California Rangeland Reference Area (RRA) Inventory and Database

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The Rangeland Reference Area (RRA) Database for California is the result of increased interest in the management and conservation of native and introduced rangeland plant communities. Federal and State agencies, non-profit organizations, universities and individuals were requested to provide information on reference areas. A spatial RRA database was created using these data. The database contains location and vegetative characteristics of 193 protected or reserved range areas in California. The database allows scientists and educators to locate sites that coincide with their research interests.

The Rangeland Reference Areas were identified, mapped, assessed and classified by range cover type. The database is in an ArcView Geographic Information System (GIS) format and is available to the public.[1]

Rangeland Reference Areas

Reference areas have been valuable for understanding trends and predicting vegetative changes in plant communities. In 1927, the U.S. Forest Service (USFS) began to establish protected areas called Research Natural Areas (RNAs) to serve as sites for scientific research. These RNAs serve as preserves, and provide examples of pristine habitats or other features of interest. The Society for Range Management (SRM) found that rangeland plant communities were under represented by the Forest Service RNAs, and in 1966, suggested that a nationwide conservation network of rangeland areas, called Rangeland Reference Areas (RRAs), be established (Laycock 1975). A rangeland reference area was defined as:

> "An area set aside which illustrates or typifies virgin conditions of forest and range growth (or) other conditions that have special unique characteristics of scientific interest and importance from a range resource standpoint, to be retained primarily for the purpose of science, research and education" (Laycock 1975).

Because of the lack of areas with "virgin conditions", the Rangeland Reference Area (RRA) definition was expanded to include restored grasslands and other areas that had not been grazed in recent history, although they may have been grazed in the past.

One of the primary functions of RRAs is to provide information about the baseline biological and physical processes of rangeland communities. Through research and observations in these areas, range scientists will be able to create more accurate classifications for range conditions and understand the impacts of various management techniques.

The California RRA Database

During the 1960s and 1970s, Rangeland Reference Area (RRA) database projects were initiated in several western states including Arizona, Kansas, Oklahoma, Montana, Nebraska, Washington, Oregon, Utah, and Wyoming (Allen 1986). However, the scope and content of these early databases varied. In 1990, the SRM called for each of its 19 nationwide sections to inventory the RRAs within their boundaries, prompting the development of a RRA database for California (Muick 1991).

The California reference area database was created to maintain a general inventory of reference areas in the state. There were no limitations or restrictions on size, vegetation type or past history, provided that the history was known. Participants were asked to answer a questionnaire and evaluate sites based on the definition of a rangeland reference area noted above.

The database includes sites managed by the Bureau of Land Management (BLM), US Forest Service (USFS), The Nature Conservancy (TNC), the University of California (UC), the U.S. Fish and Wildlife Service (USFWS), and the California Academy of Sciences (CAS).

A database was developed from the returned questionnaires. For each reference area, a range of 12–46 possible site description variables were provided. Among the mandatory 12 variables are the names of the site, ownership, location, size, elevation, and the name and address of the questionnaire respondent. Other variables include the major plant species found on the site, soil type, type of animal excluded, and the date and purpose of establishment and condition of the area (Table 1).

One hundred and ninety three Rangeland Reference Areas (RRAs) are in the database. Although the total number of RRAs in California is unknown, the current database includes nearly all of the RRAs managed by the BLM, Forest Service and University of California.

[1]The database is available as an ArcView GIS file through the authors' website:
http://www.sfsu.edu/~geog/bholzman/rrafile.htm.

Table 1. Variables included in the RRA database and descriptions of their contents.

RRACODE1—16 character code which includes the managing agency,
RRA type, and site name
RRANAME—the full name of the RRA
SITENAME— the full name of the location of the RRA site
PART—describes whether the site is part of a larger entity of managed land
NEST—describe whether the site is part of a larger RRA site
HECTARE— area in hectares, (also provided in acres)
ELEVATION—the average elevation of the site
STATE—the state in which the site is located
COUNTY—the county in which the site is located
LATITUDE—location indicator
LONGITUDE— location indicator
TOWNSHIP—location indicator
RANGE—location indicator
SECTION QUARTER—location indicator
MERIDIAN — location indicator
QUADNAME—the name of the USGS topographic quad on which the site appears
CODE—describes the managing agency
RRACATEGORY—describes the RRA type: exclosure, managed range study, research natural area, or other reference area
YEAR_ESTAB—when the RRA was established or when records are available for the site
MANAGEMENT—describes past and current management
PURPOSE—why the RRA was established
VEGTYPE— describes the life form or broad community type of the RRA
N**UVEG1, NUVEG2, and NUVEG3**—SRM code of the range cover types present
VEGFORM and VEGFORM2—description of the predominant type of life forms present
TYPENAME—the names of the SRM cover types present
VEGSAMPIN—whether the vegetation within the site has been sampled
VEGSAMPOUT—whether the vegetation outside of the site has been sampled
PERMPLOTS —are there any permanent plots in the exclosure
VEGCONTACT—the name of the person who provided the vegetation information
SOILSURVEY—the soil survey which included the site
SOIL MAPUNIT—the soil map unit names
SOIL TAXON—whether the soil taxonomy at the site has been validated by a soil scientist
A**NIMALS_EX**—the type of animals excluded by the exclosure
EXCL_KIND—describes whether exclosure has a drop fence, fixed fence, or other fence type
EXCL_TYPE—described the fencing material
EXCL_DIMEN—the dimensions of the exclosure in feet
EXCL_PARTS—the number of parts or legs to the exclosure
EXCL_COND—the condition of the exclosure or fence
EXCL_MAINT—describes who is responsible for maintaining the fence
PHOTOS —are there photos available of the site
PHOTOPOINT—has a photopoint been established on the site
PHOTOSKEPT—where photos are located, if available
OWNERNAME—the agency who owns/manages site
PURPOSE2—secondary purpose for establishment
REPORTS— listing of any reports or published papers describing the RRA
CONTACT— Name, address, and phone of immediate manager for the site

Many state and national parks and defense lands could be considered RRAs, but these agencies declined to participate.

A Geographic Information System (GIS) using ARC/INFO (ESRI 1996) and ArcView (ESRI 1997) was created to map and spatially analyze the data. An ArcView (ESRI 1997) coverage was created to allow user easy access and querying capabilities. This program allows individuals to locate sites based on the variables and create maps of the queried information.

Geographic locations/ Ownership

The locations and ownership (or managing agency) of the Rangeland Reference Area (RRA) in California are shown in Figure 1. There are very few RRAs in the extreme north, west or southeast, but they are fairly well distributed throughout most of the state's interior. The greatest concentration of sites is in the eastern part of the state, with the greatest number of sites in Mono County. Kern and Inyo counties hold the second and third greatest concentration of RRAs.

The majority of sites are overseen by the BLM (70 sites), and the Forest Service (68 sites). The BLM sites are mostly located in the eastern parts of the state.

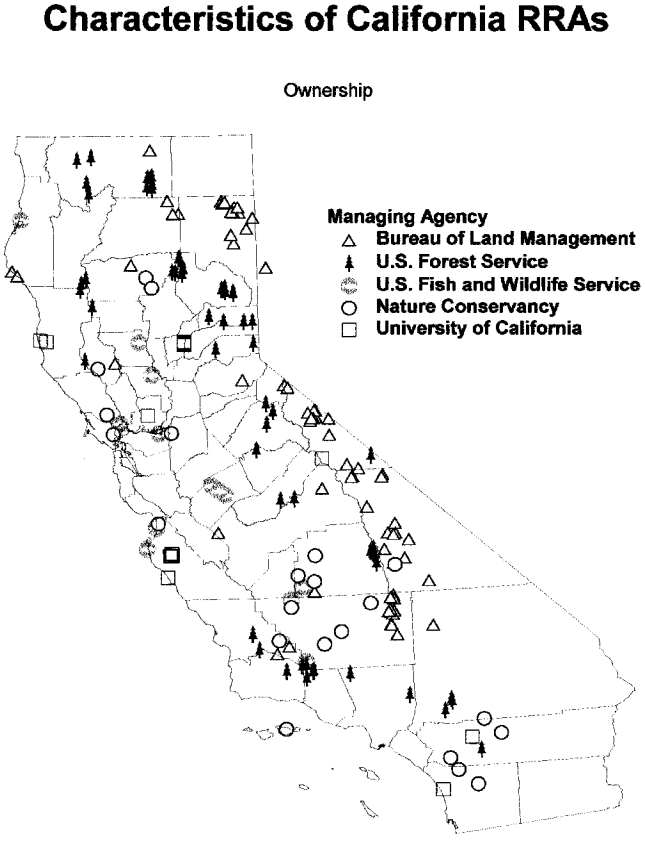

Fig. 1. ***Location and Ownership of Rangeland Reference Areas in California.***

Forest Service sites are distributed mostly in the northern and eastern areas of the state. Fish and Wildlife (13 sites) and University of California sites (20 sites) are both distributed in central and western areas, notably around the San Francisco Bay Area. The Nature Conservancy sites (22 sites) are mostly found in the central and southern areas of the Central Valley. The sites under the jurisdiction of Forest Service, BLM, and the Fish and Wildlife were all located within larger government-owned parcels. The sites owned by The Nature Conservancy and the University of California tend to be closer or adjacent to other privately owned lands.

Area

Area of Rangeland Reference Area (RRA) varied from .01 to 60,000 acres. Area data are available for 93 percent (n = 178) of the sites. The total area for all RRAs is 421,000 acres. Seventy-five percent of the sites were less than 200 ac. Forty-five percent of the sites were less than 5 ac. (Fig. 2). Spatially, the sites located in the eastern Sierra Nevada tend to be less than 50 ac. This is also true of the majority of the northern sites in Mendocino, Glenn, Butte, and Plumas counties. However, most of the sites located in the counties near San Francisco Bay are greater than 50 acres. The largest areas are owned and managed by The Nature Conservancy. The next largest areas are managed as wilderness areas by the BLM or the Forest Service. The RRAs with wetland and chaparral vegetation types have the largest means with respect to size, but they also have the largest variability. Reference Areas with meadow vegetation have the lowest average size.

The largest sites are probably the most valuable to assess the effects of no grazing on entire ecosystems. However, the smaller sites are extremely helpful for looking at small-scale rangeland dynamics.

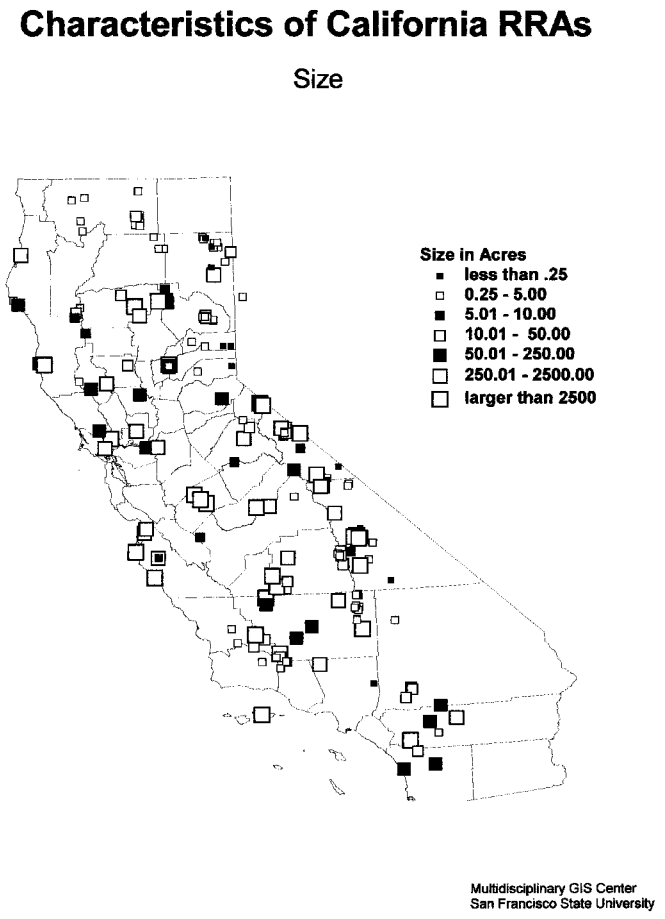

Fig. 2. ***Size distribution of Rangeland Reference Areas in California.***

Year of Establishment

Figure 3 displays the location of Rangeland Reference Area (RRA) with respect to the year of establishment. Information on year of establishment is available for 82 percent (n = 159) of the sites. Over 40 percent of sites were established during 1980–1989, while only 16 percent of the RRAs were established prior to 1970. The oldest RRA within the database was established in the early 1900s within the Mendocino National Forest; it consists of 2 ac. within a meadow. Twenty additional acres within the Mendocino National Forest have excluded domestic livestock grazing since 1910. Three other reference sites were established in the 1930s within oak woodlands of the state. In general, the western side of the state has a slightly higher concentration of older sites. Grassland and hardwood RRAs have the oldest average age while desert and chaparral sites have the most recent average establishment date.

We believe that although all reference sites should be maintained, it is critically important to maintain the oldest sites to observe and provide data on long-term vegetative dynamics in rangeland communities.

Additional Information:

Elevation was provided for 83 percent (n = 160) of the sites and varied from sea level to 10,000 ft. The majority of sites (66.3%) are located at low elevations (sea level to 2,000 ft., n = 42) and mid elevations (2,001–4,000ft n = 23) (4,000–6,000 ft., n = 63). Eighteen sites are at 6,000–8,000 ft. and 14 are located at elevations above 8,000 ft.

Rangeland Reference Area (RRA) were established for protection or restoration of riparian habitat, protection of endangered or threatened plant or animal species, rangeland research on forage productivity or plant dynamics, refuge for wildlife, as well as specifically to act as a reference area. In most reference areas domestic livestock are excluded. Some areas provide protection from all grazers including above ground and below

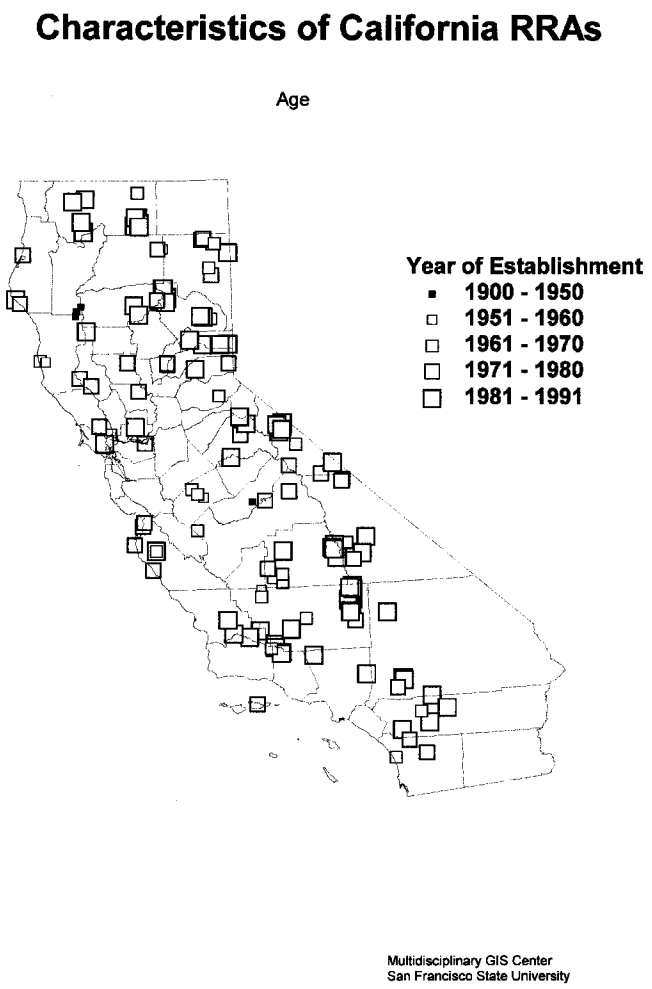

Fig. 3. ***Age distribution of Rangeland Reference Areas in California.***

ground rodents. The database lists the animals excluded from the sites.

The database provides additional information about the rangeland reference areas such as directions to the site, current management, exclosure type, soil type, reports and studies regarding the site, and photographs or permanent plots taken on the site as well as the contact person for each site.

SRM Rangeland Cover Types

The database used Shiflet (1994) rangeland cover type classification to determine the representiveness of the Rangeland Reference Area (RRA) with regard to cover type. In the Shiflet classification, California falls into two of the ten geographic regions, the Pacific Southwest, which contains 23 range cover types, and the Desert or Great Basin Region, with 13 range cover types.

Using the SRM Range Cover Type Manual (Shiflet 1994) and the data provided in the questionnaires, cover types were manually assigned to each RRA. When no suitable SRM Range Cover Type was available for a site, it was classified as an unknown.

The areas associated with each SRM Range Cover Type are displayed in Table 2. The "Riparian Woodland" cover type was found to occur on the largest percentage of RRAs. "Low Sagebrush" and "Other Sagebrush" occurred on the smallest percentage of RRA area. Several of the cover types with the largest areas only occur on a few large sites. For example, "Chamise Chaparral" occurs on 16 percent of the total RRA area, but it is only found on five sites. "Salt Desert Scrub" accounts for 10 percent of the total RRA area, but it is found on three sites.

Interestingly, the cover type that occurs on the most number of sites represents one of the smallest areas. Although 37 sites include "Montane Meadow" vegetation, the total area of this type is only 897 acres. This dichotomy is true for the "Basin Bigbrush" and "Mountain Big Sagebrush" types. Although 24 sites contain one of these sagebrush types, they represent less than one percent of the total RRA area.

The cover types that are least represented with respect to both frequency and area include: "Ceanothus Mixed Chaparral", "Coastal Prairie", "Curlleaf Mountain Mahogany", and "Basin Riparian". All of these cover types occur on fewer than five sites and each comprise less than one percent of the total RRA area.

Table 2. SRM Range Cover Types listed and coded (Shiflet 1994) with reference to size and percentage of total RRA Area.

Rangeland Cover Type	SRM Code	Area	Percent of Total Area	Number of RRAs
		(acres)	(%)	
Blue Oak Woodland	201	49304	11.65	9
Coast Live Oak Woodland	202	5582	1.32	6
Riparian Woodland	203	60894	14.46	11
Coastal Sage Scrub	205	3854	.091	4
Chamise Chaparral	206	60047	14.26	4
Scrub Oak Mixed Chap.	207	263	0.06	2
Ceanothus Mixed Chap.	208	388	0.09	1
Montane Shrubland	209	21559	5.12	7
Bitterbrush	210	7681	1.82	3
Creosote Bush Shrubland	211	50344	11.95	15
Blackbrush	212	5760	1.37	2
Coastal Prairie	214	1135	0.27	4
Valley Grassland	215	55026	13.06	15
Montane Meadow	216	897	0.21	37
Wetlands	217	27842	6.61	4
Other-Unknown	218	5288	1.25	10
Basin Bigbrush	401	1022	0.24	15
Mountain Big Sagebrush	402	1000	0.24	9
Low Sagebrush	406	0.02	<.01	2
Other Sagebrush Types	408	0.77	<.01	2
Juniper-Pinyon Woodlands	412	10560	2.50	2
Salt Desert Scrub	414	38401	9.12	4
Curlleaf Mtn Mahogany	415	14080	3.34	2
Joshua Tree Woodland		12.50	<.01	7
Basin Riparian		80	0.02	1

Most cover types were represented in the database. Surprisingly, several of the vegetation types that are not common throughout the state comprise a significant amount of RRA area. Riparian, wetland, and meadow areas all have very low overall totals in the state, but they are all fairly well represented on RRAs (California Department of Forestry and Fire Protection 1988). This is fortunate because these are crucially important habitats for native plants and wildlife, and are highly susceptible to disturbance. Although they may not represent a significant amount of RRA area, there are examples of almost every cover type that exists in California. There are examples of every range cover types of the Pacific Southwest Region, and all but five of the Great Basin cover types found in California are represented. The Great Basin cover types that are not represented are not common in the Great Basin Region of California, as it is the westernmost edge of their range. Thus, the results of the range cover type analysis suggest that the sites contained in the RRA database are well representative of the Pacific Southwest Region and to a lesser extent, the Great Basin Region Cover Types.

Conclusion

The majority of California's Rangeland Reference Area (RRA) are less than 50 acres in size, located in low to mid elevations, and have been established in the last fifteen years. The reference areas are primarily located in the southeastern and northeastern parts and are managed by the BLM and USFS. Sites are lacking in the central and north central parts of the state. As these are productive agricultural lands, it appears little land is left as preserved or restored wildlands. When new sites are considered, attention to possible sites in these areas is recommended. There are also very few sites in the northwest and extreme southeastern counties in the state. The northern counties contained predominantly forests, although many meadows do exist that may serve as rangeland reference areas. The southeast is primarily desert and RRAs in these areas would also be useful in understanding vegetative responses in such xeric conditions.

The reliability of some of the reference areas' attributes is variable. Until it is used for its intended purpose, the significance of the RRA characteristics that have been described cannot be assessed. Users of this database are invited to notify the authors of any incorrect or additional RRA data.

The Rangeland Reference Area (RRA) are critical to ongoing rangeland research in California. Understanding an ecosystem's response to grazing and recovery from disturbance are important tools for future resource management. The areas provide researchers and managers with a network of sites of varied age, size and community types to use as baselines as well as sites for future inquiry.

There has been no comprehensive database that includes all known California RRA locations, and for many years only those individuals involved in the individual sites have known this information. Because of these individuals' and their agency's participation, and the assistance and funding provided by the US Forest Service, Pacific Southwest Station and California Department of Forestry and Fire Protection, and San Francisco State University, these data are now available to all interested parties.

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