David Stoms, Biogeography Lab manager, for his advice and technical assistance, and the staff at UCSB's Institute for Computational Earth System Science, especially Kathy Scheideman, John Sanchez, and Claudia Kashin, for their administrative support.

Table of Contents