RANGELAND INVENTORY

INTRODUCTION

This chapter provides basic information necessary to conduct rangeland inventory. It is designed to provide instruction for field survey and sampling of grazing allotments. Rangeland inventory involves identification of plant species and their relative composition, determination of relative rangeland health, preparation of an allotment analysis map, and summarization of data for range planning decisions. In order to conduct a reliable inventory, ***good plant identification skills are mandatory***.

Two situations will be encountered in the Pacific Southwest Region:

- inventory *with* a formal ecological type classification, and
- inventory *without* a formal ecological type classification.

The inventory procedures utilized depend on whether or not a classification is available. Most rangeland ecosystems within the Region are not formally classified.

WITH A CLASSIFICATION

An ecological type classification defines and describes vegetation community types. They may be based on existing vegetation or the potential natural community. Each description includes information on biotic (vegetation composition, abundance, and productivity) and abiotic (climate, landform, and soil) characteristics. Community response to management activities can be estimated once biotic and abiotic variables are understood. Rangeland inventory and analysis aided by a set of classification tools can facilitate desired plant community determination by first, clarifying the range of viable possibilities and second, quantifying and qualifying the community type properties. Ecological status can be determined by comparing the existing plant community to potential natural community.

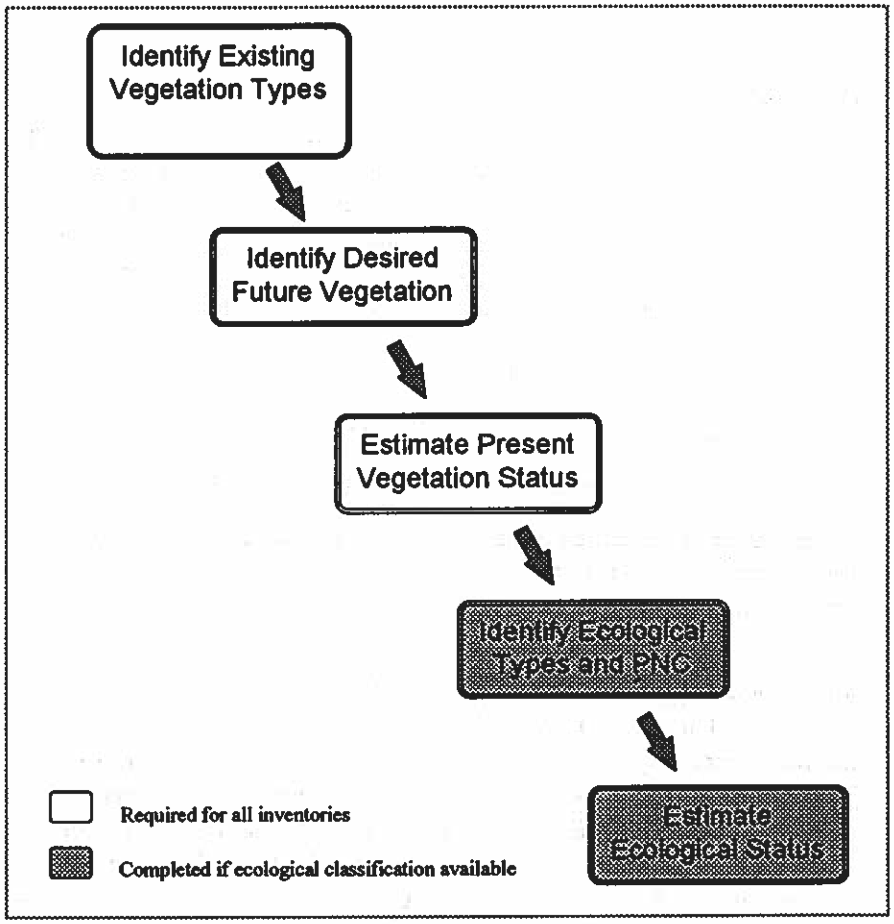
WITHOUT A CLASSIFICATION

Potential natural communities (PNC) have not been defined for most rangeland vegetation in the Pacific Southwest Region Consequently, the rangeland inventory and analysis process must concentrate on existing vegetation. Specifically, the process will compare existing plant communities to a desired plant community. The desired community may be defined by comparison with a healthy, unimpacted site with similar environmental characteristics — the optimal scenario, or it may be a composite developed by the interdisciplinary team of key characteristics which if achieved will establish a trend towards a desired state. The degree of similarity between existing and desired plant communities approximates present vegetation status (page 3-13).

Rangeland Inventory Requirements

The inventory process portrayed in Figure 3-1 is discussed in detail throughout this chapter.

Figure 3-1. RANGELAND INVENTORY PROCESS



PRIORITIES AND INTENSITY

Rangeland analysis is the systematic collection and evaluation of rangeland resource data. The Forest Supervisor shall establish analysis priorities, analysis intensities, and the area to be analyzed.

Priorities for Analysis

1. Allotments not meeting Forest Plan standards and guidelines.
2. Allotments with threatened, endangered, or sensitive plant or animal habitat that are impacted by livestock grazing.
3. Allotments with sensitive riparian areas.
4. Allotments with other resource conflicts such as recreation.

INTENSITY OF ANALYSIS

Minimum requirements for accomplishing the inventory phase of the rangeland analysis process can be found in Forest Service directives.[1]

Factors to be considered in determining sampling intensity are: complexity or sensitivity of known or anticipated resource use conflicts or controversy, diversity of vegetation types, ecological status, trend, and the desired level of precision. Sampling intensity is dependent on the kind, quality, and quantity of data needed. In determining the sampling intensity, the examiner should weigh the desired level of inventory against funding and personnel capabilities. Professional judgment plays a major role in making these determinations. Table 3-1 provides guidelines for determining the appropriate level of inventory intensity.

Table 3-1. GUIDELINES FOR ANALYSIS INTENSITIES

INTENSITY	BASE LEVEL	MID LEVEL	HIGH LEVEL
WORKING RELATIONSHIP	Cooperative	Cooperative or potential for conflict	Non-cooperative
PRESENT VEGETATION STATUS	Meets management objectives for desired future vegetation	Some areas do not meet management objectives for desired future vegetation	Does not meet management objectives for desired future vegetation
GRAZING MANAGEMENT	Minor or no changes are needed	Moderate changes in grazing system or improvements are required	Major changes in stocking levels and/or management strategies needed
OTHER RESOURCE ISSUES OR CONFLICTS	No significant issues or resource conflicts exist	Potential issues have been identified and minor conflicts expected to develop	Major issues are identified; conflict resolution necessary
ALLOTMENT MANAGEMENT PLANNING	Need rewritten, easy AMP design and straight forward EA	Moderate changes in AMP are required, with an EA	Major changes with EA or EIS
PERSONNEL REQUIRED	Team Leader plus a few technical consultants	Team Leader plus a small interdisciplinary team	Full interdisciplinary team including specialists
PROCEDURES	• Prepare allotment boundary map showing: pastures, improvements, and existing vegetation types • Field reconnaissance of rangeland conditions in key upland sites, and Proper Functioning Condition (BLM-PFC) in key riparian sites • Establish extensive monitoring	Base level, plus: • Validate capable rangelands as determined in Forest Plan • Inventory existing vegetation type polygons with cover-frequency and/or line intercept transects, supplemented with ocular plant composition plots • Select desired plant communities • Establish extensive monitoring for satisfactory sites and intensive monitoring on unsatisfactory sites	Mid level, plus: • Install rooted nested frequency transects along with cover- frequency transects to monitor trend • Consider production-utilization studies (minimum of 3 years)

[1] FSM 2212.11; also refer to FSM 2060 and FSH 2090.14

AREA INCLUDED

Rangelands to be analyzed include:

- Rangelands within the allotment that are grazed by permitted livestock, including non-Forest Service lands if those lands are used as basis for private land permits. The analysis for private lands should be guided by the following:
    - Be mindful that it is private land and we need to be sensitive to the landowner's rights.
    - The landowner should be consulted regarding the analysis concerning their property.
    - Forest Service authority to manage the livestock use on the private land (through the grazing permit) should be exercised only during the time the livestock are on the allotment.
    - Any private land resource information needed for the analysis should be obtained from the landowner or extrapolated from known information on adjacent national forest system lands. If you fail to get land-owner cooperation adequately enough to complete the analysis, then you should consider changing the private land grazing permit to a Term Grazing Permit with an On-Off Provision or not issue a grazing permit at all. Be mindful of not expending federal dollars on private land through survey or data collection efforts. This may be a violation of our appropriation laws and could require a Collection Agreement with the landowner.
- Public and private rangelands within or adjacent to allotments where the Forest Service is cooperating with other Federal agencies, state agencies, or private landowners in the development of coordinated allotment management plans.

OFFICE PREPARATION

Office preparation includes gathering available information contained in the 2210 and 2230 folders. Much of the preliminary aerial photo interpretation can be done in the office and verified during field work. Sources of information include:

- Forest Land and Resource Management Plan, especially the inventory and data base, and the maps prepared for the Plan.
- Integrated Resource Inventory (IRI) photo-interpretation and field verification maps and data base, if available.
- Old range maps and records.
- Old allotment management plans.

- Timber survey, range site (NRCS), soil inventory, and soil-vegetation maps, such as Multiple-Use and Area Guides.
- Annual range inspections, and range readiness, utilization, and actual use reports.
- Personal observations by permittees, State wildlife agency personnel, public groups maintaining data bases on ecology, and Forest users. Grazing permittees can provide information on locations of existing and needed range improvements, capable range, problem areas, and livestock distribution and use habits.
- Aerial photographs (recent and past).
- Photographs and camera point records.
- Wildlife use, census, and habitat analysis records.
- Fish and Game Department reports and studies.
- Land adjustments and status records.
- County records for land ownership.

ALLOTMENT FAMILIARIZATION

It is imperative field examiners be intimately familiar with the allotment regardless of the inventory intensity level used. There is absolutely no substitute for personally conducting the following:

- Review allotment folders and files concerning the allotment. These records provide insight into grazing use history and various problems and opportunities on the allotment. Discuss the allotment with the permittee(s) and other interested parties in order to determine past and present use, patterns of livestock use and movement, problem areas, and potential range improvements.
- Become knowledgeable concerning the presence of threatened, endangered, and sensitive species and their habitats within the allotment. The Forest wildlife biologist or botanist can assist with this.
- Locate and describe desired future vegetation (DFV) and/or potential natural communities (PNC). Data from these areas are required for similarity analysis, to develop ecological type classifications, and to prepare ecological guides. Search the allotment for undisturbed or relatively undisturbed occurrences of DFV or PNC. However, when comparing undisturbed sites with other portions of the allotment, *care must be taken to ensure they are ecologically similar.*

- Observe the use patterns of livestock and wildlife. Utilization studies are helpful aids.
- Identify key areas for wildlife species of interest on the aerial photos or GIS base maps, by coordinating closely with wildlife biologists and local state wildlife officials.
- Determine if the Ecological Unit Inventory map or soil resource inventory is complete for the allotment. If available, use them to the fullest possible extent. If they are not available and cannot be scheduled in a timely fashion, the project leader must arrange for the collection of soil information with the help and advice of a soil scientist. In addition, soil parent material observations should be made along with general observations on watershed damage, gully systems, and sheet erosion.
- Observe and record all water locations on aerial photos or GIS base maps. Water availability and location are major factors influencing livestock and wildlife distribution. It also has a bearing on range capability and influences range management planning. In areas where water is in short supply or is poorly distributed, there may be a greater potential for conflict between various uses.
- Become familiar with allotment boundaries and accurately locate them on aerial photos with a stereoscope, or on the base map. They should be ground-truthed to be certain they conform with the approved written boundary description or map.
- Basic plant ecology knowledge is essential to determine resource values, and to establish management goals. Minimally, one team member must be familiar with vegetation of the area and be able to identify all the plant species. PNC can best be determined from ecological guides and through examination of protected areas that have not been grazed by livestock.

FIELD DATA COLLECTION

Field data collection is perhaps the most essential, but time consuming aspect of rangeland analysis. Data collected in the field is the basis for allotment management decisions as described in the Planning Chapter. Field data should be recorded on appropriate forms and noted on the field map or aerial photo. Field sampling will provide information on: range improvements, existing vegetation, desired plant communities, capability, and production.

To facilitate coordination with adjacent landowners and other agencies, the Pacific Southwest Region has adopted the procedures described in the Interagency Technical Reference "Sampling Vegetation Attributes" BLM/RS/ST-96/002+1730. This interagency guide was developed to provide a basis for consistent, uniform vegetation sampling that is economical, repeatable, statistically reliable, and technically adequate. The interagency technical team that developed the guide included representatives from the Forest Service, Bueau of Land Management, Natural Resource Conservation Service, and Cooperative Extension Service.

Range Improvements

Existing range improvements within the area or allotment should be inspected and accurately located on aerial photos or appropriate field maps. Condition of the improvements should be noted, as well as future reconstruction needs.

Existing Plant Communities

Existing vegetation should be mapped and described using a classification system appropriate to the scale and the issues in question. For example, for forest wide landscape level assessments, or general allotment level assessments, existing vegetation as described by CalVeg or Wildlife Habitat Relationship (WHR) mapping vegetation units may be sufficient. For areas on the allotment where there are specific resource concerns or where key areas have been established, use the finer-grained plant community level classification provided in *A Manual of California Vegetation* (Sawyer, Keeler-Wolf 1995) to classify existing vegetation. The regional ecology program is developing classifications based on potential natural vegetation. As these become available for rangeland vegetation types, incorporate this information into descriptors for allotment vegetation.

Field work adjusts and corrects existing vegetation types based on what is actually found on-the-ground. Minimum unit size is not fixed. Small units may be extremely important if they produce large amounts of forage or provide important resource values. Unit size ultimately depends on the amount of information needed by the line officer to make an informed decision.

Perhaps the most important field inventory task is to describe specific plant communities within the vegetation type. Any method described in this chapter can be used to describe vegetation characteristics. Soil descriptions are an important part of understanding the analysis area, and evaluating and managing the resources. Use the appropriate inventory intensity indicated in Table 3-1. Temporary or permanent plots can be used, although permanent plots have far greater utility for wider application. Locate plots within representative key areas throughout the entire unit, as required. Accurately document plot locations on the field map or aerial photo.

Desired Future Vegetation

Desired Future Vegetation (DFV) selection is crucial to effective rangeland planning. The DFV has composition, structure, and function characteristics that best represent the desired condition specified in the Forest Plan. DFV is part of the overall desired condition and must be integrated with other features, for example, soil, wildlife cover, and visual characteristics. Identifying DFV is a collaborative process involving an interdisciplinary team. The team should document the reasoning behind the selection of desired plant communities. Forest Plans identify management areas with particular resource emphases.

Often existing plant communities comply with Forest Plan direction, providing a broad range of resource benefits. In these situations, allotment management objectives should maintain existing conditions.

In other cases, a different plant community may be more appropriate and better comply with the Forest Plan. The DFV should provide a broad range of values for all resources, but should be selected primarily for the management emphasis in the Forest Plan. Desired plant communities must currently exist in the general area in similar environmental settings, and are capable of occupying the site within a reasonable time period, through a management change.

It is not necessary to select the ultimate DFV that satisfies all Forest Plan and allotment objectives immediately. It is reasonable to identify a DFV that establishes the correct trend over the short-term, and then adjust the DFV later as the vegetation responds to the management change.[2] Effective documentation and communication of desired condition, desired plant community, allotment objectives, and their relationships will prevent confusion regarding short- and long-term objectives.

Many communities are difficult to change through normal management practices. For example, many bluegrass dominated sites exist due to loss of watertable. It is often extremely difficult to convert them to a native meadow community. Likewise, converting California annual grasslands back to perennial needlegrass communities is not readily done. Neither situation can be corrected by simply changing the grazing management strategy. Objectives that convert the existing plant community to another community must be reasonable.

The inventory crew, or at least the crew leader, must be familiar with Forest Plan management areas. The inventory crew will describe vegetation and soil characteristics of the existing conditions. The IDT will determine whether the existing vegetation is the DFV for each vegetation map unit. Relict areas, research natural areas, and old exclosures or pastures may furnish valuable information.

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[2] In a few situations, DFV or a community displaying short-term objectives may not exist in the local area. Use of composite set of biotic and abiotic characteristics to define and describe allotment management objectives is encouraged.

RANGELAND CAPABILITY

Rangeland inventory identifies rangelands capable of supporting livestock grazing.

Determining **CAPABILITY** and **SUITABILITY** of an area to produce resources including livestock grazing, is required by law and regulation. Capability and suitability for livestock use is determined at the two Forest Service planning levels (i.e. Forest Plans and project, Allotment Management Plans (AMPs).

Forest Service regulations 36 CR 219.3, Definitions and terminology, includes the following definitions:

"**Capability**: The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture, or protection from fire, insects, and disease."

> For livestock grazing, capability considerations might include pounds of forage produced annually per acre, distance from water and soil erodibility.

"**Suitability**: The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and alternative uses foregone. A unit of land may be suitable for a variety of individual or combined management practices."

> Suitability of a management practice needs to consider both timing and intensity, as well as the issues involved. The Forest Plan should specify areas generally unsuited for livestock grazing such as fenced campgrounds, adminstrative sites, some designated management areas or parts thereof (Research Natural Areas, Experimental Forests), critical habitat for specific T&E species. Project analysis will determine suitability for use for specific areas. Early season grazing may be a suitable practice on bitterbrush and some riparian areas, but not suitable for occupied willow flycatcher habitat. Some meadows may be suitable for grazing at a 20-30% use level, while a 50-60% use level might not be suitable to retaining adequate residual vegetation needed to meet management objectives for recovery of a depleted meadow.

The 1900-Planning portion of Forest Service Manual includes the definitions established by regulations for Capability and Suitability, and adds a definition for Lands Suitable for Grazing or Browsing.

"Lands Suitable for Grazing or Browsing. Lands with vegetation that can be used by grazing animals, both domestic and wild herbivores, without damage to the soil and water resource values."

This definition includes lands capable of producing adequate usable forage and suitable for use while protecting soil and water resources. These are the land areas that are basically available to be considered for some type of domestic livestock use. It does not include lands that are closed to grazing for various reasons such as administrative sites, T&E habitat, fenced campgrounds, fens and bogs, and other sites.

Process for determing capability and suitability of lands for livestock use.

1. Determine lands Capable and Non-capable for livestock grazing based on, ability to grow palatable forage, accessibility, soil impacts, and distance from water.
2. Determine which Capable lands are Lands Suitable for Grazing or Browsing. These are the capable lands that are not allocated to uses that preclude grazing such as administrative sites, recreation sites and some research natural areas.
3. Determine for the Lands Suitable for Grazing or Browsing the specific management practices, standards and guidelines, including timing and intensity of use, that can be applied. The Forest Plan identifies the available choice of management practices that can be made in various areas of the Forest. The selection of a specific management practice to be applied is made at the project level following site specific analysis.

CLASSIFICATION OF RANGELAND CAPABILITY

Rangeland **Capable** of livestock productivity is accessible to livestock, produces forage or has inherent forage-producing capabilities, and can be grazed on a sustained basis under reasonable management practices. Accessible areas that produce forage as a result of timber management practices, fire, or other events may be classified as capable range. Such areas are often called transitory range even though forage may be produced ten or more years before natural or man-caused changes terminate it. Many prescribed burns, especially in tall shrub or timber types, create transitory range.

Rangeland meeting the above criteria, but not available for grazing because of land management decisions, is still classified as capable range. Such areas may be closed to grazing and the reason for closure indicated. Capability maps often identify improved utilization opportunities. Capable rangeland should be identified and mapped based on:

- patterns of use by livestock under the existing management and range improvements, and
- expected changes in patterns of use resulting from specified changes in management and improvements.

Rangeland considered **Non Capable** includes areas where livestock grazing should not be planned because of unstable soil, steep topography, lack of management improvements, or inherently low potential for production. Some primary considerations are:

- Physical characteristics of the terrain such as steepness and length of slope and natural barriers.
- Soil and vegetation characteristics that may be classified as non capable (as determined by Forest Plan capability criteria) because of limitations such as:
    - Loose granitic soil on steep slopes.
    - Highly erosive soil from shale and mudstone.
    - Vegetative cover insufficient to protect the soil from erosion, where restoration would not be possible or practical under continued grazing use. Soil protection is not the sole criteria for determining capability. Rangelands may be in a depleted condition due to past use. They may provide little forage currently, but should be classified as capable if they meet all other criteria.
    - Boggy areas that prevent livestock use.
- Areas that are otherwise capable except for the lack of appropriate range improvements, such as water developments, fences, or vegetation manipulation.

Standards And Guides For Capability Classification

Written capability criteria must be prepared by an IDT in advance and approved by the appropriate line officer. Upon completion of field inventory, the approved capability criteria should be retained with the analysis data as a permanent record. Capability criteria shall be consistent with a site specific refinement of Forest Plan criteria. The following elements should be considered in developing capability criteria.

Site productivity should be evaluated in pounds of herbage and browse produced annually per acre. The minimum acceptable productivity is the level below which it would not be feasible or practicable to graze livestock. Lands that are not capable of producing at least 100 pounds total dry weight of forage per acre per year are usually classified as non capable and require no further consideration.

Soil stability is the inherent ability of soil to resist erosion. It depends on several factors, principally climate, erodibility, topography, and cover.

These factors are used to evaluate erosion potential or erosion hazard. The following factors affecting soil stability may be considered in developing capability guides.

- Erodibility is the inherent tendency of soil to erode without consideration of climate, topography, or cover. It is based on:
  - the strength and size of the surface soil aggregates, and
  - profile characteristics, such as texture, depth to restrictive layer, and coarse rock fragments that affect infiltration, percolation, and storage of water.
- Slope gradient, length, roughness, shape, and aspect affect erosion hazard. Long slopes build up greater heads of water than short ones. Steep slopes are more subject to erosion by overland flow than are gentle slopes, because erosion capability increases as the rate of flow increases.
- Cover consists of vegetation, litter, and rock fragments. The amount, kind, and dispersion of cover determines its efficiency in protecting the soil from accelerated erosion.

Physical barriers include steep slopes, cliffs, brush, trees, down woody debris, rock, and other obstructions that restrict free movement of livestock. Range classified as non capable because of barriers should be reclassified if the obstructions no longer exist.

Management prescribes livestock kind and the management system, which may affect capability. A change from band herding to herderless fenced pasture sheep management may result in safe use of areas previously identified as non capable because of soil damage risks. Intensified management may result in the need to redefine capability criteria.

Interrelationships between factors such as soil stability, erosion, accessibility, slope, and distance to water determine capability. For instance, one mile to water on flat ground could be capable range, but one mile to water on a 40 percent slope might be non capable range.

APPLICATION OF INVENTORY DATA

The following is a discussion of some applications of inventory data. Other applications may arise in the future.

Evaluation of Status

There are two separate but related approaches in which inventory data can be used to evaluate status. First, is the evaluation of present vegetation status based on the desired future vegetation. Second, is the determination of ecological status based on the potential natural community (Table 3.2).

The desired future vegetation is determined as part of an ID team process, and be the potential natural community on a seral stage.

Present vegetation status is the difference between the existing vegetation and the desired future vegetation

The evaluation of present vegetation status provides the rangeland manager with a 'yardstick' for evaluating the similarity of existing vegetation to a desired plant community. Similarity is an evaluation tool that can be applicable in the absence of an ecological classification.

Ecological status is the degree of similarity between the existing plant community and the potential natural community. Ecological status cannot be accurately determined unless an ecological type classification exists and the potential natural community is known. Determination of ecological status is based on specifics of the ecological classification.

In order to keep these approaches distinct, it is important to clearly understand ecological classification concepts. Specifically, knowing and understanding qualitative and quantitative differences between existing and potential natural communities, the nomenclature used to discuss them, and their application, is essential..

Figure 3-2 illustrates a hypothetical ecological type, with each circle representing a seral plant community that may occur in that type. Dashed lines represent successional relationships. For instance, there is a direct successional relationship between PC6 and PC5. But there is no direct relationship between PC6 and PC3. Changes between two communities, consistent with the arrows, occur because of the presence or absence of disturbance. In addition, the rate of change is influenced by periodicity, intensity, and duration of disturbance events. Events may be natural, or the influence of management activities.

In this illustration, existing vegetative condition is represented by PC4 and the desired future vegetation is represented by PC3. Both communities are seral to the potential natural community, PC1.

Vegetation status is shown by the solid lines connecting communities in Figure 3-2. Present vegetation status is obtained by determining the similarity of existing vegetation found in plant community PC4 to the desired future vegetation found in plant community PC3. Ecological status is obtained by determining the similarity of existing vegetation found in plant community PC4 to the potential natural community PC1.

Figure 3-2. RELATIONSHIP OF ECOLOGICAL STATUS AND PRESENT VEGETATION STATUS

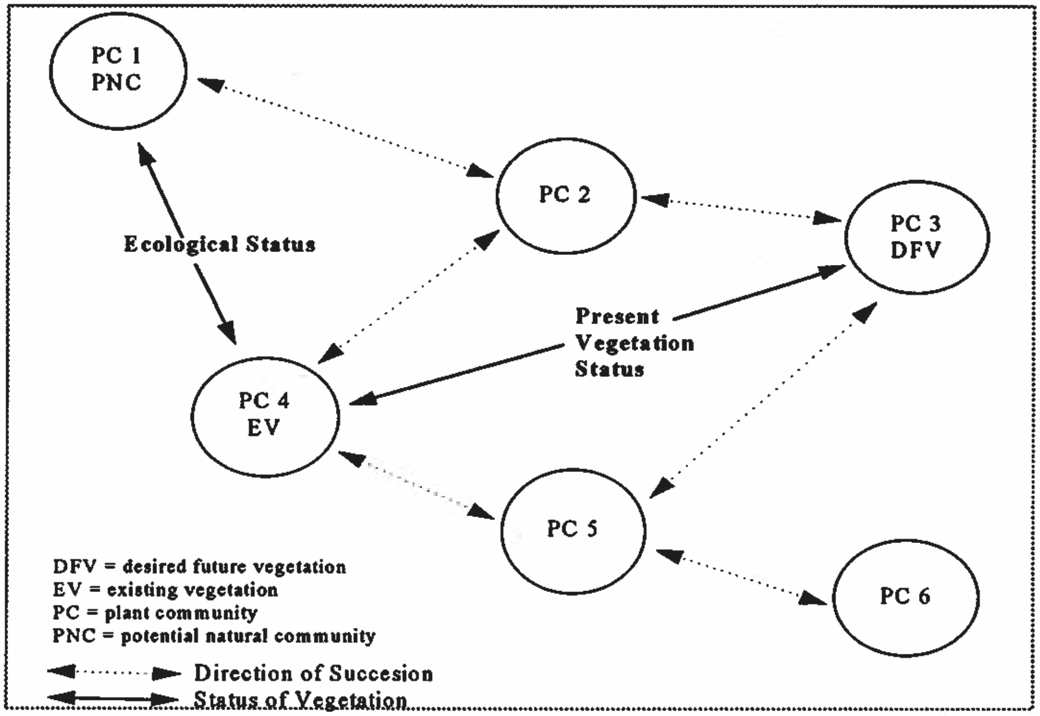

Figure 3-2. DEFINITION OF STATUS IN RANGELAND ANALYSIS AND MANAGEMENT CONTEXT

Status	Definition
Present Vegetation Status	Determination of the relative similarity between existing vegetation and the desired future vegetation (DFV). The relative degree to which kinds, proportions, and amounts of vegetation in the present plant community resemble the desired plant community chosen for an ecological site.
Ecological Status	Determination of the relative similarity between existing vegetation and the potential natural community (PNC). The degree of similarity between the existing vegetation (all components and their characteristics) and existing soil conditions compared to the potential natural community and the desired soil condition on a site.
Rangeland Management Status	Determination of the relative success of rangeland management rhrough desired condition status and trend. A rangeland is considered to be in satisfactory condition when the existing vegetation community is *similar* to the desired condition or short-term objectives are being achieved to move the rangeland toward the desired condition (trend). Unsatisfactory condition is when the existing vegetation community is *not similar* to the desired condition or short-term objectives are not being achieved to move the rangeland toward the desired condition (trend).

SIMILARITY COEFFICIENTS

Characteristics such as species composition and abundance, and ground cover are considered in the evaluation. Using nomenclature from Figure 3-2, the following relationships exist.

Present Vegetation Status ≅ f (EV, DFV)

Ecological Status ≅ f (EV, PNC)

Without an ecological classification it is difficult to determine a general or acceptable level of similarity for all types of communities. The inherent variability of natural communities can lead to difficulty in achieving high similarity values.

COVER-FREQUENCY INDEX

Similarity coefficients are computed on the worksheet provided (page 3-19 - 3-22). The coefficients are a function of canopy cover and frequency. The result is the canopy cover-frequency index (CFI), similar to the index developed by Uresk (1990).

Average Canopy Cover × % Frequency = CFI

Using the index is inherently stronger than using either canopy cover or frequency by itself.

COMPUTING SIMILARITY COEFFICIENTS

Any inventory method (page 3-33) can be used to collect the data. Ocular plant composition and cover-frequency data are most often available. Use averaged canopy cover and frequency values from one or more cover-frequency transects. Use relative canopy cover, and constancy[3] from one or more ocular plant composition plots. The coefficient of community similarity is determined by using the following formula.

$$\frac{2w}{a+b}$$

where:

a is the sum of values for measured parameters of existing vegetation,

b is the sum of values for measured parameters in the desired plant community (desire condition status) or the potential natural community (ecological status), and

[3] Relative canopy cover is the sum of all cover values for a species from two or more ocular plant composition plots divided by the number of plots in which the species occurred. The following table illustrates. Constancy can be used as a surrogate for frequency.

	Plot 1	Plot 2	Plot 3	Relative Canopy Cover	Constancy	CFI
FETH	10	2		6%	67%	402
POPR	2	10	15	9%	100%	900
TAOF		5		5%	33%	165

w is the sum of the values for the measured parameters that are common to both.

The values summed for "*w*" are obtained by comparing the existing and desired values (or measures). The amount similar is the lesser of those two values for each species. "*w*" then is the sum of the similar portion for all species.

INTERPRETING SIMILARITY COEFFICIENTS FOR PRESENT VEGETATION STATUS

As with any model developed for natural resource application, similarity coefficients do not provide black and white conclusions. Similarity coefficients do provide one evaluation of the similarity between two plant communities. This point cannot be over-emphasized. The allotment management plan resulting from rangeland analysis will be the composite product of many different pieces of information.

Therefore, the similarity coefficient is merely one guide or tool, by which the similarity of two plant communities can be evaluated.

Professional judgment and common sense are needed to interpret similarity data.

It is the responsibility of the rangeland manager to interpret similarity coefficient results and to thoroughly document whether the similarity evaluation is accurate or not. ***Application of similarity coefficients is inherently risky without a good understanding of the vegetation community relationships and ecological significance of specific plant species.*** Identifying and describing these components is one objective of ecological type classifications.

PRESENT VEGETATION STATUS

The following guidelines for determining present vegetation status, and application to management objectives is taken from the Ecological Classification and Inventory Handbook FSH 2090.11, sections 4.42 - 4.45.

Base the present vegetation status on floristic similarity to the desired future vegetation on a scale of 0-100, where 100 represents the desired future vegetation. Express adjective ratings in four equal classes:

1. Low similarity (0-25).
2. Moderate similarity (26-50).
3. High similarity (51-75), and
4. Desired future condition (76-100), or other appropriate classes.

PRESENT VEGETATION TREND

Determine present vegetation trend as outlined below. Trend should be expressed as: toward, away from, or not apparent in relation to the desired future vegetation. Trend in this case will indicate direction toward or away from management accomplishment rather than direction toward or away from the potential natural community.

APPARENT TREND

Apparent trend may be inferred from indicators based on observations at a single point in time. Knowledge of apparent trend will help determine if current practices are sound or if corrective actions are needed. Estimate apparent trend of reference sites when they are established.

LONG-TERM TREND

Determine long-term trend from observations and measurements made on permanently established monitoring sites. Select monitoring sites in areas sensitive to change in management practices. Sample reference and monitoring sites periodically by methods appropriate to the site. Procedures for remeasurement must be identical to those used for the previous measure. The number of measurements to make at each site depends on the sites inherent variability. An acceptable level of sample reliability and monitoring frequency shall be determined according to management need.

INTERPRETING TREND DATA

Evaluate existing records and other pertinent data and use the results for interpreting trend. Evaluation of trend information should attempt to isolate and identify all significant factors. Differentiate the effects of management from those of weather or other environmental factors.

To aid in interpreting trend, establish at least one photo station at each reference and monitoring site. Repeat the photographs at each remeasurement, and if possible, each year when major plant species are in the same phenological status.

APPLICATION TO MANAGEMENT OBJECTIVES

This can be based on status and trend, and reported by acres in two classes (Table 3-3). The site meets or does not meet forest plan requirements for the desired future vegetation. A site not at the desired future vegetation status, but with trend toward the desired future vegetation should be rated as meeting forest plan requirements.

Table 33. Classification of compliance with management objective on present vegetation status and trend in relation to the desired future vegetation (DFV):

	Vegetation Status and Trend	
Trend	**At DFV**	**Not at DFV**
Toward		
Rate acceptable	N/A	Yes
Rate unacceptable	N/A	No
Not apparent	Yes	No
Away from	Yes	No

SIMILARITY COEFFICIENT

Forest	District	Plot ID
Allotment Name and Number		Pasture
Year of Study	Date	Examiner(s)
Potential Natural Community	Existing Plant Community	Method of Measurement

SPECIES	Canopy Cover-Frequency Index by Species			NOTES
	Present	DPC	Similar	
	(a)	(b)	(w)	
TOTAL				
Similarity Coefficient (%)				$\frac{2w}{a+b}$ = % Similar
Desired Condition or Ecological Status				

SIMILARITY COEFFICIENT

SPECIES	Canopy Cover-Frequency Index by Ground Cover Categories: Present	DPC	Similar	NOTES
WOOD				
LITTER/DUFF				
MOSS/LICHEN				
BASAL VEG				
WATER				
BARE SOIL				
GRAVEL				
COBBLE				
STONE				
BOULDER				
ROCK				
	(a)	**(b)**	**(w)**	

TOTAL			
Similarity Coefficient (%)			
Desired Condition or Ecological Status			

$$\frac{2w}{a+b} = \text{\% Similar}$$

SIMILARITY COEFFICIENT

Forest Headwaters	District Red Cloud	Plot ID
Allotment Name and Number Turret Peak		Pasture Pat Park
Year of Study 1993	Date 6/25/93	Examiner(s) MJB
Potential Natural Community ARTRV/FEID/Agric Cryoborolls	Existing Plant Community ARTRV/FEID	Method of Measurement Cover-Frequency Transect

SPECIES	Canopy Cover-Frequency Index by Species			NOTES
	Present	DPC	Similar	
POTR5		100		
SABE2		500		
ARTRV	293	250	250	
SYOR2	1	75	1	
CHNA2	353			
CHVI8	10			
RILA		80		
SARA2		50		
FEID	170	500	170	
CAEL3	7	100	7	
POPR	520	100	100	
PONE2	1500	750	750	
CAGE2		100		
KOMA	7	50	7	
CAFI	1			
KOCR	8			
PASM	25			
BROMU	115	25	25	
ELEL5	1			
ACLA5	1083	700	700	
TAOF	1327	500	500	
MEFU2	180	250	180	
LATHY	323	100	100	
VIAM	110	75	75	
DEBA2	110	75	75	
RAGL	11	25	11	
NOMO2	11	25	11	
ANSE4	10			
GASE6	10			
ERIOG				
PHMU3	1			
ANAM	1			
	(a)	(b)	(w)	
TOTAL	6188	4430	2962	
Similarity Coefficient (%)			56%	$\frac{2w}{a+b}$ = % Similar
Desired Condition or Ecological Status			Not similar	

SIMILARITY COEFFICIENT

SPECIES	Canopy Cover-Frequency Index by Ground Cover Categories			NOTES
	Present	DPC	Similar	
WOOD	**18**	**50**	**18**	
LITTER/DUFF	**4200**	**6000**	**4200**	
MOSS/LICHEN	**325**	**200**	**200**	
BASAL VEG	**200**	**400**	**200**	
WATER	**0**	**0**	**0**	
BARE SOIL	**3300**	**1000**	**1000**	
GRAVEL	**180**	**150**	**150**	
COBBLE	**25**	**30**	**25**	
STONE	**20**	**20**	**20**	
BOULDER	**1**	**0**	**0**	
ROCK	**0**	**0**	**0**	
	(a)	**(b)**	**(w)**	
TOTAL	8269	7850	5813	
Similarity Coefficient (%)			72%	$\frac{2w}{a+b}$ = % Similar
Desired Condition or Ecological Status			Similar	

Resource Value Ratings

A resource value rating (RVR) is the quantification of a particular use or benefit for an ecosystem. RVRs are part of the characterization of an ecological type and associated seral communities in an ecological classification. They can be determined for any plant community as long as the coefficients associated with individual species or combinations of species is known. RVRs must be set within the capability context of the plant community and can be quantitative or qualitative, expressed with adjective ratings such as low, moderate, and high.

RVRs are usually developed for individual plant species at the Regional level.[4] This approach must be extended to assemblages of plant species. In this fashion, RVRs can be developed for each plant community and be better suited for ecosystem management application. The RVR list for plant communities should be developed at the Forest, or possibly District, level through an interdisciplinary process, and supplemented as the ecological classification is done. The following is an example of RVRs.

> A desired plant community in a mountain allotment is the Big Sagebrush - Idaho Fescue (ARTR2-FEID) plant community. The resource value ratings determined by the local District staff for that plant community are:

Resource of Interest	Resource Value Rating
Forage for cattle	High (during summer)
Forage for sheep	Low
Forage for deer	Moderate
Nesting habitat for ground birds	High
Water quality	High

Soil Ratings

Erosion rates are difficult to directly measure. Erosion hazard is related chiefly to effective vegetation, litter, slope and other ground covers. Ground cover is determined from cover-frequency or rooted nested frequency sampling methods. Minimum quantities of vegetation and litter cover to prevent excessive soil erosion should be established for each ecological type by evaluating areas representative of natural erosion rates. These comparisons or standards will be adjusted for slope and aspect. Soil ratings may be expressed as the ratio between vegetation/litter cover on the site and vegetation/litter cover for the ecological type.

[4] See Appendix F

GRAZING CAPACITY DETERMINATION

The true grazing capacity for an area will depend upon a variety of factors including: climate, type and breed of livestock, management system, permittee involvement, improvements, and many others. **Trend towards objectives is the primary consideration used in adjusting stocking rates.** Capacity estimates are not considered as static. Estimates shall be periodically reviewed, particularly after a period of monitoring and adjusted to bring them in line with changing conditions. Stocking rates must allow a safety margin to provide for low forage producing years. The quality of management and system of use also has a marked effect on grazing capacity.

In most of the Region, grazing has occurred for many years and grazing capacity estimates have been adjusted based on actual use observations. In those few instances where initial capacity needs to be determined (new allotment or reactivation of vacant allotments) the following is recommended:

- Estimate capacity from historic use records.
- Estimate capacity based on use occurring on adjacent allotments with similar vegetation types.
- Over a 3 year period, monitor the use and adjust the capacity as necessary to comply with the LRMP standards and guidelines. One useful tool in recording the annual utilization data is the preparation of a utilization map.

When adjusting stocking rates on active allotments, the following approach is recommended:

- Once the objectives are established for an allotment and it is clear what standard and guidelines will be required, the permittee should be given the opportunity to demonstrate their ability to meet those objectives with his permitted numbers over a three year period..
- After the first year of use, discuss the results of the monitoring with the permittee. Highlight when and where standards and guidelines are not being met. Notify the permittee they will be required to move livestock from those and other areas when standards and guidelines are reached during the next grazing season.
- After second year of use, document and review monitoring results with permittee. Note the adjustments, time and location, made to meet the standards and guidelines. Again, the permittee will be required to move livestock whenever the standard and guidelines are reached during the next grazing season.

- After the third year of use, document and review the three years of data with the permittee. Based on this 3 years of data, the manager should be able to determine why and what permanent modifications are necessary to the livestock operation, whether it's an adjustment to the numbers of livestock, season of use, distribution patterns, grazing system, etc.

The three year period is necessary to account for the weather variation and assume that everything else remains the same. This method of doing capacity offers the permittee a chance to help control their destiny by being very dependent on how well they manage their livestock. Their management in the second year is often greatly improved after they have been asked to leave early the year before.

FURTHER GRAZING CAPACITY CONSIDERATIONS

In the past, other methods have been used to estimate grazing capacity. The most commonly used method was to determine pounds of forage per acre, multiply it by a proper use factor and number of acres which gave you the available forage. The available forage was divided by the daily consumption rate for the kind and class of livestock permitted, which was then divided by 30 days/month to calculate the estimated capacity in AUMs. Another method is the production-utilization (P-U) study. P-U studies are time consuming, intensive and require a long term committment of time and money. The P-U study method is described on page 70-119 of the Interagency technical reference, *Utilization Studies and Residual Measurements, 1996.* These methods require a huge investment in time and are not very reliable if use patterns are diverse, such as in mountainous terrain.

GRAZING ALLOTMENT SUMMARY and LIVESTOCK CAPACITY ESTIMATE

Forest		1. Gross area of allotment	
District		2. Alienated land, no capacity estimate	
Allotment Name and Number		3. Total area open (#1 - #2)	
Kind and/or Class of Animal		4. Non capable area (N)	
Allowance (lb/day/animal -- dry wt.)		5. Closed to livestock use	
Field Work Completed (Date)		6. Total area unusable (#4 + #5)	
Examiner:		7. Total suitable for grazing or browsing (#3 - #6)	
Summary Completed (Date)		8. Alienated land open and usable	
By:		9. NFS land usable and open (#7 - #8)	
		10. Estimated Carrying Capacity (AUM)	

OBLIGATION AND RATE OF STOCKING: Permits and Past Actual Use

	Animal Kind	Animal Class	Animal Numbers	Season	Animal Months	Animal Unit Months
Term Permit						
Permit						
Permit						
Permit						

Year	19	19	19	19	19	19	19	19	19
Number of Animals									
Season of Use									
Animal Months									

Attach analysis tabulations, calculations, and reports showing condition class, and maps. Make cross-reference to or include other data such as range inspections, administrative studies, climatic records, research publications, periodic utilization checks, production studies, and plant development measurements.

Miscellaneous information (recommendations: special problem areas, relationship to Forest Plan, etc.)

GRAZING ALLOTMENT SUMMARY and LIVESTOCK CAPACITY ESTIMATE

Forest GM/UNC/GUNN NF	1. Gross area of allotment	10,723
District TAYLOR RIVER RD	2. Alienated land, no capacity estimate	--
Allotment Name and Number RED CREEK	3. Total area open (#1 - #2)	10,723
Kind and/or Class of Animal C/C	4. Non capable area (N)	2,115
Allowance (lb/day/animal -- dry wt.) 34#/DAY	5. Closed to livestock use	--
Field Work Completed (Date) 93/08/01	6. Total area unusable (#4 + #5)	2,115
Examiner: J. POPE	7. Total suitable for grazing or browsing (#3 - #6)	8,608
Summary Completed (Date) 94/02/15	8. Alienated land open and usable	--
By: J. POPE	9. NFS land usable and open (#7 - #8)	8,608
	10. Estimated Carrying Capacity (AUM)	1,578

OBLIGATION AND RATE OF STOCKING: Permits and Past Actual Use

	Animal Kind	Animal Class	Animal Numbers	Season	Animal Months	Animal Unit Months
Term Permit	CATTLE	C/C	320	6/15-10/15	1280	1664
Permit						
Permit						
Permit						

Year	19 87	19 88	19 89	19 90	19 91	19 92	19 93	19___	19___
Number of Animals	320	320	185	320	320	320	320		
Season of Use	6/15-10/15	6/15-10/15	6/15-10/15	7/1-10/15	6/15-10/15	6/15-10/15	6/15-10/1		
Animal Months	1280	1280	740	1120	1280	1280	1120		

Attach analysis tabulations, calculations, and reports showing condition class, and maps. Make cross-reference to or include other data such as range inspections, administrative studies, climatic records, research publications, periodic utilization checks, production studies, and plant development measurements.

Miscellaneous information (recommendations: special problem areas, relationship to Forest Plan, etc.)

ALLOTMENT MAP STANDARDS

There are at least four layers of information that need to be developed for use in rangeland inventory and analysis:

- **Existing Vegetation**
- **Existing Facilities**
- **Capable Rangelands**
- **Lands suitable for livestock grazing or browsing**

EXISTING VEGETATION

Existing vegetation should be mapped and described using a classification system appropriate to the scale and the issues in question. For example, for forest wide landscape level assessments, or general allotment level assessments, existing vegetation as described by CalVeg or WHR mapping polygons are sufficient. For areas on the allotment where there are specific resource concerns or key areas have been established, use the finer-grained plant community level classification provided in *A Manual of California Vegetation* (Sawyer, Keeler-Wolf 1995) to classify existing vegetation. The regional ecology program is developing classifications based on potential natural vegetation. As these become available for rangeland vegetation types, incorporate this information into descriptors for allotment vegetation.

EXISTING FACILITIES

Physical facilities significant to allotment management need to be accurately recorded. Items such as fences, ponds, troughs, springs, key areas, salt grounds, roads and trails should be recorded using the symbols shown on the sample Allotment Map Legend in Figure 3-3 page 3-30. Units with GIS capability should also use the approved symbols until such time as National or Regional GIS standardized symbols are established.

CAPABLE RANGELANDS

A map displaying Capable Rangelands will be developed using appropriate criteria for forage production, access to water, and soil impacts. See page 3-8.

LANDS SUITABLE FOR LIVESTOCK GRAZING OR BROWSING

A map showing land areas that are available to be considered for some type of domestic livestock use. See page 3-9

ESTIMATED UTILIZATION

A map showing typical utilization patterns is essential for evaluating existing and anticipated impacts of livestock grazing that might occur with different management strategies. See pages 4-9 and pages 23-24 of the Interagency technical reference, *Utilization Studies and Residual Measurements, 1996*.

Figure 3-3

Figure 3-4. ALLOTMENT MAP (SCALE 1:24,000)

INVENTORY METHODS

The most frequently used methods for vegetative inventory are ocular plant composition, cover-frequency, and line intercept. Data collected by these methods can be used for:

- classification of ecological types,
- community type descriptions,
- predicting vegetation response to treatment,
- developing resource value ratings,
- calculating similarity to desired plant community or to potential natural community, and
- monitoring change over time (except for ocular plant composition method).

STANDARD INVENTORY METHODS

OCULAR PLANT COMPOSITION METHOD

This method allows the examiner to more thoroughly inventory all portions of a stand of vegetation. The method has wide applicability and is suited for use with both grass and forbs. See page 76 of the Interagency technical reference *Utilization Studies and Residual Measurements*, 1996.

COVER-FREQUENCY METHOD

This is the primary rangeland inventory method to be used in this Region. It provides both canopy cover and frequency of occurrence data for plant species. Permanently established cover-frequency samples can be used for long-term monitoring. The cover-frequency method is described starting on page 37 of the Interagency technical reference *Sampling Vegetation Attributes*, 1996.

LINE INTERCEPT METHOD

This method is used to more accurately estimate canopy cover of shrub species, and to collect information on maturity and form classes for individual shrub plants, as well as the degree of hedging. The sample is a ***pair*** of 100-foot parallel transects at least 50 feet apart with actual occurrence of foliar shrub cover measured to the nearest 0.10 foot using the same transects from cover-frequency. Permanently established line intercept samples can be used for long-term monitoring. Line intercept is an extremely valuable method for inventorying big-game winter ranges and rangelands dominated by a shrub component. See page 64 of the Interagency technical reference *Sampling Vegetation Attributes*, 1996.

Parker Three-Step Method

The Parker three-step method (Parker 1951) should not be used for any new transects. As many existing Parker transects as possible should be converted to cover-frequency type transect. Evaluate each location of Parker three-step transect clusters, and if appropriate, re-read, then sample again with a cover-frequency transect, to complete their conversion.

It is strongly advised not to eliminate the data and photos collected under this method. The old transects have been around a long time and can still provide an indication of trend.