U.S. National Vegetation Classification:
Advancing the Description and Management of the Nation's Ecosystems

Social and economic benefits of using a standard classification for conservation in California

T. Keeler-Wolf[1], A. Ougzin[1], D. Hickson[1], M.J. Colletti[1], D. Grossman[2]

[1]Vegetation Classification and Mapping Program, California Department of Fish & Wildlife, [2]California Strategic Growth Council

Background

California has embraced the US National Vegetation Classification System (USNVC) as the standard for classification and mapping of vegetation. Vegetation maps based on the USNVC can be used to identify rare and sensitive habitats for conservation in planning scenarios, which range in size from small projects to large multijurisdictional planning processes spanning millions of acres. They can also be used to evaluate ecological reserve and connectivity design, and landscape resilience. A recent economic analysis and user questionnaire summarizes the values of standardized vegetation classification and mapping, and synthesizes its many benefits for conservation planning and other purposes. Because the classification is standard throughout the state and the maps are richly attributed, the same data can be used for many different applications, including:

- Rare plant and animal species modeling
- Fire modeling and fuel mapping
- Invasive species monitoring and control
- Hydrology and watershed assessments
- Predicting and measuring carbon sequestration levels and carbon release rates
- Detection of landscape level changes resulting from climate change
- Land use planning

Vegetation projects are undertaken as an integrated process, starting with bioregional sampling. Thousands of samples are analyzed to create a vegetation classification that corresponds to the lower and mid-level hierarchical units of the USNVC, and detailed type descriptions are written. Vegetation is mapped using quantitative rules derived from the classification to identify vegetation type. Structural and disturbance attributes are then assigned to each mapped polygon. About half of California has been classified and mapped to date.

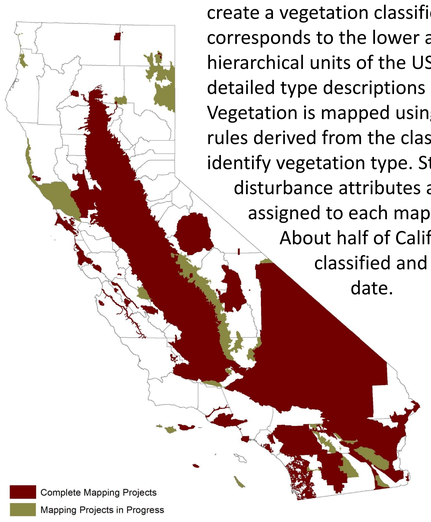


Figure 1: Vegetation classification and mapping projects in California.

Classification in California is standard, repeatable, and rule-based, producing vegetation type descriptions that cross jurisdictional boundaries. Habitat managers and development planners can confidently compare vegetation throughout the state, whether it is situated on public (local, state, federal) or private land.

Examples of Use for Conservation

Example 1: Regional Open Space Planning
The San Francisco Bay Area Open Space Council used vegetation mapping as a means to identify biologically representative landscape units for conservation. The vegetation map was compared with urban areas and existing conservation lands to identify additional possible lands to round out the conservation network. These potential lands were then screened using different relative importance values based on rarity, acreage, and habitat importance.

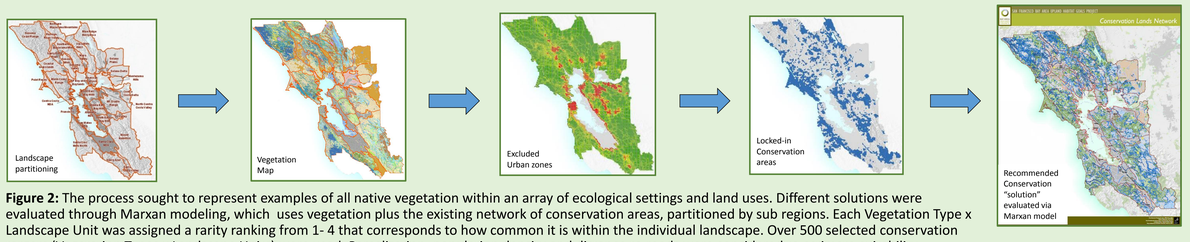


Figure 2: The process sought to represent examples of all native vegetation within an array of ecological settings and land uses. Different solutions were evaluated through Marxan modeling, which uses vegetation plus the existing network of conservation areas, partitioned by sub regions. Each Vegetation Type x Landscape Unit was assigned a rarity ranking from 1- 4 that corresponds to how common it is within the individual landscape. Over 500 selected conservation targets (Vegetation Types x Landscape Units) were used. Parcelization, population density and distance to roads were considered to estimate suitability.

Example 2: Regional Advanced Mitigation Planning
Prior to the siting and construction of planned infrastructure, Regional Conservation Assessment uses **advanced mitigation** to drive the delicate process of securing different portions of a planning landscape for development of viable reserves with interlinking corridors.

Developing a process-driven approach to regional planning uses vegetation to:

1) define broader (Macrogroup level) target ecoregional habitats for State Wildlife Action Planning (integration of federal and state planning) and
2) aggregate land parcels based on suitability for conservation (as critical habitat or wildlife corridor) or as part of developed landscape.

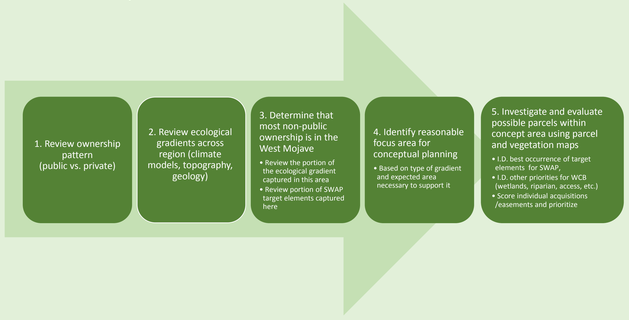


Figure 3: An example of the main steps in regional advanced mitigation planning from the Mojave Desert, where detailed vegetation maps exist. Management plans can be developed for sensitive animal and plant species, such as the Mojave Ground Squirrel, the Mojave Eriophyllum and the Alkali Mariposa Lily, as well as sensitive communities like Joshua Tree woodlands and Shadscale shrublands.

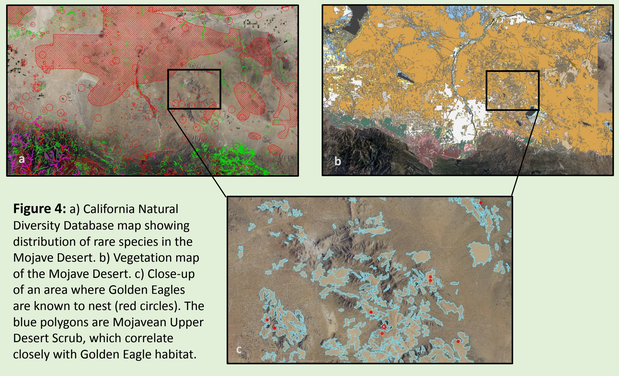
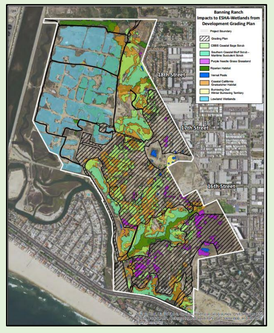


Figure 4: a) California Natural Diversity Database map showing distribution of rare species in the Mojave Desert. b) Vegetation map of the Mojave Desert. c) Close-up of an area where Golden Eagles are known to nest (red circles). The blue polygons are Mojavean Upper Desert Scrub, which correlate closely with Golden Eagle habitat.

Example 3: Banning Ranch
The California Coastal Commission uses detailed vegetation descriptions and fine-scale maps to define Environmentally Sensitive Habitat Areas (ESHAs); sensitive natural communities that are protected by law. In this example from Banning Ranch in Orange County, the Commission showed that the only natural stands of Purple Needle Grass (*Stipa pulchra*) remaining in the county occur on this property.



The ESHAs defined here target these few remaining areas of native coastal grasslands as well as other rare vegetation. The vegetation classification was instrumental in providing scientifically substantiated definitions that withstood legal scrutiny and prevented development of this area.

Figure 5: California Coastal Commission map showing environmentally sensitive areas. The purple polygons show the location of Purple Needle Grass stands.

Example 4: Sonoma County Open Space District
One of the recent technological extensions to vegetation mapping is the ability to precisely measure aboveground carbon storage using LiDAR. In Sonoma county, high resolution LiDAR was used to calculate carbon volume in the woody vegetation of the county. The distribution of higher carbon stocks throughout the county corresponds closely with vegetation type, enabling appropriate identification and management of stands of high overall value as carbon reserves.

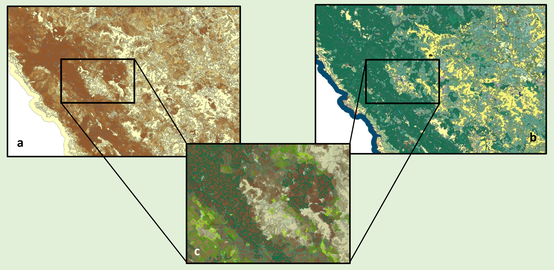


Figure 6: a) Carbon volume map of Sonoma County; the darker the color, the higher the carbon density. b) Vegetation map of Sonoma County; the dark green polygons show the location of tree vegetation stands. c) Close-up of an area of high carbon sequestration, which corresponds to stands of dense Coast Redwood.

Economic Benefits

A recent study by California State University, Northridge, entitled "A Shared Vision for the Survey of California Vegetation," analyzes social and economic benefits of standardized classification and maps. It presents a detailed benefit–cost analysis, case studies of the many current uses, and results of a survey of map users throughout the state.

The benefit–cost analysis demonstrates a return on investment from 15% to over 550% under different scenarios using current costs for classification and mapping. These only include the easily quantified tangible benefits, such as increased work productivity, reduced duplication of effort, fewer visits to potential development sites, etc. Other intangible or difficult-to-quantify benefits range from fostering communication and collaboration across regional boundaries to reducing litigation costs and helping to preserve healthy landscapes for future generations.

Lower costs resulting from efficiencies in classification and mapping will improve these returns on investment significantly. These efficiencies include the use of drones for reconnaissance and accuracy assessment in inaccessible terrain (Figure 7), and improvements in automated mapping and vegetation data analysis. The Northridge study identified a high demand for detailed, consistent and reliable vegetation data. The Department of Fish and Wildlife is seeking funds to complete the classification and first-round mapping of the state and to enable future updates.

Figure 7: Unmanned Aerial Vehicles (drones) provide high speed reconnaissance of vegetation in inaccessible terrain, greatly reducing costly and potentially dangerous human access. a). A small drone takes off from a high point over steep terrain. b) An image taken from the drone ca. 1.5 km from launch, hovering several meters above a mountain mahogany (*Cercocarpus montanus*) stand growing on an inaccessible steep slope. c) Drone flight path (orange line) and individual reconnaissance points (orange squares) with detailed supporting imagery. Information can be immediately reviewed by field crews, clarifying vegetation information quickly, accurately, and safely.