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 Rocky Mountain 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 successional (seral) community types, including the potential natural community. Each description includes information on biotic (vegetation composition, abundance, and productivity) and abiotic (climate, landform, and soil) characteristics, as well as seral relationships between communities, resource value ratings, and community response to management activities. 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 easily be determined by comparing the existing plant community to the potential natural community.

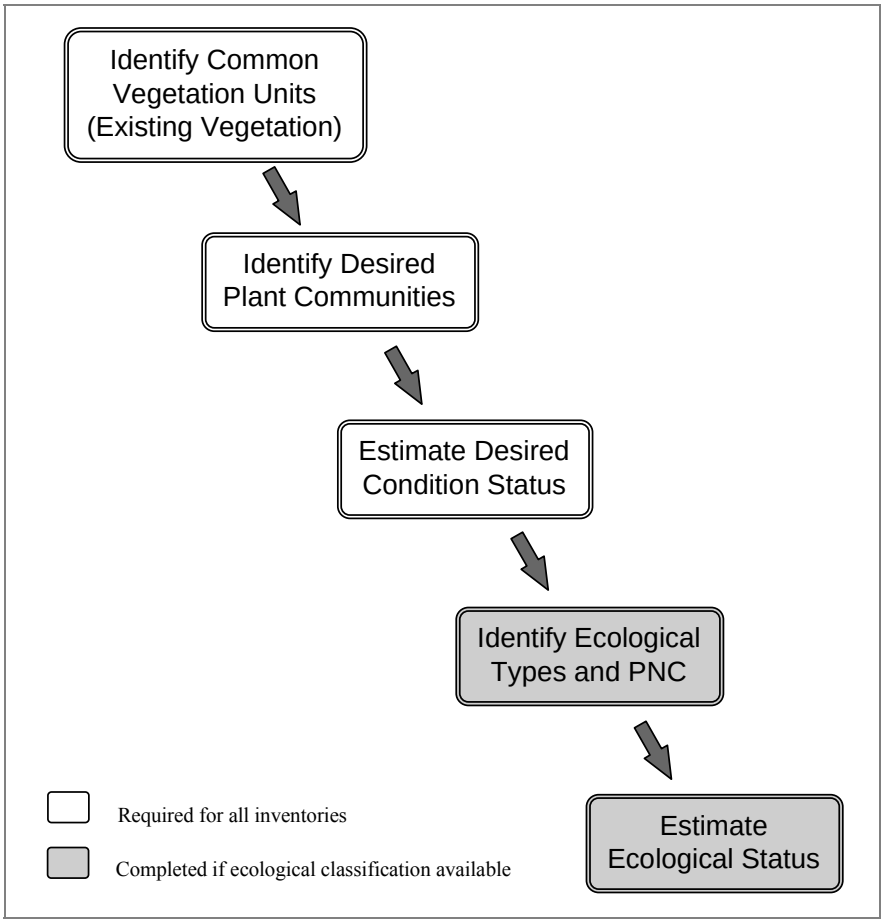
WITHOUT A CLASSIFICATION

Potential natural communities (PNC) are not well defined nor described without an ecological type classification. 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 occur within the general area, on sites 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 the desired plant community. The degree of similarity between existing and desired plant communities approximates desired condition status (page 3-10).

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

PRIORITIES FOR ANALYSIS

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.

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 big game-livestock conflicts.
4. Allotments without NEPA or Forest Plan compliance documentation.

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
RANGELAND CONDITION	Satisfactory	Some areas are unsatisfactory	Unsatisfactory
GRAZING MANAGEMENT	Minor or no changes are sufficient	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 vegetation (CVU) • Field reconnaissance of rangeland conditions using: Rangeland Health Matrix (R2-2200-RH) 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 CVU 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 administered lands if those lands are used as basis for private land permits.
- 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.
- Rangelands outside active allotments as necessary to meet objectives for resources such as wildlife or watershed.
-

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.
- 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 testimony 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, as well as The Nature Conservancy.
- Locate and describe desired plant communities (DPC) 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 DPC 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 Common Land Unit[2] 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

[2] Integrated Resource Inventory

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.

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 VEGETATION

Common Vegetation Units should be identified, mapped, and described according to IRI standards. There are seven delineation criteria for common vegetation units: physiognomic class, species, density, size, crown condition, vertical structure, and horizontal structure.

Field work adjusts and corrects CVU delineations 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. The IRI Training Guide (U.S. Forest Service, 1995) provides additional information on delineation criteria and procedures.

Perhaps the most important field inventory task is to describe specific plant communities within the common vegetation units. 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 PLANT

Desired plant community (DPC) selection is crucial to effective rangeland planning. The DPC has composition, structure, and function

characteristics that best represent the desired condition specified in the Forest Plan. DPC is part of the overall desired condition and must be integrated with other features, for example, soil and visual characteristics. Identifying DPC 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. The role of rangeland analysis is to identify plant communities that provide high quality resource values for the management area.

COMMUNITY

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 DPC 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 DPC that satisfies all Forest Plan and allotment objectives immediately. It is reasonable to identify a DPC that establishes the correct trend over the short-term, and then adjust the DPC later as the vegetation responds to the management change.[3] 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 prolonged, past overgrazing. It is often extremely difficult to convert them to a native bunchgrass community. Additionally, many sagebrush dominated communities evolved through a combination of management practices and natural succession. Neither situation can be corrected by simply changing the grazing management strategy. They require additional forms of disturbance to move the existing plant community towards the DPC. 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 DPC. The IDT or rangeland manager will determine whether the existing vegetation is the DPC for each common vegetation map unit. Relict areas, research natural areas, and old exclosures or pastures may furnish valuable information.

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

Rangeland inventory identifies rangelands capable of supporting livestock grazing.

RANGELAND CAPABILITY

CLASSIFICATION OF RANGELAND CAPABILITY

Capable rangeland 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.

Non capable rangeland 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 200 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.

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

APPLICATION OF INVENTORY DATA

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 desired condition status based on the desired plant community. Second, is the determination of ecological status based on the potential natural community (Table 3-2). Rangeland management status, then, is the overall assessment of the effects of the allotment management plan.

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. Following is an explanation of the relationship between these concepts and a sample application of rangeland inventory data. Some variability in application will be required, dependent on the nature and quality of ecological classification products available.

DESIRED CONDITION STATUS

Evaluation of desired condition status and ecological status are somewhat similar. The difference is that existing vegetation data is compared to the desired plant community for desired condition status, while the same existing vegetation data is compared to the potential natural community for ecological status.

Figure 3-2 illustrates a hypothetical ecological type, with each circle representing a seral plant community that may occur in that type. 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 plant community is represented by PC3. Both communities are seral to the potential natural community, PC1. Desired condition status is the relationship, or similarity, between PC4 and PC3.

The evaluation of desired condition 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 normally applicable in the absence of an ecological classification.

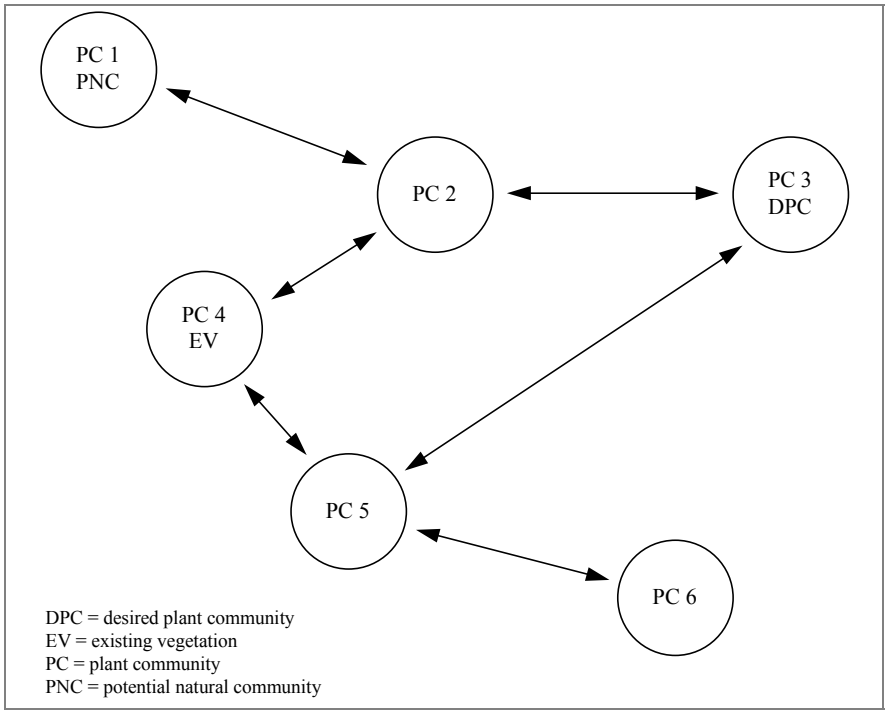
ECOLOGICAL STATUS

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.

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

Status	Definition
Desired Condition Status	Determination of the relative similarity between existing vegetation and the desired plant community (DPC)
Ecological Status	Determination of the relative similarity between existing vegetation and the potential natural community (PNC)
Rangeland Management Status	Determination of the relative success of rangeland management through desired condition status and trend

Figure 3-2. RELATIONSHIP OF POTENTIAL NATURAL COMMUNITIES AND SERAL COMMUNITIES



SIMILARITY COEFFICIENTS

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

$$\text{Desired Condition Status} \approx f(EV, DPC)$$

$$\text{Ecological Status} \approx f(EV, PNC)$$

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 (R2-2200-SC). 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).

$$\text{Average Canopy Cover} \times \text{\% Frequency} = \text{CFI}$$

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

COMPUTING SIMILARITY COEFFICIENTS

Any inventory method (page 3-**Error! Bookmark not defined.**) 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[4] 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

[4] 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

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. The break between similar and not similar desired condition status is established at 65 percent (Table 3-3).

Professional judgment and common sense are needed to interpret similarity data. This is especially true the closer the similarity coefficient is to 65 percent. Preliminary data analysis indicates that often a 60 percent similarity is acceptable for many community types. At this level of similarity many communities with the same dominant species will appear similar; for management and community description purposes they can be grouped together. Likewise, a 70 percent similarity may be not similar dependent on which species are present and which species are desired.

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 more complete 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.

Table 3-3. DESIRED CONDITION STATUS

Similarity Coefficient	Desired Condition Status
65-100%	Similar to the desired plant community
0-64%	Not similar to the desired plant community

RANGELAND MANAGEMENT STATUS

Rangeland management status can be described by combining desired condition status with trend determinations. For example, a plant community with a similar desired condition status and a trend "away from" management objectives would be considered in unsatisfactory rangeland management status (Table 3-4). Likewise, a not similar desired condition status with a trend "towards" objectives might be considered in satisfactory rangeland management condition. Trend determination is described on page 3-23.

Table 3-4. INTERPRETING RANGELAND MANAGEMENT STATUS FROM DESIRED CONDITION STATUS AND TREND

TREND	DESIRED CONDITION STATUS	
	Not Similar	Similar
Toward	Satisfactory	—
Static	Unsatisfactory	Satisfactory
Away From	Unsatisfactory	Unsatisfactory

SIMILARITY COEFFICIENT (R2-2200-SC)

Forest **Headwaters**	District **Red Cloud**	Plot ID **FS 02 12 10 373010830 0045 94**
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%**	$\frac{2w}{a+b} = \%\ \text{Similar}$
Desired Condition or Ecological Status			**Not similar**	

SIMILARITY COEFFICIENT (R2-2200-SC)

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.[5] 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 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, 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.

DETERMINING INITIAL GRAZING CAPACITY

In most of the western United States, grazing has occurred for many years and grazing capacity estimates have been adjusted based on actual use observations (see page 4-9). However, in those instances where initial capacity needs to be determined (new allotment or reactivation of vacant allotments) the following procedure can be followed (see R2-2200-GA).

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[5] See Appendix L

[6] Valentine, John F. Nutrient Requirements of Beef Cattle, Fifth revised edition. Committee on Animal Nutrition, National Academy of Sciences -- National Research Council. San Diego, CA: Academic Press, Inc. 1990.

[7] Personal communications: Colorado State University and Colorado Division of Wildlife Research Unit personnel.

1. Determine total forage production on each common vegetation unit considered to be capable range (see page 3-75).
2. Multiply pounds per acre in each common vegetation unit by proper use factor (a maximum of 40-45 percent for initial stocking rates) and the number of acres. This amount is available forage.
3. Total the available forage production for all map units.
4. Divide available forage by the daily dry weight consumption rate (Table 3-5) for the kind and class of livestock permitted.
5. Divide by 30 days/month to calculate estimated capacity in AUMs.
6. The estimated capacity *must* be checked against stocking rates on nearby allotments with similar characteristics and objectives before use is permitted. Initial capacity estimates should be conservative, allowing for the many other uses and values on public land.
7. Monitor actual use; adjust stocking as needed to meet objectives.

Livestock weights are average mid grazing season weights. Length of time on National Forest or Grassland range, breed of livestock, and when the animal is born can result in figures different from the averages listed. Big game values are fall-season averages.

Table 3-5. DAILY FORAGE CONSUMPTION RATES

Livestock Kind and Class	Animal Unit Factor	Daily Dry Weight Consumption	
		lbs	kg
Cattle[6]			
1000-lbs (454 kg) animal	1.000	26	11.79
Dry cow	1.000	26	11.79
Cow with calf	1.308	34	15.42
Yearling	0.692	18	8.16
Weaner	0.500	13	5.90
Bull	1.500	39	17.69
Bison	1.000	26	11.79
Horse	1.192	31	14.06
Sheep			
125-lbs (57 kg)	0.192	5	2.27
Ewe with lamb	0.308	8	3.63
Big Game[7]			
elk 430-lbs (195 kg)	0.462	12	5.44
deer 135-lbs (61 kg)	0.173	4.5	2.04

GRAZING ALLOTMENT SUMMARY and LIVESTOCK CAPACITY ESTIMATE (R2-2200-GA)

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 open and usable (#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) (from back)	**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.)

Map Label	Acres	Trend	Resource Value Rating	Forage Allowable Use %	Forage Production (dry lb/ac)	Est. Carrying Capacity (AUM)
6CS ABLA-PIEN	**1205**	↔		**10%**	**300**	**35**
6NS ABLA-PIEN	**2115**	↔		**--**	**--**	**--**
10CS POTR5	**1640**	↔		**40%**	**450**	**289**
4CS QUGA/POPR	**1278**	↔		**30%**	**500**	**188**
4CN ARTR2/POPR	**1680**	↓		**30%**	**525**	**259**
2CN POPR/TAOF	**518**	↓		**30%**	**400**	**61**
2CS DECE-CANE2	**285**	↔		**45%**	**925**	**116**
2CN POPU9/DECE	**113**	↔		**30%**	**900**	**30**
2CS SAGE2/CARO5	**135**	↔		**45%**	**1175**	**70**
2CS CANE2	**92**	↔		**45%**	**925**	**38**
1CS FETH-FEID	**625**	↔		**45%**	**750**	**207**
1CS FETH-STLE4	**820**	↔		**35%**	**725**	**204**
1CS DAIN	**217**	↔		**45%**	**850**	**81**
Totals	**10,723**					**1,578**

TREND DETERMINATIONS

Trend is basically a measure of management's effectiveness in meeting allotment objectives for desired plant communities. Trend is described as toward, static, or away from objectives. Trend determinations are a key part of rangeland monitoring. An in-depth discussion of trend determinations can be found in the Monitoring Chapter.

Field data collection should include re-sampling permanent trend plots. Trend should be estimated from either permanent plots or a recording of apparent trend based upon the observer's professional opinion. It is important to document whether trend determinations were measured or estimated. Major management changes involving considerable investments of time, funding, or livestock adjustments should be based primarily on measured trend studies at permanent locations.

ALLOTMENT MAP STANDARDS

There are two maps used in rangeland inventory and analysis: the inventory map and the allotment map. Gradually, the inventory map will be replaced by IRI maps.[8] Allotment maps are updated with every re-analysis of the grazing allotment. Some units have the necessary GIS technology to produce their own allotment maps. Where this technology exists, Forests should follow, as closely as possible, the guidelines for legends and labeling in this chapter. On those units without GIS technology, final allotment maps will be prepared according to the following standards.

Allotment maps throughout the Region will be similar in design, content, and appearance. Consistency can be obtained by utilizing the Regional Geometronics Photo Lab or a private contractor to prepare the base maps. Analysis information can be drafted onto the base maps by the person(s) completing the analysis. The following steps should be followed in the preparation of the base map:

1. Allow approximately three months for the preparation of the base map. Contact the Lab Director (303-275-5338) or private contractor prior to ordering maps; establish time frames, map content, and costs. This contact is extremely important to insure that the Lab understands your needs and expectations.
2. Complete a Photographic Work Requisition (FS-7100-41) and submit it to the Photo Lab. This form should contain a short narrative requesting preparation of an allotment base map to regional standards. Any special instructions or expectations should be included in the narrative. Attached to the requisition should be:
    - ♦ Forest Recreation Map or standard USGS Quad Map with the allotment boundary delineated. The area outside the allotment to be included in the base map should also be delineated. A completed FS-7100-41 follows and Figure 3-3 shows the associated map.

[8] Common vegetation, land, and water units

Form FS-7100-41

☆ U.S. GOVERNMENT PRINTING OFFICE: 1979-303-698

USDA-FOREST SERVICE

PHOTOGRAPHIC WORK REQUISITION

Instructions: Prepare field orders in accordance with local instructions. See FSM 7140 for orders to W.O.

CHARGE TO (Unit): Red Cloud RD Headwaters NF	APPROPRIATION AND PROJECT: MC:664287	
SEND TO: R-2 GEOMETRONICS Photo Lab	ADDRESS: 740 Simms Lakewood, Co 80225	DATE DESIRED: 4/1/94
ORDERED BY (Signature)	TITLE: Support Services Supervisor	ORDER DATE: 12/15/93
FOR INFORMATION (Name & Phone No.): M.Bovine 303-287-2635	ORDERING OFFICE REFERENCE (What & Date)	REQUISITION NO.: 65

CLASS OF WORK	NO. COPIES DESIRED	SCALE	NEGATIVE NUMBERS, DESCRIPTION OF WORK AND SPECIAL INSTRUCTIONS	NEG./ORIG. SENT	NEG./ORIG. RETURNED
Aerial index					
Aerial mosaic					
Aerial photo (Contact-Enlargement)					
Autopositive					
Blue-line prints					
Blueprints					
Color proof					
Contact prints					
Diapositive plates					
Diazo					
Diazo reproducibles					
Duplicate slides (35 mm)					
Enlargements					
Field photography					
Film developing					
Film positives	1	1:24000	This requisition is for the preparation of a Matte Film Positive of the Turret Peak C&H Allotment.		
Line film					
Map mosaic					
Microfilm print					
Mounting			Attached is a Forest Map of the area to be included on the positive. Also attached are the topographic map positives to be used in constructing the Matte Film Positive. Please return these topo map positives upon completion.		
Multilith					
Opaque plastic prints					
Paper negative					
Photostat prints					
Polyester					
Reductions					
Scribe coating					
Solar bromide prints					
Transparencies					
Vandyke neg. or pos.					
Watercote					

Photographic Laboratory Record

DATE PROMISED: DATE SENT:

CLASS OF WORK	NO. COPIES	TOTAL NO. COPIES	SIZE	UNIT COST	TOTAL COST	MONTH BILLED

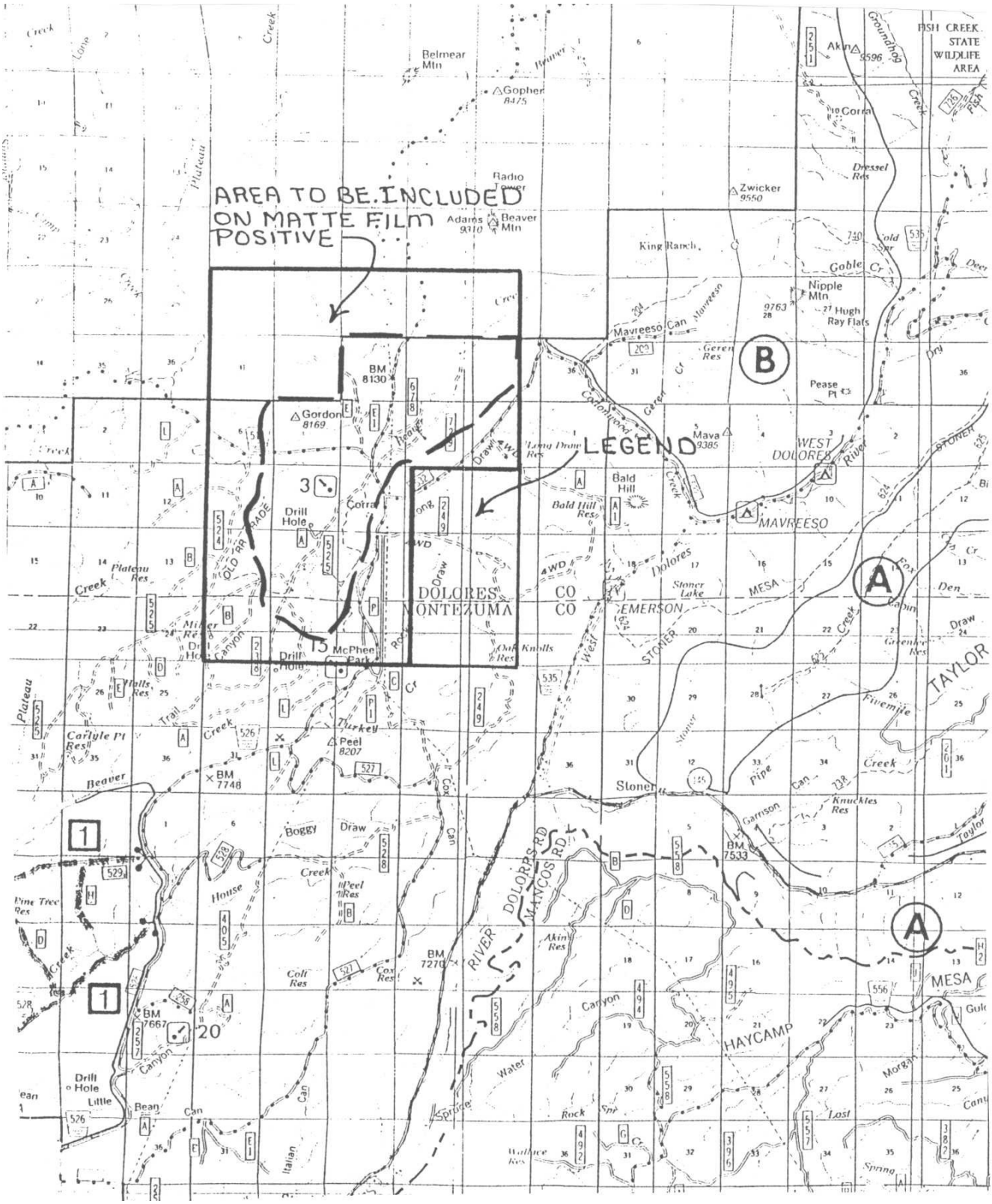
Accounting Data for Use by Ordering Office

ESTIMATED OBLIGATION:

APPN. (F. S.)	STATE	ACCOUNT OR ACTIVITY	FUNCTION Major	FUNCTION Sub.	FUNCTION Exp.	PROJECT	SPECIAL LIMITATION	OBJECT CLASS Major	OBJECT CLASS Sub.	OBJECT CLASS Rate	AMOUNT

7100-41 (11/78)

Figure 3-3. SAMPLE MAP



- Topographic map positives at the standard 1:24,000 scale for each USGS quadrangle within the allotment. Topographic positives are available on most Districts and in all Supervisor's Offices. Positives will be returned to the requesting unit when the map is complete.
- The Photo Lab has the standard regional map symbols legend for the title block[9] that will be attached to every map (Figure 3-4). Additions or deletions to the Regional legend should be made by the ordering unit and submitted to the Lab. A title block should also be prepared by the ordering unit and submitted with the requisition. All additions to the legend and the title block should be prepared with the same quality and format as the exhibits.

3. The Photo Lab or contractor will prepare a negative and a matte film positive of the allotment. The negative will be kept by the Photo Lab for future use and the positive returned to the requesting unit. The positive will be used as the base map upon which analysis information is drafted. Analysis information can be drawn on the positive itself, or drafted on overlays. Allotment maps can be produced for field use on several types of copy machines. **Error! Reference source not found.** shows an example of a complete standard allotment base map.
4. For ease of map interpretation, the final allotment map will be colored using the standard rangeland cover type colors as defined on page 3-27.

ALLOTMENT MAP LEGEND

If IRI is complete for the analysis area, then rangeland inventory will validate, refine, and update the CVU layer. Identified changes must be coordinated through the Forest IRI leader and will be incorporated directly into the electronic CVU layer.

If the CVU layer is not developed for the allotment(s) being inventoried, then rangeland inventory will follow Integrated Resource Inventory protocol (U.S. Forest Service, 1995) as closely as possible. The intent is to develop a map that will facilitate the IRI process later. These guidelines are intended to serve during the transition period between traditional rangeland analysis and implementation of new GIS and IRI technologies.

In either case, it is likely that information above and beyond that available through the CVU layer will be required on the allotment map. The allotment map must be useful to resource managers and permittees alike, at the project level. Several important pieces of information often included on the map are listed below. The first six (cover type, range capability, desired condition status, common vegetation unit, acres, and trend) are the minimum attributes required to adequately label the range allotment map. Two additional items that may be added to the map label, if available, are ecological type and ecological status.

[9] Map legend must be provided for private contractors.

Figure 3-3

ALLOTMENT MAP LEGEND

IMPROVEMENTS

- Dam and Reservoir
- Stock Pond or Tank
- Spring Development
- Spring and Trough
- Trough
- Well
- Irrigation Ditch
- Windmill
- Windmill and Trough
- Water Tank
- Pump
- Fence
- Pipe Line
- Cattle Guard
- Corral
- Trail
- Alineated Land
- Forest Service Guard Station
- House, Cabin, or Other Building
- Recreation Site
- Stock Driveway (STOCK DRIVEWAY)

MAP DESIGNATIONS

- Permanent Stream
- Intermittent Stream
- Benchmark: Location and Number (2)
- Permanent Trend Transect
- Permanent Camera Point (CP)
- Study Exclosure
- Allotment Boundary
- Pasture or Management Unit Boundary
- Existing Vegetation Polygon
- Apparent Trend
- Measured Trend
- Trend Towards Objective
- Trend Away From Objective
- Static Trend
- Noxious or Poisonous Weed Infestation (Musk Thistle)

4CS ARTR2-FEID 95 ↔

Sagebrush cover type that is capable rangeland with similar desired condition status; ARTR2-FEID plant community that is 95 acres with a static trend.

STANDARD RANGE TYPES

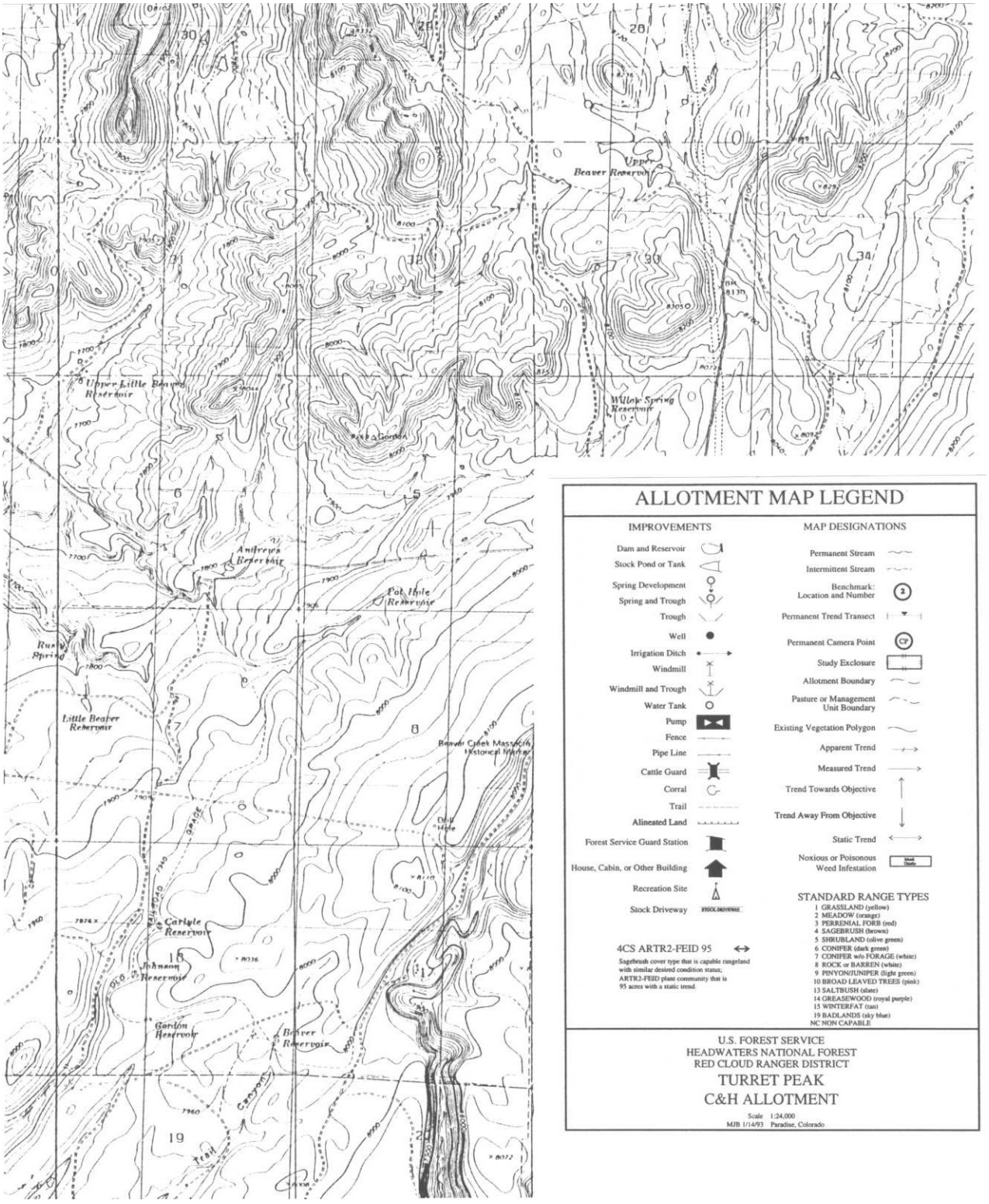
1 GRASSLAND (yellow)
2 MEADOW (orange)
3 PERRENIAL FORB (red)
4 SAGEBRUSH (brown)
5 SHRUBLAND (olive green)
6 CONIFER (dark green)
7 CONIFER w/o FORAGE (white)
8 ROCK or BARREN (white)
9 PINYON/JUNIPER (light green)
10 BROAD LEAVED TREES (pink)
13 SALTBUSH (slate)
14 GREASEWOOD (royal purple)
15 WINTERFAT (tan)
19 BADLANDS (sky blue)
NC NON CAPABLE

U.S. FOREST SERVICE
HEADWATERS NATIONAL FOREST
RED CLOUD RANGER DISTRICT

TURRET PEAK
C&H ALLOTMENT

Scale 1:24,000
MJB 1/14/93 Paradise, Colorado

Figure 3-5. ALLOTMENT MAP (SCALE 1:24,000)



A sample allotment inventory map unit label will look like:

4CS ARTR2-FEID 95 ↔

This indicates a sagebrush-Idaho fescue cover type that is capable rangeland with similar desired condition status. It is the ARTR2-FEID plant community type, and the 95 acres in the map unit have a static trend with respect to meeting management objectives.

STANDARD RANGELAND COVER TYPES

Use the following number and color codes to indicate rangeland cover types. Labeling and coloring the map may be done by hand, at present. In the future, GIS technology will produce maps with the same numbering and coloring conventions. Or, the conventions may be easily modified, as warranted.

1.	Grassland	yellow
2.	Meadow	orange
3.	Perennial forb	red
4.	Sagebrush	brown
5.	Browse -- mountain shrub	olive green
6.	Conifer	dark green
7.	Conifer without forage	[no color]
8.	Rock or barren	[no color]
9.	Piñon juniper	light green
10.	Broad-leaved trees	pink
13.	Saltbrush	slate
14.	Greasewood	royal purple
15.	Winterfat	tan
19.	Badlands	azure-sky blue

RANGE CAPABILITY

Range capability is expressed as either:

C (capable), or

N (non capable).

DESIRED CONDITION STATUS

Desired condition status is expressed as either:

S (similar), or

N (not similar).

COMMON VEGETATION UNIT

There are two naming conventions of which one or both may be used on the allotment map.

1. The map unit legend will be as described in the Common Vegetation Unit Chapter of the IRI Training Guide, including physiognomic class, species, size, density, crown condition, vertical structure, and horizontal structure.
2. In the absence of a Common Vegetation Unit map, a plant community name may be used. The name is usually two (sometimes three) species, with usually one identified per layer, that are usually the most abundant in the existing vegetation. For example, *Artemesia tridentata—Festuca idahoensis* (ARTR2-FEID). The source of the community name is an ecological classification. Without a classification, it is advisable to omit this information.

ACRES

The number of acres included in the map unit.

TREND

Use the following symbols to indicate trend.

Trend	Symbol
Toward	↑
Static	↔
Away From	↓
Not Apparent	?

ECOLOGICAL TYPE

Ecological types are commonly named with a two-part name including abiotic and biotic information. The abiotic portion is based on physical features such as landform or soil family. The biotic name consists of two (sometimes three) scientific names of characteristic, prominent, or diagnostic species. Ecological types are identified and described only through thorough statistical analysis of biotic and abiotic data. Only then can a name be assigned to an ecological type. The source of the name is an ecological classification. Without a classification, it is advisable to omit this information because the most abundant species are not always reflected in the name. (The Common Land Unit map legend may be alternatively used instead of the ecological type name.)

ECOLOGICAL STATUS

Ecological status is indicated by PNC, LS, MS, or ES, or the appropriate scorecard rating as described in the classification.

INVENTORY METHODS

There are three categories of information collection methods related to rangeland inventory. First is regionally standard inventory methods for collecting information about and describing vegetative characteristics. Second is descriptive site data, ***which is required*** for all inventory and monitoring samples. Third is additional methods that may be developed locally.

The most frequently used methods for vegetative inventory in the Rocky Mountain Region, in order of increasing intensity, 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 (OP)

This method allows the examiner to more thoroughly inventory all portions of a polygon. The sample is usually a 0.10 acre or 0.20 acre circle, with canopy cover estimates for each species present. The General Field Form ***must*** be completed for each sample, or cluster of samples. The ocular plant composition method is described in Exhibit OP. This method is identical to the process used by IRI.

COVER-FREQUENCY METHOD (CF)

This is the primary rangeland inventory method used in this Region. It provides both canopy cover and frequency of occurrence data for plant species. The sample is a ***pair*** of 100-foot parallel transects at least 50 feet apart with canopy cover measures developed from twenty Daubenmire plot frames placed at 5-foot intervals along each transect line. The General Field Form ***must*** be completed for each transect pair. Permanently established cover-frequency samples can be used for long-term monitoring. The cover-frequency method is described in Exhibit CF.

LINE INTERCEPT METHOD (LI)

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 wither ranges and rangelands dominated by a shrub component. The General Field Form ***must*** be completed for each sample. The line intercept method is described in Exhibit LI.

PRODUCTION DATA (PD)

A key element of initial inventory is collection of vegetative production data. Production information is useful for making general decisions regarding plant community health and vigor. Additionally, production is a necessary element in determining carrying capacity for grazing animals. The production data method is described in Exhibit PD.

PARKER THREE-STEP METHOD

The Parker three-step method is not an approved method in the Rocky Mountain Region. However, as many existing Parker transects as possible should be converted to cover-frequency transect data. 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. See Exhibit Parker for a more complete discussion of converting Parker transects.

DESCRIPTIVE SITE DATA

GENERAL FIELD FORM (GF)

This form is required as an integral part of data collection, regardless of inventory or monitoring method used. This form must be completed for all samples, or cluster of samples: temporary and permanent.

Fields are indicated as required or optional based on rangeland analysis and other applications. General field data has wide utility to many applications, not just rangeland inventory and analysis. It can be used to stratify District, Forest, and Regional data bases, as well as a basis for extrapolating information with confidence to other sites. It also provides ground-truthing information for IRI. The absence of general field data weakens the utility of the data for other purposes. The General Field Form is described in Exhibit GF.

Normally, a General Field Form must be completed for each and every sample. The exception where one General Field Form can be used for several plots is when more than one transect for cover-frequency and/or line intercept are clustered together — similar to the way Parker three-step transects were clustered.

RANGELAND HEALTH EVALUATION MATRIX (RH)

This form is used to generally characterize the health of the rangeland (National Research Council, 1994). It is useful in orienting the examiner's eye towards characteristics and features that are important in managing rangeland ecosystems. This form is normally completed as part of every sample. The rangeland health evaluation matrix is described in Exhibit RH.

COMMENTS DATA FORM (CD)

This form is used to record any comments for a plot, transect, or polygon as the need arises. Important observations not recorded on other forms should be noted. Clarification of non standard conditions or data codes is documented on this Form. The Comments Data Form is described in Exhibit CD.

OTHER METHODS

Other inventory methods may be employed in addition to the standard region-wide methods for vegetative inventory listed above. Forests are encouraged to adopt statistically sound methods. For example, Uresk (1990) describes a technique using discriminate and cluster analysis for classifying rangeland ecosystems into ecological stages on the basis of cover and frequency estimates of only a few vegetation species.

Currently there is an on-going interagency project to develop a series of inventory and monitoring technical guides for use by all agencies. These technical guides will include methods in this guide, plus additional methods for use in specific locations and situations in the western United States. Methods in these interagency technical guides are approved for use in the Rocky Mountain Region. The technical guides are scheduled to be available in the near future.

In order for another method to be used, it must be published and subjected to peer review, and be approved by the Regional Forester.

TIMING OF SAMPLING

Installation, measurement, and remeasurement of all samples should be timed to coincide with maximum phenological development. This helps in plant identification and also reduces variation in canopy cover estimates. Where possible sample prior to grazing. When planning remeasurements bear in mind the stage of phenological development rather then calendar dates.

LOCATION OF TRANSECTS

The objective of proper transect location is to randomly select a site that is representative of existing conditions or of the desired plant community. Sample plots must be located within definite boundaries of the common vegetation unit to be described. They must be placed on representative and uniform sites so that ecotones are avoided.

Temporary transects should be located in the key area based upon the

professional judgment of the rangeland manager. For permanent transects to be used for trend measurements for many years, special care must be taken to eliminate bias in location. It is advisable to utilize a grid system in locating the benchmark where the transect will be located.

NUMBER OF TRANSECTS

Regardless of the method(s) selected for conducting the inventory, the examiner will have to rely on common sense, professional judgment, and statistical reliability to determine the number of transects required to adequately describe the common vegetation unit. Reference Appendix C for the procedure to determine the appropriate number of transects necessary to describe the variability of the site. Parameters such as intensity, controversy, and the magnitude of the decision to be made will help determine the number of sample sites.

It is preferable to record more transects than to increase the number of sample points on a single transect. This is especially critical in sparse vegetation or plant communities that are patchy in occurrence. After completion of the first transect and use a species-area curve to determine whether the site is adequately sampled. If more transects are needed, be sure they are at least 50 feet apart and parallel, if possible.

ESTABLISHING TRANSECTS

Permanent or temporary transects can be used with all sampling methods. ***Regardless of transect duration, permanent or temporary, all plot or transect locations must be marked on maps and/or aerial photographs.*** Transect locations should be sufficiently described for easy relocation, including road or trail log, reference point description, distance and bearing to the plot from the road or trail, and plot center description. The location should be labeled with the plot number.

Temporary transects are adequate for most inventory purposes, but permanent transects are recommended for benchmark areas where trend of the ecological unit will be monitored over time. Temporary transects are established identical to permanent transects except there are no permanent stakes. ***Paced transects are not approved for collecting vegetation canopy cover and frequency data.***

A common problem related to permanent transects is that too many are initially established and eventually resources may not be available to do an adequate job of remeasurement for monitoring purposes. Bear in mind the intensity needed and the reasons for monitoring when making decisions about number and placement of permanent transects. Also recognize that establishment of permanent transects does not automatically mandate frequent and regular remeasurements. Remeasurement intervals may be decades, or even unknown. Relocation of photo locations from the turn of the century is an example of a "remeasurement."

MARKING AND DOCUMENTING PERMANENT TRANSECTS

Locate permanent transects so they are effective in evaluating change over time. A key item to remember when installing a permanent transect is the ease of relocating the transect in the future. The following items should be addressed during installation:

- Locate transect locations on the allotment map and pin-prick aerial photos. Describe the transect location on the back of R2-2200-PH for all methods, including road or trail log, reference point description, distance and bearing to the plot from the road or trail, and plot center description.
- Use GPS (global positioning system) technology where possible to identify transect location.
- Mark the 0.0 foot and the 100.0 foot transect ends, or center point of the ocular plot, with a metal stake. The stake can be either 1-inch angle iron or 1/2-3/4 inch re-bar. Aluminum survey caps with imprinted transect numbers may be considered for marking the transects. Paint the stake yellow or orange to make it easier to find. It is also a good idea to paint a 6-8 inch rock and place it against the stake. This helps protect it from disturbance and also make the transect much easier to relocate.

PLANT IDENTIFICATION SKILLS

All methods require inventory crews to identify vegetative species encountered in the plots. Rangeland management specialists, wildlife biologists, foresters, soil scientists, ecologists, and other personnel involved in inventory of rangelands should be able to visually identify the common and significant species in the area. The inventory crew should also have available, and be able to use, reference material to properly identify all other vegetative species encountered.

Some of the more obscure plants may play a vital role in detecting trend. Identification of all vegetation encountered in the plots will prove critical to IRI, soil surveys, biodiversity assessments, Forest planning, and ecological classification efforts. Plant identification can be enhanced through self-study. All employees should be familiar with at least 25 of the local predominate graminoid species, 50 forb species, and 15 shrub species through plant collection or herbarium study.10

PHOTOGRAPHS

The following guidelines are universal for all sampling methods. Use them to ensure the highest quality photographs and documentation.

1. It is preferable to use a good quality 35mm camera with a 28mm wide angle lens. However, many modern compact automatic 35mm cameras will take good quality photographs suitable for monitoring purposes. Use color slide film (avoid Ektachrome film because colors tend to wash out due to ultraviolet light). Slide film is superior because good quality prints can be made from the slides, and the slides are still available for presentations.
2. Record information on the Comments Form (R2 2200 CD) as

[10] References recommended for self-study are listed in Appendix D.

necessary regarding lens size, photo direction (bearing), camera settings, and film speed. This is especially important for photographs that are highly probable of being included in a publication.

3. Pictures will be identified by placing symbols in chalk on a small blackboard, or by visibly displaying Form R2 2200 PH with transect photo identification in the picture. For the 3 feet by 3 feet plot, the blackboard should be placed just behind the plot, and for the general view, alongside the tape.
4. Make notes on the R2 2200 CD Form that will help to identify the vegetation in the picture and other conditions worthy of note. Photo information is a permanent part of the transect record.

PHOTOGRAPHING OCULAR PLANT COMPOSITION SAMPLES

Photo records of ocular plots should capture the essence of the plot. Take as many photos as necessary to characterize the site.

1. Take a close-up photograph as described in Photographing Transects, number 2. This photograph should be taken standing at the plot center and facing up-slope. It is not necessary to set the camera at the specified 42 inches; the examiner can hold it at eye level. Use the 3 feet by 3 feet square formed by the carpenters rules, or some other indicator of scale in the photograph.
2. Four additional photos should be taken — one at each of the cardinal directions (Figure 3 6). These photos are to depict the landscape. Each photograph should be framed so that the area above the horizon fills one-fifth or less of the photo frame.

PHOTOGRAPHING TRANSECTS

Two photographs will be taken before reading the transect to show undisturbed vegetation. One photograph will be a close-up shot and the other a general view along the transect line (Figure 3 7). Photographs are inexpensive permanent records of any plot. Examiners should not hesitate to take as many pictures as are deemed necessary to capture important characteristics and features of the site.

1. Photographs will be taken from over the 0.0 foot stake, in the direction of the transect. The camera should be set up at an approximate height of 42 inches directly over the point, or high enough to include the entire 3 feet by 3 feet close-up plot, with Form R2 2200 PH or the identification board.

   The 3 feet by 3 feet plot will be established, using 6-feet folding carpenter rules (white) so the near edge is 3.5 feet from the stake and the far edge 6.5 feet from the stake. It is helpful to clip the rules together so that they will stay in place. Lay the carpenter rule frame on top of the transect tape.
2. The general view will be taken down the transect line and should be focused at 20 feet. Pictures will appear neater if some sky is shown (20 percent or less of the picture). For best results, take pictures

when the light is coming from the left or right of the camera (side lighting). Use a lens hood (sunshade) if available. Use as small an aperture and correspondingly slow shutter speed as possible, so depth of field is maximized.

3. Benchmark clusters will be numbered consecutively for each allotment. Transects will be numbered consecutively for each cluster. This numbering should be unchanged once it is established. The symbols should clearly show in the picture and not be obscured by vegetation.

Figure 3-6. OCULAR PLANT COMPOSITION PHOTOGRAPH LAYOUT

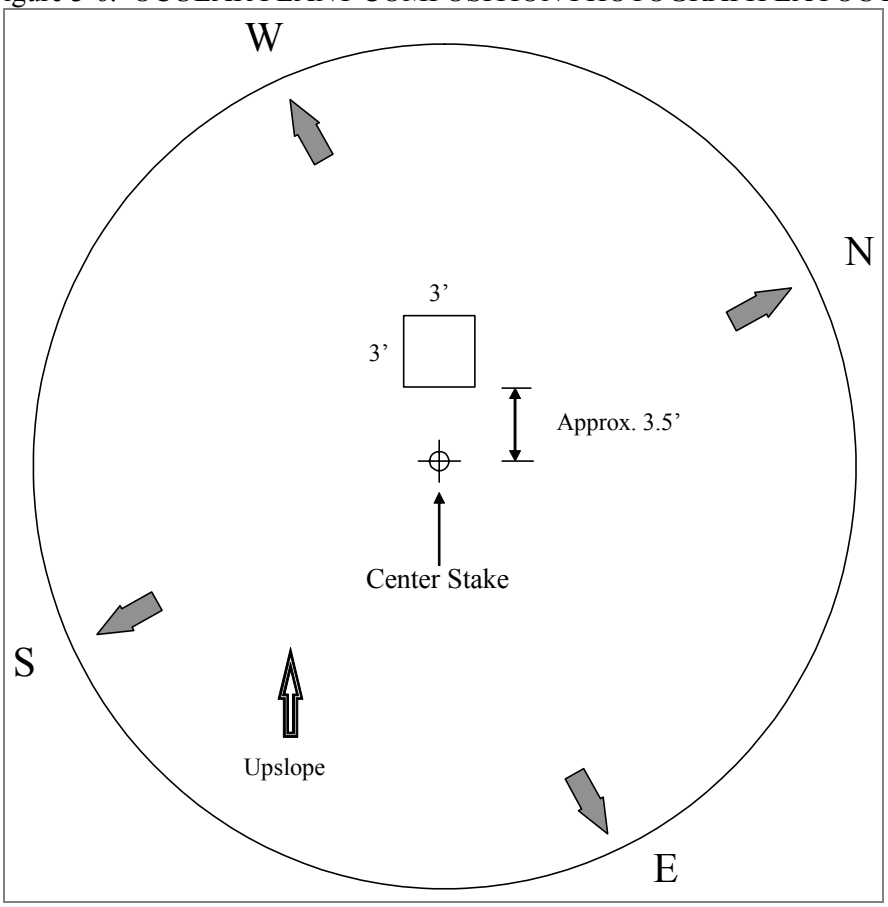


Figure 3-7. COVER-FREQUENCY PHOTOGRAPH LAYOUT