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Monitoring Annual Grassland Residual Dry Matter

A Mulch Manager's Guide for Monitoring Success

Wildland Solutions Field Guide Series

COASTAL TRAINING PROGRAM ELKHORN SLOUGH

CONSERVATION PARTNERSHIP

CALIFORNIA RANGELAND Trust

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Monitoring Annual Grassland Residual Dry Matter

A Mulch Manager's Guide for Monitoring Success

Wildland Solutions Field Guide Series

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Contents

Part 1
Why Monitor Residual Dry Matter (RDM)?

Mulch or RDM has been recognized by researchers and rangeland managers as an important indicator of rangeland health and productivity for over 60 years.

The amount of mulch (RDM) on the ground surface in October has a direct influence on a large number of environmental factors (Barry 2006, Grazing Impacts 2007) including:

- Forage productivity
- Seedling germination and establishment
- Soil surface erosion
- Water infiltration
- Wildlife habitat
- Livestock forage availability
- Fire hazard
- Nutrient cycling
- Plant species composition
- Soil stability and structure

The purpose of an RDM monitoring program is to collect information in a practical manner that is adequate to assess grazing objectives and make management adjustments when needed.

Residual Dry Matter (RDM) when measured in lbs./acre is objective, measurable, supported by research and directly related to rangeland health.

What Exactly is Residual Dry Matter (RDM)?

How RDM is described and defined has evolved with time. The early researchers and managers did not refer to RDM, they used terms such as herbage, residue, mulch and forage.

In **1942** Hormay suggested that ranchers should measure and evaluate "Forage left on the ground from the previous year's growth."

In **1951** Bentley and Talbot suggested a need to evaluate and manage for the "…amount of herbage left to protect the soil."

In **1956** Heady suggested range managers should manage for mulch and defined it as "The portion of herbage crop that remains on grasslands is mulch."

In **1980** Bartolome et al. measured "Mulch or plant residue."

In **1982** Clawson et al suggested managing for Residual Dry Matter (RDM) which was "…residual dry matter (the amount of dry plant material left on the ground from the previous year's growth)."

In **2006** Bartolome et al. defined RDM as "Residual dry matter is the old plant material left standing or on the ground at the beginning of a new growing season." However; in the same publication they suggest removing all summer annuals and leaves when measuring RDM if forage production is the primary management goal.

RDM/Mulch: Components and Definitions

When measuring RDM, it is important to record what is being included. The organic components of RDM/mulch can be broken into three components as follows:

Components

A. Current year's growth of palatable forage plants.

B. 1. Weeds and non-palatable plants.
2. Trees and shrub leaves.
3. 1/4" stubble, seeds and some residue on the ground that is not picked up when clipping plots. (100-200 lbs./acre)

C. Thatch, which is dead organic matter more than one year old.

Definitions

1. Forage: Includes only component A–Palatable and available herbage from the previous 12 months growth that occurs on the site.

2. Residual Dry Matter (RDM): Includes components A and B–All herbage from the previous 12 months growth that is present if providing protection and nutrients to the site. Include herbage that is not picked up when clipping plots.

3. Total Litter/Mulch: All un-decomposed herbage including older herbage (thatch) that might be providing soil protection and nutrient recycling.

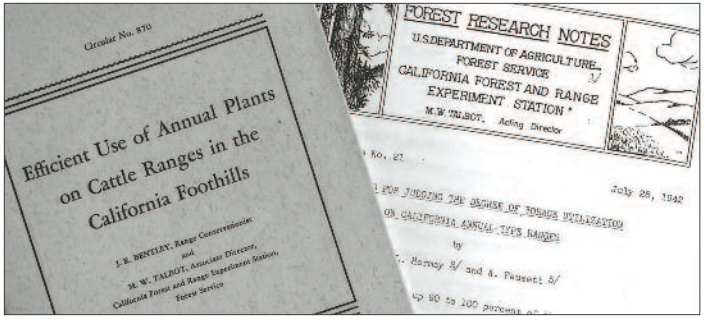
A brief history of selected research that supports the management and monitoring of RDM.

1942 "A healthy, productive range condition in these annual types depends on the amount of old forage left on the ground at the end of the grazing season. This residue forage determines both the amount and the quality of forage produced in following years. An adequate cover of vegetation serves to protect the soil from the direct action of rain, wind, sunshine, and other forces that may cause erosion or lower the fertility of the soil." (Hormay and Fausett 1942)

1951 "Moderate utilization. This patchy use of annual-plant vegetation maintains satisfactory soil conditions and a good plant mixture, without evidence of deterioration in either." (Bentley and Talbott 1951)

1956 "On the basis of this experiment there seems little doubt that the amount and position of mulch in the California annual-type grassland are important factors which influence botanical composition and speed of plant growth." (Heady 1956)

1980 "Mulch protects the soil surface from erosion and provides a favorable environment for plant growth." (Bartolome et al. 1980)


Circular No. 870

Efficient Use of Annual Plants on Cattle Ranges in the California Foothills

J. R. BENTLEY, Range Conservationist
and
M. W. TALBOT, Associate Director,
California Forest and Range Experiment Station,
Forest Service

FOREST RESEARCH NOTES

U.S.DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CALIFORNIA FOREST AND RANGE
EXPERIMENT STATION
M.W.TALBOT, Acting Director

July 28, 1942

1982 "Residue is the variable in the fall that can be most controlled by management." (Clawson et al. 1982)

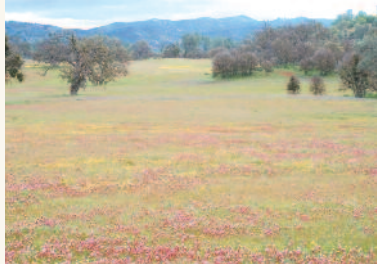
1988 "Residual dry matter provides favorable microenvironments for early seedling growth, soil protection, adequate soil organic matter maintenance, and a source of low-moisture fall forage for livestock." (Frost et al. 1988)

2003 "Native annual forb species richness and cover were higher in grazed sites, and this effect was concomitant with decreased vegetation height and litter depth." (Hayes and Holl 2003)

2006 "…the amount of RDM remaining in the fall, subject to site conditions and variations in weather, will influence subsequent species composition and forage production." (Bartolome et al. 2006)

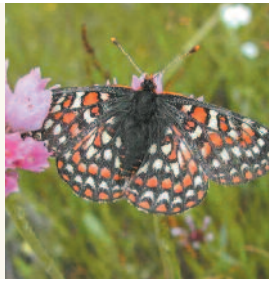
Key Ecological Findings:

In general low to moderate mulch levels favor low growing wildflowers such as poppies, lupine, and buttercups.



High mulch tends to favor tall exotic annual grasses such as wild oats and bromes. Meadow voles are also benefited by high RDM levels.

Bay checkerspot butterfly has been found to respond positively to low RDM levels that reduce exotic annual grasses and encourages forbs used by the butterfly such as clovers and plantain.



Vernal pool habitat with high mulch levels may become dominated by exotic annual grasses. Grazing can remove the exotic grasses, encourage native vernal pool plant species, and increase pool longevity.

Perennial native flowering bulbs and corms tend to be favored with low to moderate mulch levels, becoming dominated by exotic annual grasses when ungrazed.

Livestock tend to browse willows, oaks and various shrubs during the summer when annual grasses and forbs are dry and of low nutritional quality.

Adequate mulch levels are important for good germination and establishment of new annual grass seedlings, reduces rainfall impacts and minimizes soil erosion while improving water infiltration into the soil.

Low mulch levels result in poor germination and survival of seedlings, unacceptable soil erosion and surface runoff instead of water infiltration.

Key Management Findings:

There are many and varied reasons to mange for and monitor RDM (Bush, 2007).

"Fall feed is available 2-4 weeks earlier on moderately grazed ranges compared to heavily grazed rangelands with low RDM. Areas heavily grazed often appear to greenup earlier than areas with good mulch. However; the areas with good mulch can be grazed earlier in the fall."

—Tim Koopmann, Rancher, Director CA Rangeland Trust

"Retaining an adequate mulch layer is smart range management and is never a waste of forage. Areas with adequate RDM in the fall consistently produce more forage the next year than areas grazed hard with little RDM left on the site."

—Pete Van Hoorn, Range Conservationist, Alameda County RCD

"Livestock grazing is an economical tool for maintaining native wildflowers including bulbs such as Brodiae, perennials such as shooting stars, and annuals such as popcornflowers, clovers, and tarplants associated with Coastal Prairie grasslands. Without livestock grazing, or some risky strategy such as prescribed burning, these species eventually get choked out by exotic grasses including velvet grass, tall fescue and bromes."

—Grey Hayes, Grassland Ecologist

"Saving forage for use during the summer and in early fall makes economic sense as running livestock on native grass is much cheaper and less effort than feeding hay to livestock on a regular basis..."

—Darrel Sweet, Rancher, past President, California Cattlemen's Association

"A grazing strategy that retains adequate RDM in the fall helps to ensure the long term productivity of the many rangeland resources found on a ranch."

—Sheila Barry, Natural Resources/Livestock Advisor, UC Cooperative Extension

"Carefully managed livestock grazing can be used as an effective stewardship practice for maintaining high biodiversity in California annual grasslands, vernal pool communities, and oak savannahs."

—Rich Reiner, Senior Ecologist, The Nature Conservancy

"Livestock grazing can be an effective tool for managers of public properties who need to integrate multiple objectives such as fire hazard reduction, maintenance of native wild-flowers and habitat suitable for wildlife species associated with low structure vegetation."

—Pat Congdon, Manager, Santa Clara County Open Space Authority

Training is Important

It is recommended that anyone intending to monitor rangeland RDM levels first attend an appropriate training session. Training sessions that include monitoring of RDM are often sponsored or cosponsored by the Society for Range Management, University of California Cooperative Extension, Resource Conservation Districts and Federal Agencies. To develop accuracy and consistency, users of the photo-guide should clip and weigh enough RDM plots to assure that their estimates of RDM classes are appropriate.

Part 2
How to Monitor RDM

To be effective, monitoring data must be compared to an objective, a hypothesis, or a baseline dataset. All of the following four steps need to be conducted if an RDM monitoring program is to be effective and capable of providing useful information for making management decisions.

Four steps for monitoring:

1. ***Set objectives.*** Far too often monitoring is attempted without realistic objectives being first established.
2. ***Establish RDM classes to be used when collecting data.*** Consistency is important here. This step needs to consider how the data collected in step three will be utilized in step four.
3. ***Collect data.*** Data collected can be intensive with considerable clipping and weighing of RDM plots, or extensive with reliance on visual observations based on published photo guides. Intensive data collection does not always provide more useful information.
4. ***Prepare report.*** Reports can be a simple paragraph written into a diary by a rancher, or a detailed report as part of a formal study. It is important to be sure data is collected in a manner that easily fits into a format appropriate for the final report.

Setting RDM Objectives

Specific, measurable objectives that are appropriate for the site potential need to be established before field surveys are ever conducted.

A monitoring program cannot be implemented without clearly defined objectives. By definition, monitoring is the collecting, analysis and interpretation of information to see how well management objectives are being met.

Below are some examples of well stated objectives.

Example RDM objective A:
The objective is to retain 750-1100 lbs./acre of RDM in the fall on 90% of the forage areas within the pasture.

Example objective A clearly states the targeted RDM level, when it is to be measured, and what is an acceptable level for success.

Example RDM objective B:
The objective is to retain on 90% of the pasture RDM levels that are:

700-1000 lbs./acre on slopes less than 10%
900-1200 lbs./acre on slopes 10-40%
1200-1500 lbs./acre on slopes over 40%

Example objective B establishes RDM objectives based on slope.

Example objective C:
The objective is to retain on 85% of each pasture or sub-unit within a pasture the following RDM levels:

1500-2000 lbs./acre on sensitive riparian units
700-1000 lbs./acre on upland grass habitat
500-800 lbs./acre on valley floor habitats

Example objective C recognizes that RDM levels may need to vary by habitat type and basic site productivity to meet different goals. Of course this type of objective will require locating where the various habitats occur, preferably prior to monitoring of RDM levels.

NOTE: The objectives shown in A-C are provided as examples and are not recommendations. These examples are expressed as a range that applies to the pasture and not as an average or a minimum value. Averages often mask problems. When a pasture is 40% overused, but the average is O.K., there still may be a problem that needs to be addressed.

The RDM objective established for a site will depend on the goals for the site. Recommended RDM levels for basic site protection are provided in UC DANR publication 8092. (Bartolome et al. 2006)

Often there are several goals for the same rangeland area. The website www.grazingimpacts.info provides an analysis tool using the indicator concept to assist in evaluating various grazing strategies when multiple, sometimes conflicting, goals exist for a single management unit.

Establishing RDM classes to be used when conducting surveys and collecting data.

Prior to field mapping a decision needs to be made as to what and how many RDM classes are to be utilized. A predetermined set of RDM classes increases the efficiency of pasture surveys. There is no specific best number of classes to use. Many surveys are conducted that record RDM levels as single pound increments. Instead of recording information as single pound increments, establishing RDM classes that utilize a limited number of classes allows a significant increase in efficiency with no apparent decrease in quality of information gathered. Some examples include:

A minimum of 2 classes is required.

- Meets the objective
- Does not meet the objective.

UCCE publication 8092 (Bartolome 2006) recommends the use of 3 RDM classes:

- RDM level is high (exceeds the objective)
- RDM level is moderate (meets the objective)
- RDM level is low (below the objective)

The RDM classes utilized for monitoring RDM on a typical California annual grassland site that produces 1,800-2,000 lbs. of herbage in an average year could also use 7 classes as follows:

- RDM is more than 1,500 lbs./acre
- RDM is between 1,000-1,500 lbs./acre
- RDM is between 700-1,000 lbs./acre (established objective)
- RDM is between 350-700 lbs./acre
- RDM is below 350 lbs./acre
- RDM has been removed by fire and is below 100 lbs./acre
- Facilities-No RDM level established

The RDM classes utilized for monitoring RDM on a highly productive coastal prairie site that produces more than 4,000 lbs. of herbage in an average year could use 8 classes as follows:

- RDM exceeds 4,000 lbs./acre
- RDM is between 3,000-4,000 lbs./acre
- RDM is between 2,000-3,000 lbs./acre
- RDM is between 1,200-2,000 lbs./acre (established objective)
- RDM is between 800-1,200 lbs./acre
- RDM is below 800 lbs./acre
- RDM has been removed by fire and is below 100 lbs./acre
- Facilities- No RDM level established

The classes established for monitoring can be done in a manner that accommodates variable objectives for differing slopes or productivity classes found within a ranch or project area.

- High RDM (RDM is more than 200% of minimum)
- Exceeds objective (RDM is between 150% and 200% of minimum)
- Meets objective (RDM is more than minimum but less than 150% of minimum)
- Below objective (RDM is below the minimum, but more than 50% of minimum)
- Low (RDM is less than 50% of minimum)
- Burned by fire (Site has been burned by a fire with less than 100 lbs./acre of RDM)
- Facilities (Facilities with no RDM minimum established)

Collecting Data

Collect data only after specific RDM objectives and RDM classes to be used in monitoring have been established. The format for how results will be reported also needs to be determined before data collection begins.

There are many acceptable procedures for collecting data that can be utilized for assessing objectives. Publications describing useful monitoring techniques, include "How To" (UCCE 1994), "Utilization studies and residual measurements" (USDI BLM 1996) and "Sampling vegetation attributes" (USDI BLM 1996).

Useful information collected when surveying annual grassland vegetation types often includes RDM zone mapping, photo points, clipping and weighing plots, comparative yield surveys, visual estimates and estimates of species composition.

RDM Zone Map

An RDM zone map can be an extremely useful document.

The RDM zone map can be fairly general with only 2-3 categories, (ie: meets the objective, or does not meet the objective) with zones sketched on a piece of paper and retained in a folder.

RDM zone maps can also be very detailed with 3-7 RDM classes evaluated and data entered into a modern GIS mapping program that permits calculation of acreages with comparisons to previous year's data. (Frost et al. 1988, Guenther 2007)

Photo Points

Photo points are particularly suited for evaluating long term changes related to:

- Grassland encroachment by shrubs
- Impacts to willows within riparian areas
- Vegetation changes when grazing strategy is modified
- Vernal pool vegetation changes
- Recovery after fire
- Annual variation of RDM levels

Publications describing the effective use of photo points are available from several sources. (UCCE 1994, Hall, 2001, Hall 2002, McDougald et al. 2003)

Supplemental Data

Additional data may be collected to provide supporting information for an RDM zone map. Information can be in the form of reference photographs, notes regarding plant species composition, noxious weeds, and unusual wildlife seen. The supplemental information can be recorded as general observations for the entire pasture, as detailed information recorded at specific reference sites with GPS coordinates or at sites established with permanent reference markers.

Focus on information related to stated goals and objectives when collecting supplemental data.

The supplemental data collected at a reference site will depend on the objectives for a property. The Wildland Solutions RDM monitoring procedure can be found at www.wildlandsolutions.com which includes a sample form and materials that can be used to collect supplemental data at monitoring reference sites. (Guenther 2007)

Clipping and Weighing RDM Plots

The amount of herbage that occurs on a site can be estimated by clipping and weighing small plots. For annual grassland sites the plots are typically either a 13.25" diameter circular hoop or a 12" square frame plot. The herbage is weighed in grams and converted to lbs./acre of RDM. Different formulas need to be used due to the differing plot size. The concept is the same in that for both plot sizes the formula is:

(grams per plot) x (conversion factor) = lbs/acre of RDM

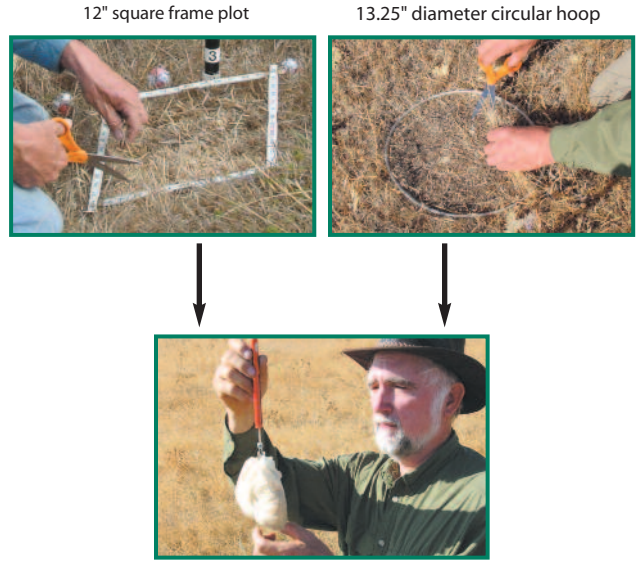
Examples for conversion are:

Circular 13.25" diameter hoop plot.
(Grams clipped) X 100 = lbs/acre of RDM
(11 grams) X 100 = 1,100 lbs/acre of RDM

Square 12" frame plot
(Grams clipped) X 96 = lbs/acre of RDM
(14 grams) X 96 = 1,344 lbs/acre of RDM

Clipping notes:

- Document what herbage components are being included, (ie palatable forage, weeds, leaves, thatch)
- Include an estimate for uncollected material left on the ground.
- Set the scales to zero with the collection bag attached to scales, or subtract the weight of bag after weighing.
- Air dry any wet or green samples for 2-3 days.



The herbage is weighed in grams and converted to lbs./acre of RDM. Different formulas need to be used due to the differing plot size.

Spring-Summer RDM Monitoring

Monitoring of RDM is typically conducted in the fall, October-November. However; monitoring of RDM can be conducted at anytime with the RDM level projected to a fall date. RDM disappears due to weather and microbial action throughout the summer even if not grazed. The rate of RDM disappearance depends on the vegetation being measured. Some plants such as fine leafed annual clovers and filaree have a higher than average disappearance rate; while coarse plants such as wild oats and thistles have a lower than average decomposition rate. An average decrease of 7% per month was found to occur in one study (Frost 2005). An estimated decrease of 5-13%/month should be included when determining fall RDM levels based on spring or summer measurements.

Mapping RDM Zones

RDM mapping can be a quick, efficient, and accurate method for monitoring livestock use. (Harris, 2002) A good map such as a 1:24,000 scale USGS topographic map, which includes management unit or pasture boundaries and important features such as livestock water, fences and roads, is typically utilized as a base field map for recording data.

The mapping detail required should be proportional to the decisions being made. A combination of reference photographs, descriptive narrative and clipping and weighing RDM within representative areas is utilized to determine the specific class for a particular portion of a pasture. Mapping of RDM zones is conducted by visually examining an adequate amount of the pasture to determine and map where each of the RDM classes occur within the pasture.

Livestock tend to graze in a patchy manner, heavily using small areas and lightly using an adjacent area. Boundaries between RDM zones are recorded on the map. When determining the boundary between two classes it is often necessary to decide that an area is "mostly" within a given class and an adjacent area is "mostly" in a higher or lower class. The boundary is placed on the map where one "mostly" shifts to the other "mostly". Features such as topographic breaks in slope, changes in aspect and the resulting vegetation changes influence livestock use patterns and often can be used to help determine the boundary between two RDM classes.

Interestingly, even though 3-6 classes of RDM are typically utilized when mapping RDM, most pastures tend to only have 1-3 classes of RDM when surveyed. Cattle tend to spread out and locate areas of good remaining forage before severely impacting a significant portion of any pasture.

Notes are made on the field map regarding specific information obtained, especially from monitoring reference sites, and sites that have been clipped and weighed.

The RDM zones need to be delineated and recorded before leaving a given pasture.

The RDM zone map data can be entered into a GIS database that provides the ability to archive the data, compare data to previous year's data and conduct extensive analysis of the data. An important capability of a GIS system is the ability to display raw data as information that assists managers to make knowledgeable decisions.

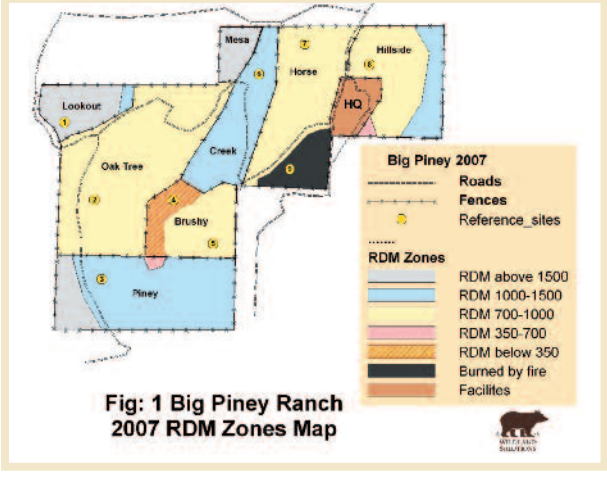


Fig: 1 Big Piney Ranch
2007 RDM Zones Map

When creating GIS maps it is important to work with GIS staff to incorporate meaningful colors and legends that will assist in the communication of intended information in an effective manner.

Preparing A Report

Preparing a monitoring report is much more than data collection. It is conducted to determine if management objectives are being met. Before collecting field data it is essential to determine how the data collected is going to be utilized.

Three questions need to be addressed and answered.

1. Who is going to utilize the information collected?
2. What decisions need to be made?
3. How is data and analysis information to be stored and shared?

Understanding why monitoring is being conducted and how the information developed is to be utilized will facilitate efficient collection of data and report preparation.

To avoid wasting time and energy include data that:

- Can help someone make a decision
- Actually addresses specific questions of interest
- Can be compared to future surveys

A report can be as simple as an entry in a diary describing what was observed and the date observed, or it can be a complex GIS map with archived data tables.

Report formats are numerous, varied, and may include:

- Narrative entries in a diary
- Narrative report to a client or supervisor
- Photographs of specific sites
- Tables of data
- Maps, paper or digital GIS
- Recommendations for future actions

Interpreting large amounts of monitoring data without a map can be difficult, especially if data is retained as field notes, data tables and transect averages. Including a pasture success map in a report can provide a powerful visual aid that assists in focusing attention on specific pastures with potential problems of overuse and under use.

A GIS system is a valuable tool that allows the development of color coded maps which present data as visual information that ranchers and managers can utilize for making knowledgeable decisions.

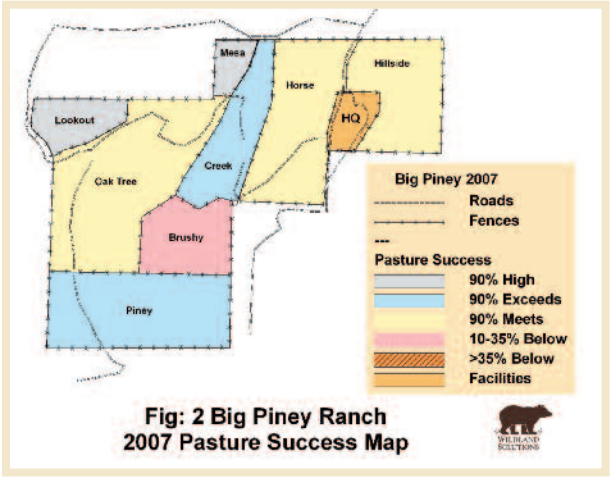


Fig: 2 Big Piney Ranch
2007 Pasture Success Map

Livestock management is typically implemented on a pasture or management unit basis; therefore it makes good sense to show levels of success on a pasture basis.

Part 3
Photo Guide Techniques

Photoguides are valuable tools that assist in the efficient monitoring of RDM. Photo guides have been used for more than 60 years as aids to monitoring of RDM within annual grassland types. (Hormay 1942, Bentley 1951, USDA-SCS 1962, Clawson 1982, Guenther 1998, Hall 2001, Hall 2002, Bartolome 2006)

A photo guide cannot be used alone. To develop accuracy and consistency, photo-guide users need to clip and weigh enough plots to verify their estimates of RDM classes as appropriate. An important advantage of a photo guide when compared to clipping and weighing is efficiency and the ability to effectively evaluate large areas. Clipping and weighing is time consuming and because each plot evaluates only a very small area, numerous plots are needed to have a high degree of accuracy.

Caution needs to be exercised when using photo guides as the type of herbage and time of year need to be considered. Sites that have been grazed during the dormant season often have been trampled by livestock with little standing grass, and an appearance of low RDM even though RDM may be fairly high. Clipping and weighing a few plots periodically will help the surveyor calibrate the visual estimation in the field.

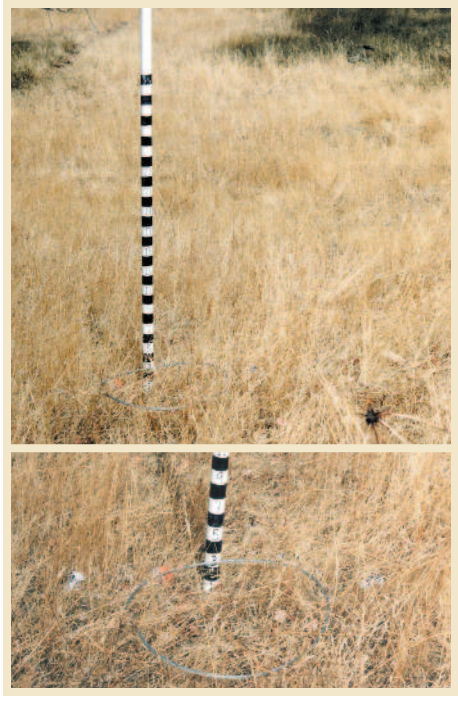
Two RDM photo guides are available for CA annual grasslands. UC Pub 8092 (Bartolome 2006) which utilizes B&W photographs originally developed by the USFS in 1951 (Bentley 1951). The second photo guide is included in this publication which utilizes color photographs originally developed in 1998 (Guenther 1998). Both photo guides use a combination of representative pictures and a narrative description to estimate the class of RDM that occurs on a site.

RDM is more than 1,500 lbs. per acre

Rangeland may show evidence of grazing use. Ground cover is essentially complete. Little bare soil apparent. Robel pole is obscured to a height of 5-8+". Golf ball sized objects seldom seen at a distance of 10 feet and not visible from a distance of 20 feet. Under some circumstances if a site is grazed after grass has cured, cattle may trample herbage, laying it flat on the ground, resulting in a situation where reference items may be visible even with high levels of herbage present. Always clip some plots to establish a reference for the site being surveyed.

*Note the example above is in excess of 3,000 lbs./acre RDM.

RDM is 1,000-1,500 lbs. per acre



Rangeland may show evidence of considerable grazing use. Seedstalks may be heavily utilized. Ground cover is essentially complete. Little bare soil apparent except for occasional pocket gopher activity and livestock/game trails. Robel pole is obscured to a height of 2-4+". Some golf ball sized objects may be partially visible or only barely visible at a distance of 10 feet, but seldom visible at a distance of 20 feet.

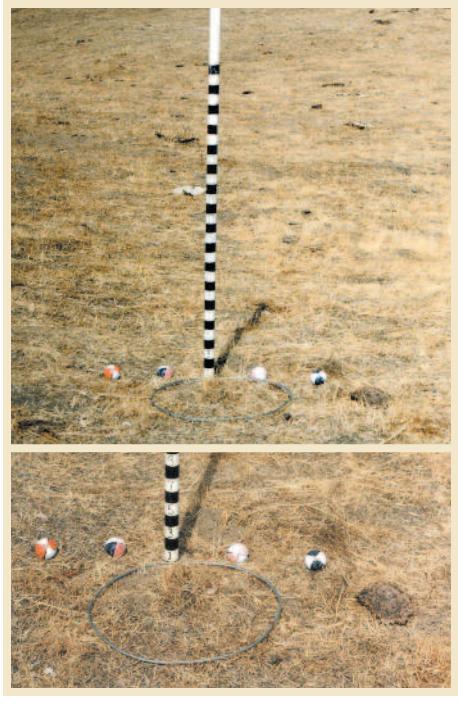
RDM is 700-1,000 lbs. per acre

Rangeland typically shows clear evidence of grazing use. Seedstalks may be heavily utilized or trampled. Considerable ground cover present. Some bare soil apparent, including pocket gopher activity, from a distance of 20 feet. Robel pole is irregularly obscured to a height of 1-2+". Many golf ball sized objects are partially visible at a distance of 10 feet, and some may be visible at a distance of 20 feet.

RDM is 350-700 lbs. per acre

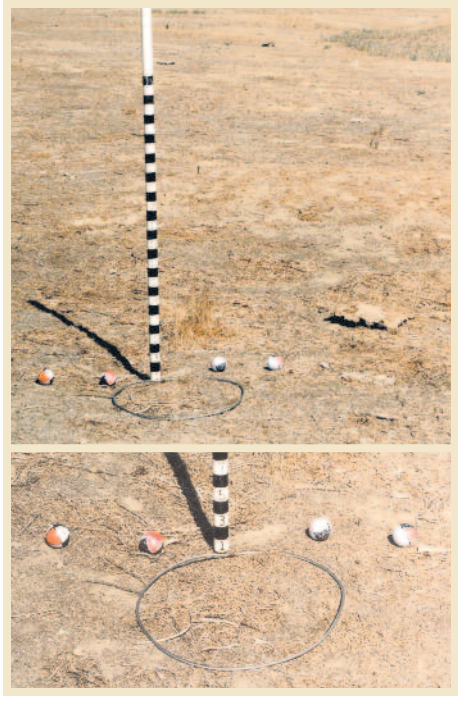
Rangeland shows evidence of extensive grazing use. Residual vegetation is patchy with many areas grazed to less than 1" and other areas with 3-5" of vegetation remaining. Some bare soil apparent. Robel pole is only partially obscured at a height of 1-2". Many golf ball sized objects clearly visible at a distance of 10 feet and mostly visible at a distance of 20 feet.

RDM is 200-350 pounds per acre



Rangeland shows evidence of extensive grazing use. Standing seedstalks scarce, some seedstalks occur as litter on the ground. Ground cover sparse and clumpy, large areas uniformly grazed to about 1", scattered areas of 3-5" vegetation exist. Some bare soil readily apparent. Robel pole is fully visible. Most golf ball sized objects clearly visible at 10 feet, and mostly visible at 20 feet.

RDM is less than 200 lbs. per acre



Rangeland shows evidence of total use. Unofficial terms such as “blitzed”, “nuked”, “hammered”, and “slicked” have been used to describe this class. No standing seedstalks remain. Some seedstalks and seed heads occur as litter on the ground. Most areas grazed to less than 1". Considerable bare soil readily apparent. Golf ball sized objects clearly visible at 20 feet. (Visible at 200 feet!!)

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Understanding Livestock Grazing Impacts

This website is sponsored and hosted by Wildland Solutions. It is based on information contained in *Understanding Livestock Grazing Impacts*. UC DANR publication 21626 published in 2006. The website serves as a source of information related to grazing impacts for a large number of ecological indicators. It also provides the ability to compare and analyze impacts to indicators when considering potential grazing strategies. For more information, visit www.grazingimpacts.info