PLANT COMMUNITY MAPPING AND CLASSIFICATION AT POINT REYES NATIONAL SEASHORE AND GOLDEN GATE NATIONAL RECREATION AREA

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ABSTRACT

During the 1995 Vision Fire at Point Reyes National Seashore, the lack of a vegetation map significantly hindered fire suppression logistics and the ability of resource managers to analyze fire effects, make recommendations for post-fire rehabilitation, and mitigate fire suppression impacts. As a result, a project was initiated to develop an aerial photography-based vegetation map (at a scale of 1:24,000) for Point Reyes National Seashore, Golden Gate National Recreation Area, and adjacent state lands. Under contract with the National Park Service (NPS), air photo interpretation, digitizing, and map production were conducted by Environmental Systems Research Institute, Inc. (ESRI) and Aerial Information Systems, Inc. (AIS).

Extensive field data collection occurred simultaneously with mapping, and a vegetation classification for the area was developed from these data, based on the California Native Plant Society's classification system (Sawyer and Keeler-Wolf 1995). Based on preliminary data analysis, 55 plant communities (alliances) were identified during this effort; some of which are new additions to the California classification system. Within these alliances 57 plant associations and 95 vegetation "types" were described.

INTRODUCTION

Between October 3rd and October 7th, 1995, the Vision Fire burned 12,534 acres of private, state, and federal lands. Over 90 percent (11,598 acres) of the burned area was within Point Reyes National Seashore, an area administered by the U.S. National Park Service (NPS) that is north of San Francisco, California. In addition to burning wildlands, the fire consumed 45 homes in the town of Inverness Park. Fanned by winds up to 45 miles per hour, the fire moved quickly, burning 6,521 acres in 24 hours.

Due to the wildland/urban interface present and the associated threats to life and property, fire suppression efforts were aggressive. At the peak of suppression activities, 2,164 personnel were on site, encompassing 74 hand crews, 27 bulldozers, 7 air tankers, 7 helicopters, and 196 engines. Logistics, coordination and planning were complicated and decisions had to be made quickly. At the time of the fire, Point Reyes National Seashore did not have a vegetation map. Had a map been available, it would have been of great assistance in making the crucial decisions associated with suppression of a major fire. The map would have helped in projecting rates and direction of fire spread, in implementing logistics and planning, and in ensuring firefighter and public safety.

The natural resources of the Seashore, particularly vegetation and soils, were subject to significant adverse impacts as a result of suppression activities. These impacts primarily were associated with 23.1 miles of bulldozed fireline (13.6 miles occurred on slopes greater than 30%), 6.4 miles of handline in designated wilderness, 13 helispots, and trees felled in streams. The Department of the Interior's interagency Burned Area Emergency Rehabilitation (BAER) team arrived at the Seashore during the fire to assess the effects of the fire and fire suppression on natural and cultural resources. A vegetation map would have been invaluable to the BAER team for their impact assessment and for post-fire rehabilitation planning and implementation.

Without a map, several of the team's post-fire analyses were only partially completed or were only moderately reliable. In addition, post-fire assessments of fuels and canopy cover, and determination of priority areas for prescribed burns require current information on vegetation types and distribution, information that is easily interpreted using vegetation maps.

Upon recognition of this critical gap in the Seashore's resource inventory database, resource managers developed a proposal to acquire a digital vegetation map and vegetation classification. Although the NPS Inventory and Monitoring (I&M) Program, in close cooperation with the US Geologic Survey Biological Resources Division, is in the process of developing vegetation maps for all NPS units, the projected date for mapping Point Reyes National Seashore was unknown. The Seashore's proposal was a mechanism for accelerating the mapping. It involved financial contributions and support from NPS FIREPRO, the Golden Gate National Recreation Area, the NPS I&M Program, the California State Department of Parks and Recreation, and the Gulf of the Farallones National Marine Sanctuary, as well as Point Reyes National Seashore.

The two key components of this project involved development of the digital vegetation map, and concurrent collection and analysis of data to classify plant communities within the project area.

VEGETATION MAPPING

Vegetation mapping is being completed under an existing USGS-NPS contract with Environmental Systems Research Institute, Inc. (ESRI). A subcontractor to ESRI, Aerial Information Systems, Inc. (AIS) conducted aerial photo interpretation. The GIS-based map is being developed at a scale of 1:24,000, with a minimum mapping unit of 0.5 hectares.

The project area includes approximately 155,000 acres, encompassing Point Reyes National Seashore, Golden Gate National Recreation Area, the Presidio lands, Alcatraz Island, Angel Island State Park, Samuel P. Taylor State Park, Mount Tamalpais State Park, and Tomales Bay State Park. Interpretation of intertidal areas and kelp beds also will be possible from the products of this effort.

At the initiation of the project, the NPS provided ESRI with metric aerial photographs of the project area (in the form of natural color diapositives at a scale of 1:24,000). Preliminary photo interpretation was done prior to a field reconnaissance. Photo interpreters from the ESRI/AIS team then visited the project area to determine the signatures associated with dominant vegetation types.

Photo interpretation was done to the alliance level for all polygons delineated on the aerial photos. Whenever discernible, interpreters also assigned a vegetation association to the polygons. Polygons were delineated on overlays on the aerial photos. These overlays then were transferred and geo-referenced to overlays on digital ortho quarter quad (DOQQ) basemaps. This overlay was scan digitized and the linework was quality control reviewed and correction edited. Identification numbers were then overlaid on the polygons to facilitate linking spatial files to attribute files (QuattroPro files). Each polygon will have a unique identification number.

When photo interpretation was completed, the mapping team conducted a second field visit to resolve questions about specific problem areas identified during interpretation. These areas primarily included grassland and coyote brush scrub (*Baccharis pilularis*) vegetation types. The draft maps, digital data, and photographs were edited to reflect the field review.

In the summer of 1999, NPS personnel will conduct a field accuracy assessment of the draft map. Accuracy assessment point coordinates will be generated for all mapped alliances and associations. During the fieldwork, points will be documented using a Global Positioning System (GPS). Data collected from the accuracy assessment points will include dominant plant species and percent cover for the three vegetation layers (tree, shrub, and herb), general substrate information, slope, aspect, elevation, and general location information.

VEGETATION CLASSIFICATION

Concurrent with development of the map, NPS resource management staff collected data to develop a classification system and key for identifying the vegetation types within the project area. NPS field crews collected data from 360 plots. Data collection and development of the classification system were done in conformance with NBS/NPS standards and protocols.

Vegetation data for the classification were taken from a sample of polygons representing each of the vegetation types identified during initial aerial photo interpretation. The number of samples from each type ranged from three to seven, and was based on the distribution and abundance of the type in the mapping area (e.g., more samples were selected for vegetation types that were common and widely distributed). Sample sites were located throughout the study area and attempts were made to ensure that sample sites were relatively accessible. The objective in plot selection was to select plots that were both geographically and ecologically representative of the study area.

Field data collection methods largely followed methods for plant community classification developed by the California Native Plant Society (CNPS; Sawyer and Keeler-Wolf 1995), which are in conformance with NBS/NPS standards. Although CNPS methods use point intercept transects, for this project plant species composition and percent cover were measured using a modified relevé approach. This approach was believed to provide data that were more representative of sampled polygons than would have been provided by point intercept transects.

Specific plot locations within the polygons were subjectively selected in the field. Plots were positioned to provide the best possible representation of the vegetation within the polygon. Plots were either square or rectangular in shape. Plot size was dependent upon the configuration of the polygon and the plant community type. For herb and shrub-dominated communities, plots were $400m^2$; for forest and woodland communities, plots were $1000m^2$.

Percent cover of each plant taxon was documented as both an actual percentage and as a cover class (<1%, 1-5%, >5-15%, >15-25%, >25-50%, >50-75%, >75%). These data then were used to characterize the layering of vegetation present in the communities. The information on vegetation layers collected for this project provided more detail than is provided by using

standard CNPS methods. Ten height classes were included: moss/lichen, low herb, medium herb, low shrub, high herb/medium shrub, high shrub, low tree, low/medium tree, medium/high tree, and high tree. These data facilitated development of the classification system and will be useful in fire management (e.g., fire behavior predictions, prescribed fire planning).

Following data collection, Todd Keeler-Wolf from the California Department of Fish and Game entered the plot data into a Paradox database, and conducted Twinspan analyses to determine appropriate divisions in the classification. Preliminary analyses resulted in identification of 55 alliances. Within these alliances were 57 plant associations and 95 vegetation types represented by one or more plots. In addition to developing the classification, a key was produced to facilitate rapid identification of plant communities in the field.

CONCLUSIONS

The vegetation map and classification resulting from this project will be used as a planning tool for a wide variety of resource management tasks, from prescribed fire planning to habitat suitability analyses for wildlife. The map and data will document baseline conditions against which future change can be measured and monitored.

The value of the map and classification are significantly increased by the fact that these planning tools are regional in nature. Mapping and classification are tasks that are ideally suited to regional, or ecological approaches, rather than strictly park-specific approaches. Vegetation mapping that is approached at a regional scale facilitates a bioregional approach to land management as resources are viewed within a larger ecological context. For example, when formulating management plans for coastal prairie grassland, Point Reyes vegetation managers will have immediate knowledge of the presence and abundance of this plant community type within all areas covered by the map, both within and outside of Point Reyes National Seashore. With this information, the significance and relative rarity of Point Reyes' coastal prairie becomes more readily apparent and management efforts can be tailored to this information.

Additionally, the regional approach provided an opportunity for partnering and for involvement of multiple organizations. When the project is completed, this partnership will have provided very high quality products at reasonable costs, as the costs were borne by several different entities. If each of the parties involved in the project had attempted to produce such products on their own, the costs would have been prohibitive. The vegetation mapping effort that arose from the ashes of the Vision Fire provides an example of a successful cooperative effort between federal and state land management agencies that can serve as a prototype for future vegetation mapping endeavors.

REFERENCES

Sawyer, J. O. and T. Keeler-Wolf. 1995. A Manual of California Vegetation. California Native Plant Society. Sacramento, CA.