Range Improvement Task Force • Report 76

Data Entry, Organization and Analysis for Rapid Assessment Methodology

NM STATE UNIVERSITY

Range Improvement Task Force
Cooperative Extension Service / Agricultural Experiment Station
College of Agriculture and Home Economics

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INTRODUCTION

Monitoring is the act of watching, keeping track of, or checking, usually for a special purpose. On rangeland, there are many potential parameters to monitor. To determine if current management is meeting specific objectives, as many parameters as possible should be considered. Adaptive Management is the process of modifying management practices based on scientifically derived and objectively collected quantitative monitoring data (Ringold et al. 1996). Most ranchers and rangeland managers regularly monitor their resources, often this is simply a windshield or horseback survey of the resources while taking mental notes. Our purpose in this publication is 1) to describe why natural resource monitoring may require more attention to detail, procedures, and records; and 2) to present an effective and efficient monitoring database to track rangeland resources through time.

Approximately 80% of New Mexico is classified as rangeland, about half of which is federally owned (NRCS, 2007). Public rangeland laws and regulations, as well as executive and judicial orders and decisions, have changed the regulatory environment in which livestock producers operate. These changes affect the stability of New Mexico's livestock industry (NMDA, 2007). Many of these regulations dictate the desired status of range parameters, such as by setting minimum stubble heights or maximum utilization levels. Additionally, several pieces of legislation, including the Federal Land Policy and Management Act and the National Environmental Policy Act, require that the managing agency conduct monitoring on federal lands (Elzinga et al. 1998).

We believe that a comprehensive monitoring program is an essential component in all natural resource management activities on New Mexico's private and public rangelands. Natural resource management activities include management of livestock, wildlife, watershed, forestry, and range resources as well as associated restoration activities. Monitoring data can improve adaptive resource management decision making, document compliance with federal policies and regulations, and help maintain and manage New Mexico's natural resources.

Recognizing the need for comprehensive monitoring, the Range Improvement Task Force (RITF) and New Mexico State University Department of Animal and Range Sciences faculty developed the Rapid Assessment Methodology (RAM) (Allison et al., 2007). RAM was designed to quickly and objectively assess range condition in order to make range management decisions based

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Figure 1. **Ground level photo.**

Figure 2. **Landscape photo.**

on quantitative data with the addition of qualitative data to aid in inference.

RAM is an effective and flexible monitoring tool that fits easily into an adaptive management plan. A RAM transect can be run in approximately 30 to 60 minutes and documents stubble height, ground cover, species composition, standing crop, and ungulate fecal group numbers. When paired with ungulate exclosures, RAM can be used to estimate utilization or relative use. We are providing as a resource the RAM input and summary workbooks and Microsoft Excel files, found on the enclosed CD. Using this program, data can be quickly entered, analyzed, and interpreted. This allows natural resource managers to efficiently collect and analyze data in a short period of time (typically between one and five days) and then use that data in making management decisions.

METHODS—FIELD WORK

It is assumed that data have been collected using RAM (Allison et al., 2007). We will briefly outline the monitoring protocol and types of data collected for use with the data analysis program. For a complete description of monitoring methods used, see the Rapid Assessment Methodology publication by Allison et al. (2007).

Select Key Areas and Determine Monitoring Schedule

Selecting an area to monitor is the crucial step in the monitoring process. Monitoring sites should be representative of a larger area for which management decisions will be made (Allison et al., 2007). Effort in monitoring a vegetation type should be proportional to the area it represents in the pasture or allotment. For example, if 20% of the monitored area is vegetated by piñon-juniper (PJ) habitat, then approximately 20% of the monitoring sites should be located in PJ habitat. Additionally, one or two additional sites can be added for special habitats (e.g., wet meadows or riparian areas); however, these sites should not interfere with monitoring more representative sites or with the ability to complete monitoring on a regular basis. It is wise to devote enough time to site selection to ensure representation. Deciding when to monitor is most affected by the purpose or objective of monitoring. If you monitor only once a year, monitor at the end of the growing season.

Establish Photo Points

Although photographs are qualitative, they provide a valuable visual record of conditions on the day when monitoring data was collected. See Figures 1 and 2 for examples of ground level and landscape photographs.

Run Step-Point Transect

Begin your stride with your left foot, and every time your right foot hits the ground (Figure 3) record the ground cover, species of the nearest plant, and stubble height of nearest plant (Allison et al., 2007).

At each of the 100 observation points, record basal hits to determine cover. In Figure 4, point one of the transect landed on vegetation (V); in this case, the vegetation the toe landed on was Kentucky bluegrass (POPR) and stubble height of that plant was 4.5 inches. Each basal hit is classed as vegetation (V), bare ground (B), litter (L), or rock (R). Point 1 of Figure 5 illustrates field data recording technique when forbs are included in the assessment. Figure 7 is a full datasheet and can be copied for field use. To aid in forage plant species identification Appendix 1 (available on the enclosed CD) contains a list of some of the most common grasses in New Mexico, along with their abbreviations and photos and line drawings as available.

Stubble height should be measured by pulling the grass leaves up (not by measuring in place) and estimating the average of the majority of leaf lengths, to the nearest 1/2 in. (Figure 6). This reduces variability due to moisture, trampling, and other sources of variance.

Determine Standing Crop

Five 6-in. x 24-in. quadrats are clipped at the 20th, 40th, 60th, 80th, and 100th observation points (Figure 8). Clippings are dried, weighed to the nearest tenth of a gram, and analyzed to estimate pounds of standing crop of palatable forage species per unit area (Bonham, 1989; Allison et al., 2007).

Fecal Pellet Group Counts

A 12-ft. belt transect run in conjunction with the step-point transect in which ungulate feces groups are counted (Allison et al., 2003, 2007).

Figure 3. **Observation point.**

Rapid Assesment Met
Allotment Name:ABC Allotment
Pasture: South
Technician: Gomez

Obs Pt (1-100)	1	2	3
Ground Cover	V	B	V
Nearest Grass Species	POPR	BRIN	POPR
Stubble Height	4.5	6	5
	11	12	13
	V	V	V
	BRIN	BRIN	POPR
	5.5	7	5.5

Figure 4. **Sample data sheet—grasses only.**

Rapid Assesment Met
Allotment Name:ABC Allotment
Pasture: South
Technician: Gomez

Obs Pt (1-100)	1	2	3
Ground Cover	V	B	V
Nearest Forb or Grass	POPR	BRIN	POPR
Nearest Grass and its Stubble Height	4.5	6	5
	11	12	13
	V	V	V
	BRIN	BRIN	POPR
	5.5	7	5.5

Figure 5. **Sample data sheet—grasses and forbs.**

Rapid Assesment Methodology (RAM) Datasheet

RITF (NMSU)

Allotment Name:_____ Ranger District:_____ Forest:_____ Date:_____

Pasture:_____ Location:_____ Lat/Long:_____

Technician:_____

1	2	3	4	5	6	7	8	9	10

11	12	13	14	15	16	17	18	19	20 (Clip)

21	22	23	24	25	26	27	28	29	30

31	32	33	34	35	36	37	38	39	40 (Clip)

41	42	43	44	45	46	47	48	49	50

51	52	53	54	55	56	57	58	59	60 (Clip)

61	62	63	64	65	66	67	68	69	70

71	72	73	74	75	76	77	78	79	80 (Clip)

81	82	83	84	85	86	87	88	89	90

91	92	93	94	95	96	97	98	99	100 (Clip)

Comments on Clipped Plots

1	2	3	4	5

Dot Tally of Ungulate Grazers

Elk	
Cattle	
Deer	
Horse	

Soil Moisture Depth

Comments:

Figure 6. **Data sheet.**

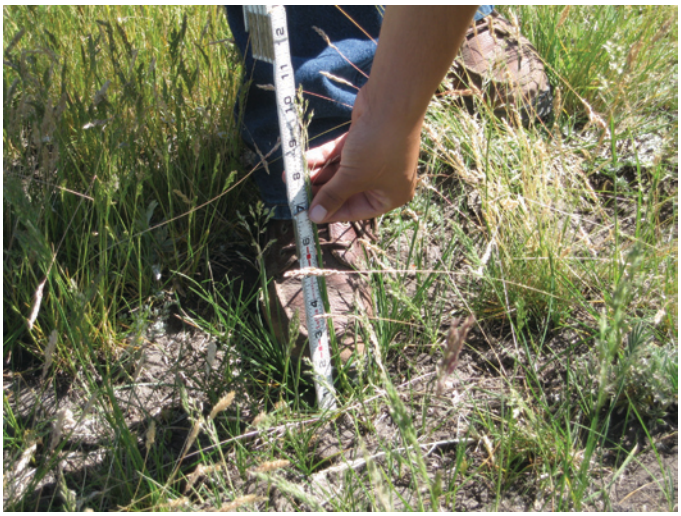

Figure 7. **Measuring stubble height.**

Figure 8. **Clipping vegetation from a 6 x 24-in. metal frame to estimate pounds per acre of production.**

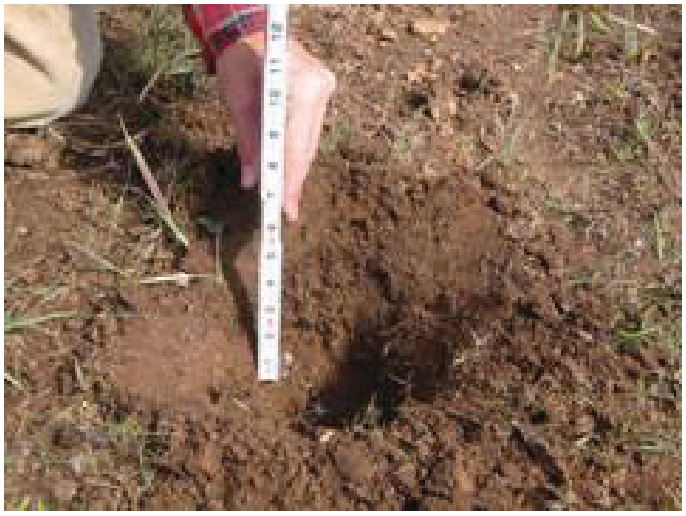

Figure 9. **Measuring soil moisture in a 12-in.-deep soil pit.**

Figure 10. **Ungulate exclosure (utilization cage) placed in a meadow to determine use by domestic and wild ungulates.**

Determine Soil Moisture

A small soil pit (Figure 9) approximately 12 in. deep should be dug near the transect to qualitatively describe soil moisture. Soil moisture can be described as dry, moist, wet, etc.

Make General Observations

These observations include suitability of key site location, presence of and distance to water or road, slope, aspect, green forage available, presence of livestock or elk, and any other relevant information.

Table 1. Stubble Height Classes of Common Species (Scientific Name) and Minimum Stubble Heights (Holecheck & Galt, 2004)

Height Classes of Common Species & Minimum Stubble Heights				
Extra Short 3/4"	Short 1.5"	Short-Mid 2.5"	Mid 4.0"	Tall 8.0"
*Bouteloua gracillis**	*Bouteloua aristoides*	*Agropyron cristatum*	*Agropyron intermedium*	*Andropogon* spp.
Hilaria belangeri	*Boutelour gracillis*	*Agropyron smithii*	*Aristida arizonica*	
Muhlenbergia torreyi	*Boutelour hirsuta*	*Agrostis hooveri* Swallen	*Blepharoneuron tricholepis*	
	Bromus tectorun	*Aristida spp.*	*Bouteloua curtipendula*	
	Carex spp.	*Aristida pansa*	*Bromus inermis*	
		Aristida purpurea	*Dactylis glomerata* L.	
		Bouteloua eriopoda	*Dactylus glomeratus*	
		Festuca ovina L.	*Danthonia intermedia*	
		Hilaria jamesii	*Danthonia parryi*	
		Juncus spp.	*Deschampsia caespitosa*	
		Koeleria cristata	*Elymus elmoides*	
		Koeleria macrantha	*Elymus smithii*	
		Lycopodium selago L.	*Festuca arizonica*	
		Lycurus phleoides	*Festuca thurberi*	
		Muhlenbergia montanus	*Muhlenbergia verescens*	
		Muhlenbergia spp.	*Oryzopsis hymenoides*	
		Muhlenbergia wrightii	*Phleum pratense*	
		Poa fendleriana	*Schazachyrium scoparium*	
		Poa pratensis	*Sitanion hystrix*	
			Sporobolus cryptandurs	
			Stipa spp.	

* *Bouteloua gracillis* is placed in *extra short* when in sod form, and in *short* when in bunch grass form

Table 2. Stubble Height Classes of Common Species (Common Names) and Minimum Stubble Heights (Holecheck & Galt, 2004)

Height Classes of Common Species & Minimum Stubble Heights				
Extra Short 3/4"	Short 1.5"	Short-Mid 2.5"	Mid 4.0"	Tall 8.0"
Blue grama*	Needle grama	Crested wheat	Intermediate wheat	Bluestems
Curly mesquite	Blue grama*	Threeawns	Arizona threeawn	
Ring muhly	Hairy grama	Wooten's threeawn	Pine dropseed	
	Cheat grass	Purple threeawh	Sideoats grama	
	Sedges	Black grama	Smooth brome	
		Sheep fescue	Orchard grass	
		Galleta	Timber danthonia	
		Reeds	Parry's danthonia	
		Prairie june grass	Tufted hairgrass	
		Club moss	Western wheat	
		Wolftail	Arizona fescue	
		Mountain muhly	Thurber's fescue	
		Muhlys	Screwleaf muhly	
		Spike muhly	Indian ricegrass	
		Mutton grass	Timothy	
		Kentucky bluegrass	Little bluestem	
			Bottlebrush squirreltail	
			Sand dropseed	
			Needle grasses	

* Blue grama is placed in *extra short* when in sod form, and in *short* when in bunch grass form

Date	Pasture	Location	Cover Classes V	B	L	R	XS	Stubble Height S	S/M	M	T	Top Five Species & # Hits 1	2	3	4	5	Pellet Count Cattle	Elk	Horse	Deer	Soil Moisture
POA	BRMO	POA	76	1	23			7.7	6.8	9.0		POA 67	BRIN 26	CAREX 7			2	2			0-12" - Wet

Figure 11. **Sample photo page with site summary data.**

Establish Utilization Cage (optional)

A utilization cage (Figure 10) can be established nearby to transect if utilization data is desired.

METHODS—DATA ENTRY

The enclosed CD contains two Microsoft Excel files. One (RAM Input Workbook 1) is for use when data on grasses and forbs is desired, and the other (RAM Input Workbook 2) is for use when data on only grasses is desired. The difference between the two files is that RAM Input Workbook 1 has an additional column where forb species can be entered. Step-by-step directions for each program will be explained.

RAM Input Workbook 1 for Use with Grasses and Forbs

For an example of how to enter the following data please refer to the "Example" tab in the worksheet.

1. Enter the allotment name, ranger district, forest, and the title of the summary sheet. For ranches on private land just enter the summary sheet title.
2. Make a list of all the species found on the allotment (using abbreviations) in column C.
3. Make a list of just the grass species found on the allotment (using abbreviations) and assign the corresponding height class number in columns F and G. For height classes see Table 1.
4. Enter the cover class, species, and height information from the data sheets into the appropriate columns.
5. If plots were clipped enter empty bag weight (in grams) in cell C112, and enter plot weights (in grams) for each site.
6. Enter fecal group counts and soil moisture descriptions.
7. Click the "Sort Species" button.
8. Review the summary sheet and select the print area to avoid printing the blank rows. (Go to File, Page Setup, select "Sheet" tab, and select the print area)

RAM Input Workbook 2 for Use with Grasses

For an example of how to enter the following data please refer to the "Example" tab in the worksheet.

1. Enter the allotment name, ranger district, forest, and the title of the summary sheet. For ranches on private land just enter the summary sheet title.

Grazing Allotment May 31-June 1, 2007 Monitoring																					
Date	Pasture	Location	Cover Classes				Stubble Height				Top Five Species & # Hits					Pellet Count				Soil
			V	B	L	R	XS	S	S/M	M	T	1	2	3	4	5	Cattle	Elk	Horse	Deer	Moisture
6/1/07	North	Kerr Canyon	82	5	13			6.3	4.4	6.8		POA 79	BRMO 15	CAREX 6			2	5			0-12" - Wet
5/31/07	North	Benson Canyon	74	23	3				4.4	7.4		POA 85	BRIN 15				4	2			0-12" - Wet
5/31/07	North	Upper Lucas	76	1	23			7.7	6.8	9.0		POA 67	BRIN 26	CAREX 7			2	2			0-12" - Wet
5/31/07	North	Mid Lucas	89	8	3				3.9	6.0		POA 53	BRMO 35	AGIM 8	BRIN 4		9	33			0-12" - Wet
5/31/07	North	Dark Canyon	98		2				4.0	5.7		POA 78	BRIN 22				1	10			0-12" - Wet
5/31/07	North	Benson Ridge	8		86	6		4.9	5.3	7.1		BRIN 50	POA 31	CAREX 19				3			0-12" - Wet
5/31/07	North	Wilmeth	79	1	20			5.3	4.0	6.6		POA 80	BRMO 15	CAREX 5			1	7			0-12" - Wet
6/1/07	South	Cathy	100						4.3			POA 100						2			0-12" - Wet
6/1/07	South	Brown Ridge	80	6	14				4.2	6.7		POA 97	BRIN 3				1	1			0-12" - Wet
6/1/07	South	McAfee	97	2	1				5.5	6.5		BRMO 76	POA 24				9	1			0-12" - Wet
5/31/07	South	Bear	89	3	8			7.6	8.7	9.2		POA 83	BRIN 12	CAREX 4	AGIM 1			1			0-12" - Wet
5/31/07	South	Wills Canyon	93	5	2				4.3	7.0		POA 97	BRIN 3				8	3			0-12" - Wet
5/31/07	South	Hay Canyon	88	5	7				3.7	4.9		POA 55	BRIN 38	BRMO 7			1	33			0-12" - Wet
6/1/07	Atkinson	Atkinson	97	3					4.5	6.3		POA 88	BRMO 12				4	4			0-12" - Wet

Figure 12. **Sample summary page.**

2. Make a list of the species found on the allotment (using abbreviations) and assign the corresponding height class number in columns B and C.
3. Enter the cover class, species, and height information from the data sheets into the appropriate columns.
4. If plots were clipped, enter empty bag weight (in grams) in cell C112, and enter plot weights (in grams) for each site.
5. Enter fecal group counts and soil moisture descriptions.
6. Click the "Sort Species" button.
7. Review the summary sheet and select the print area to avoid printing the blank rows. (Go to File, Page Setup, select the "Sheet" tab, and select the print area.) See Figure 12 for a sample completed summary page

ANALYSIS AND SUMMARY OF DATA

Once data has been collected and summarized it needs to be analyzed before it can be used for management decisions. Data should be analyzed soon after it is collected, while field collection is still fresh in everyone's mind. Data interpretation is best conducted by an interdisciplinary group of professionals with experience and expertise in collecting and analyzing data using RAM (Allison et al., 2007). All parameters should be examined collectively to make management decisions. Selecting only one or a few parameters on which to base decisions is strongly discouraged because it greatly increases the probability of missing important pieces of information useful for making informed management decisions. A sample RAM report is available in Appendix 2 on the enclosed CD.

The photos taken at each site should be put into a word processing document with ground level and landscape photos on the same page so that each monitoring period can be qualitatively analyzed. In addition to the photos, the site summary from the full summary should be cut and pasted onto the page. In looking at ground cover, the

combined percentage of vegetation, rock, and litter should be compared to that of bare ground to determine the relative soil stability of the site. If bare ground makes up a large percentage of the ground cover type, then potential causes should be considered before further management decisions are made. For example, many mountain meadows have a large percentage of bare ground in the spring and early summer; however, with the progress of summer and the advent of summer monsoons the bare ground percentage generally declines without a change in management. Also, certain ecological sites (NRCS, 2007) would be expected to have large percentages of bare ground.

Stubble heights by species are very useful parameters to examine because they indicate potential for growth when measured in the spring and species stability when taken in the fall Stubble height estimates are best averaged over a minimum of five years in determining species potential (Holechek & Galt, 2000). Stubble height classes published in this document should only be used as a guide and NOT implemented as a standard or threshold for making management decisions. Stubble heights indicate distribution of herbivore use and can be used as a guide for livestock distribution. Stubble heights should not be looked at individually but jointly with other range parameters. For example, if the stubble heights for a specific grass species are below recommended heights, while stubble heights for other species are above recommended heights, the frequency of that species should be examined to determine how important that species is in relation to other species and range parameters. Similarly, if stubble heights are low along a transect but there is adequate soil moisture and potential for growth, then long-term management decisions may be postponed until further monitoring can be conducted.

Standing crop can also be used as a livestock distribution analysis tool in the same way as stubble heights by showing overutilized and underutilized areas. This can show any distribution issues and potential opportunities to move cattle away from or to an area. It can additionally show the relative production potential of different sites by highlighting areas that are more productive as well as areas that received more precipitation

Fecal pellet group counts indicate the presence or absence of different herbivores (cattle, deer, elk, horse, etc.) and may show animal distribution trends over time. They should not be used to make density estimates. Also, due to the different defecation rates of elk (13 pellets/day) and cattle (9 pellets/day) the pellet counts should be standardized before estimating relative visitation.

The qualitative measurement of soil moisture is useful as a determinate of a key area's potential for sustaining plant growth. Soil moisture should be considered when using stubble heights, ground cover, and standing crop estimates in making management decisions.

SUMMARY

The RAM method enables a range manager to monitor a ranch or allotment from 1 to 100,000 acres in one to three days, with an additional day to enter and analyze the data. As such, RAM is a very effective tool for adaptive resource management. While data from a single monitoring should not be used to make stocking decisions, it can be useful as a guide for animal distribution. It can also indicate areas that warrant closer or more frequent monitoring. Data from multiple monitoring dates can be used in management decisions regarding livestock distributions as well as stocking rates. These decisions can be made in a relatively short period of time and be based both on qualitative and,

more importantly, on quantitative data. Further, RAM can indicate the presence of other confounding influences, such as wild herbivore distribution issues, uneven rainfall distribution patterns, and other non-controllable natural events.

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Printed September 2008