

Alternative Management Strategies to Meet Forage Shortfalls

This package includes:

- EM 8527, *Alternative Management Strategies to Meet Forage Shortfalls*
- *Workbook* to accompany EM 8527



Ordering instructions

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Important: Read this page first!

This Workbook will walk you through the process of assessing your forage situation and developing alternative strategies for addressing potential shortfalls. It is presented in seven steps. They are sequential and are tied directly to EM 8527, *Alternative Management Strategies to Meet Forage Shortfalls*. Examples are provided at each step.

Begin with page 1 of the Workbook. The Workbook is your guide to the forage assessment process. As you work through it, the text will tell you when to refer to specific pages in EM 8527 for additional information. These instructions are marked with this symbol: →

The Workbook also includes several worksheets that you will complete as part of your assessment of your forage situation. Each worksheet is preceded by step-by-step instructions, which are flagged with this symbol: ↗

You will find each worksheet immediately following its instructions. Additional copies of the worksheets are located in the back of the Workbook.

The reference material in EM 8527, *Alternative Management Strategies to Meet Forage Shortfalls*, describes a process for meeting serious long-term forage shortfalls. The publication uses as an example a hypothetical 300-brood cow herd selling either weaner calves or carrying them over to sell off grass. The hypothetical forage shortfall occurs because of a loss of public land grazing permits. The shortfall totals 37 percent of the operator's annual forage supply, but almost 75 percent of the April through September forage supply.

EM 8527 consists of four parts:

- Analysis procedures
- Alternative strategies in grazing management and rangeland improvement
- Descriptions of rangeland improvement and development
- Economic analysis procedures

The appendix includes reprints of published articles that complement the text information.

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Getting Started

➔ **READ page 1 of EM 8527.** Then return here.

Using this Workbook, you will work through seven steps:

- Developing the ranch goal
- Developing the current herd demand
- Developing the current source of forage supply
- Determining potential forage shortfalls
- Assessing forage replacement alternatives
- Inventorying your resources to meet potential forage shortfalls
- Making your economic analysis

The outcome of this process will be a better understanding of the following aspects of your operation:

- Current herd demand
- Current forage supplies
- Potential forage shortfalls
- Potential forage alternatives
- Costs that could be incurred as you make adjustments

STEP 1

Developing the Ranch Goal

This step will help you clarify what you are doing and why. This step is beyond the direct scope of EM 8527 yet is very important to your success.

You are encouraged to develop your ranch goal(s) at this point, but you may only wish to read the goal components and go on to assessing forage shortfall alternatives. If so, please come back to this section after you have completed the rest of the Workbook.

Entire books and workshops are available on setting ranch goals and objectives. Developing them is hard work. Only brief suggestions are provided here. Excellent guidance and suggestions are presented in Allan Savory's *Holistic Resource Management* (Island Press, 1988). Whether or not you use the holistic resource management approach, you need to consider this step in two phases.

Phase 1. This step consists of identifying all your resources. Divide them into three categories:

People

Who are **all** the people who need to be considered? What can or do they contribute? Do they all live in close enough proximity so you can bring them together in order to advise and help in decisionmaking?

Physical and biological

- Land—Where is it? How much is there? What is its character and current productivity? How secure is it to your operation; can you count on it when you develop goals (i.e., owned, rented, leased)?
- Livestock—Kinds, numbers, ages, quality of performance/production, etc.
- Buildings, improvements, machinery, etc.

Financial

What are the values of your assets? How secure are your credit lines? Who must you depend upon for money? How much real control over finances do you have?

It is important to write down each component in as much detail as you can. Identify the real, not perceived, skills of the people; characteristics of the animals; and condition of the land, including physical improvements, accessibility throughout seasons, etc. If you have any concerns about a resource, state them.

Develop your financial information using current assets and liabilities (both short- and long-term). Value land, animals, and improvements as practically (conservatively) as you feel you need to. Do not write down borrowing capacity on anything other than verifiable assumptions. You will probably end up with several pages of detailed information.

Phase 2. This is the actual development of the ranch goal(s) by the people identified in Phase 1. A goal needs to consist of three parts, which must be given a definite order of priority. Again, the book *Holistic Resource Management* discusses this process in detail on pages 445-457. Recognize that this is a long-term dynamic process.

The three parts of a ranch goal are as follows:

Quality of life

All people need to express what they expect and how they want to lead their lives, not just on the ranch but also in the community. Look at this part of the goal in the context of learning, benefiting, contributing, understanding, leading, and other positive aspects of life.

Production

How can the ranch support the qualities of life that all of you want? Simply put, what are viable enterprises and income that will pay for the desired life qualities?

Landscape

What do the landscapes of the ranch need to be like, in the long term, for the desired levels of productivity identified? In essence, what kinds of vegetation and animal life must exist for a positive water and nutrient cycle to occur and for efficient conversion of the sun's energy? What kind of an environment must your management work toward creating?

Long-term goal development will take time and effort that should pay off in more stable ranch business development. You may feel you cannot go through these processes or make changes without professional help. If so, your local Extension agent should be able to recommend sources of assistance.

STEP 2

Developing Current Herd Demand

In this step, you will determine the forage demand of your herd, broken down by month.

→ **READ pages 2–5 of EM 8527.** Then come back here.

Through step-by-step instructions and examples, we will help you work your way through the process. You will end up with a sheet like Table 2 on page 4 of EM 8527. (An additional example is shown in Appendix 1, Table 1 of EM 8527.) To do so, you will fill out two worksheets. This is an indoor job and can be done in your home or office.

Begin with the instructions for Worksheet A on the following page.



Worksheet A Instructions

Herd numbers by month

On Worksheet A, you will compile a record of the numbers and kinds of animals that you have.

Worksheet A immediately follows these instructions. Follow these steps to complete Worksheet A:

- List all the classes of animals under your control in the first column. For example:
 - Mature cows
 - Coming 2-year-olds to calve (or 3-year-olds if on that program)
 - Heifer calves
 - For replacement or to be sold as bred heifers
 - For stockers (not to be exposed)
 - Steer calves
 - Bulls
 - Other stock, including horses
- For the first class of stock, fill in the number you will have during each month. Be sure to put down realistic numbers to include what and when you might cull, sell, or buy, etc. For example:

Class of Stock	J	F	M	A	M	J	J	A	S	O	N	D
2-year-old heifers	45	45	45	45	45	45	45	45	45	45		

- Repeat step 2 for all other classes of stock listed in column 1 of Worksheet A.
- Now go back and fill in an approximate age for all immature stock in months (mo.). For example:

weaner heifers											60 9 mo.	60 10 mo.
----------------	--	--	--	--	--	--	--	--	--	--	-------------	--------------

You will use the age later to assign animal unit (AU) equivalents for immature stock so you can come up with the animal unit months (AUMs) of forage needed.



Worksheet B Instructions

Current forage requirements in AUMs

Now you will calculate how much forage is needed for the animals.

You will need your completed Worksheet A for this step.

1. Write the classes of stock from Worksheet A in the first column on Worksheet B.
2. Multiply the number of animals in the first January "cell" of Worksheet A by the appropriate AU equivalent figure shown at the bottom of Worksheet B. For example:

$$16 \text{ bulls} \times 1.5 \text{ AU} = 24 \text{ AUMs}$$

You can be as exact as you want in getting this AUM demand. For example, if cattle are above average size, you may want to assign higher AU equivalents than those shown on Worksheet B.

3. Write the AUMs you calculated in step 2 in the appropriate January cell on Worksheet B. For example (from Table 2, page 4, EM 8527):

Class of Stock	J
16 bulls	24

4. Repeat steps 2-3 for the remaining cells.
5. Sum up the AUMs for each month at the bottom of Worksheet B. For example:

Class of Stock	J
16 bulls	24
60 weaner heifers	
300 mature cows	300
45 2-year-old heifers	45
60 yearling replacement heifers	45
Total	414

6. Sum across to find the total needed for the year. For example:

Total	414	414	414	414	414	414	414	414	414	414	414	414	4968
-------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Note: If you believe you might build or reduce numbers, construct a yearly demand chart for that scenario.

At this point, you have determined the forage demand for your herd, both seasonally and in total. This will be similar to the examples in EM 8527 found on page 4 (Table 2) and Appendix 1 (Table 1).

Worksheet B—Current Forage Requirements in AUMs

Class of Stock	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total													

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 2 on page 4 of EM 8527.

STEP 3

Current Forage Supply Inventory

All livestock are somewhere all of the time. Now you will construct a table that will tell you where all your feed comes from at all times of the year. This step can be done in your office also.

➔ **READ these tables in EM 8527:**

- Table 3 (page 5)
- Appendix 1, Table 2

These tables are on a monthly basis in our example. If your animals move from one type of forage to another more frequently, you may need to construct your chart on a weekly basis. Otherwise, monthly will be adequate.

We'll walk through this process step by step below. First, you will use Worksheet C to indicate where your stock are at all times of the year. Then you will rework that information onto Worksheet D, which is a compilation of the forage sources (e.g., owned seeded pasture) and the numbers of AUMs each source will provide each month.

Don't expect Worksheet C to be neat and precise when you get done. It probably will have margin notes, smudges, erasures, and all forms of hen scratching. Keep the objective in mind.

Review the following example first. Then follow the step-by-step instructions to complete your Worksheet C.

Example

A partially completed sample Worksheet C follows this page. It is only for a part of the herd to give you a taste of the process. In the example, only mature cows, first-calf heifers, and yearling replacement heifers are illustrated.

Each cell contains the following information:

- Forage source (indicated by a letter). A legend at the bottom of the worksheet assigns a letter to each of the various forage sources.
- Number of animals
- Number of days on the source (e.g., 31 days)

The worksheet follows each class of animal through the year. For example, the 295 mature cows with spring-born calves progress as follows:

- From December through March, 295 cows are on raised hay (H)
- In April, 220 go to owned crested wheatgrass (A) for the first 20 days and then to owned native sagebrush-grass range (B) for 10 days
- From April 1 until September 15, 75 pair are on owned irrigated pasture (C)
- A 170-pair BLM permit (E) is used May 1–June 15
- During May, 50 head are retained on native range (B)
- From June 16–September 15, 150 pair are permitted on the National Forest (F)
- Owned native range (B) is used for 50 pair for June 1–15 but 70 pair June 16–30
- A neighbor's rented range (D) is needed for 70 pair from July 1 through September 15
- The cows coming off the forest permit (F) September 15 go onto owned seeded range regrowth (A) for the remainder of September
- Cows on irrigated pasture go to hay aftermath (G) the rest of September
- Calves are weaned in September when pasture moves are made
- Cows go to owned native range (B) in October and hay aftermath (G) in November

SAMPLE

Worksheet C—Forage Sources for the Herd (January-June)

Class of Stock	January	February	March	April	May	June
mature cows	H 295 31d	H 295 28d	H 295 31d	A 220 20d B 220 10d C 75 30d	E 170 31d B 50 31d C 75 31d	E 170 15d F 150 15d B 50 15d B 70 15d C 75 30d
first calf heifers	H 50 31d	H 50 28d	H 50 31d	A 50 30d	A 50 31d	C 50 31d
yearling replacement heifers	H 60 31d	H 60 28d	H 60 31d	A 60 30d	C 60 31d	C 60 31d

Feed Source Legend:

A = owned crested wheatgrass	E = BLM
B = owned native range	F = National Forest
C = owned irrigated pasture	G = hay aftermath
D = rented range	H = raised hay

SAMPLE

Worksheet C—Forage Sources for the Herd (July-December)														
Class of Stock	July	August	September	October	November	December								
mature cows	F 150 31d C 75 31d D 70 31d	F 150 31d C 75 31d D 70 31d	F 150 15d A 150 15d C 75 15d G 75 15d G 70 15d D 70 15d	B 295 31d	G 295 30d	H 295 31d								
first calf heifers	C 50 31d	C 50 31d	C 50 15d G 50 15d	G 50 31d	G 50 30d	H 50 31d								
yearling replacement heifers	C 60 31d	C 60 31d	C 60 30d	G 60 31d	G 60 30d	H 60 31d								
Feed Source Legend:														
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">A = owned crested wheatgrass</td> <td style="width: 50%; border: none;">E = BLM</td> </tr> <tr> <td style="border: none;">B = owned native range</td> <td style="border: none;">F = National Forest</td> </tr> <tr> <td style="border: none;">C = owned irrigated pasture</td> <td style="border: none;">G = hay aftermath</td> </tr> <tr> <td style="border: none;">D = rented range</td> <td style="border: none;">H = raised hay</td> </tr> </table>							A = owned crested wheatgrass	E = BLM	B = owned native range	F = National Forest	C = owned irrigated pasture	G = hay aftermath	D = rented range	H = raised hay
A = owned crested wheatgrass	E = BLM													
B = owned native range	F = National Forest													
C = owned irrigated pasture	G = hay aftermath													
D = rented range	H = raised hay													



Worksheet C Instructions

Forage sources for the herd

Now you should be ready to complete your own Worksheet C. In this step you will record the current forage sources used by your herd. Note that the front of Worksheet C covers January through June, and the back covers July through December. Follow the instructions below.

1. Fill out the first column of Worksheet C with each class of stock in your operation. For example:

first calf heifers
yearling replacement heifers
mature cows

2. Jot down on a blank sheet of paper all the kinds of forage and feed you have available and normally use for the herd. Some examples are raised hay, purchased hay, owned irrigated pasture, rented irrigated pasture, owned native range, owned seeded range or pasture, BLM, National Forest, State leases, other public lease, rented non-irrigated pasture, and hay aftermath.
3. Create a legend for all your feed sources at the bottom of Worksheet C, assigning each one a symbol such as a letter. For example:

Feed Source Legend:	
A=owned crested wheatgrass	E=BLM
B=owned native range	F=National Forest
C=owned irrigated pasture	G=hay aftermath
D=rented range	H=raised hay

4. For the first class of animal, fill in the source(s) of feed for January, using the legend you wrote at the bottom of the worksheet. Be sure to include all sources of forage even if there is some concern as to the future availability of some of them. For example:

Class of Stock	January
mature cows	H

5. In the same cell (January) fill in the number of head on each source.
For example:

Class of Stock	January
mature cows	H 295

6. In the same cell, fill in the number of days on each source. The number of days could be written as a percentage of the month, if you wish. For example:

Class of Stock	January
mature cows	H 295 31 days

7. Repeat steps 4-6 for February through December for the first class of animal.
8. Repeat steps 4-7 for all other classes of animal.

Worksheet C—Forage Sources for the Herd (January-June)

Class of Stock	January	February	March	April	May	June

Feed Source Legend:

Worksheet C—Forage Sources for the Herd (July-December)

Class of Stock	July	August	September	October	November	December

Feed Source Legend:

The information on Worksheet C needs to be reworked and summarized onto Worksheet D in order to be usable. Worksheet D is comparable to Table 3 (page 5) and Table 2 of Appendix 1 in EM 8527.

First review the example below and the following sample completed Worksheet D. Then follow the step-by-step instructions to complete your own Worksheet D.

Example 1

1. Look again at the sample Worksheet C. Locate the January cell for the first class of animal. It looks like this:

Class of Stock	January
mature cows	H 295 31 days

2. To transfer this information to Worksheet D, we first multiplied the number of animals (295) on hay (H) times the AU conversion factor shown at the bottom of Worksheet D. For mature cows, the conversion factor is 1.0. So:

$$295 \text{ cows} \times 1.0 \text{ AU per cow} = 295 \text{ AUMs}$$

3. We then multiplied this number (295) times the fraction of the month that the animals are on hay. (For example, 31 days is the whole month, or 1.0.) So:

$$295 \text{ AUMs} \times 1.0 \text{ month} = 295 \text{ AUMs}$$

4. We wrote this figure on Worksheet D in the January cell for the appropriate feed source (hay). For example:

Description	Acres	J
hay		295

Example 2

Now we will work through the month of April on the sample Worksheets C and D. In April, the example shows animals moving from one source to another, so you can see how a complex situation like this works.

From Worksheet C:

mature cows	A 220 20 days B 220 10 days C 75 30 days
first calf heifers	A 50 30 days
yearling replacement heifers	A 60 30 days

1. There are 220 mature cows on owned crested wheatgrass (A) for 20 days:

$$220 \text{ cows} \times 1.0 \text{ AU per cow} = 220 \text{ AUMs}$$

$$220 \text{ AUMs} \times 0.66 \text{ month (20 days)} = 147 \text{ AUMs}$$

We wrote this number on Worksheet D in the April cell of the crested wheatgrass row:

Unit	Description	Acres	J	F	M	A
1	owned crested wheatgrass	288				147

2. There are 220 mature cows on native range (B) for 10 days:

$$220 \text{ cows} \times 1.0 \text{ AU per cow} = 220 \text{ AUMs}$$

$$220 \text{ AUMs} \times 0.33 \text{ month (10 days)} = 73 \text{ AUMs}$$

We wrote this number on Worksheet D in the April cell of the native range row:

Unit	Description	Acres	J	F	M	A
2	owned native range	846				73

3. There are 75 mature cows on irrigated pasture (C) for 30 days:

$$75 \text{ cows} \times 1.0 \text{ AU per cow} = 75 \text{ AUMs}$$

$$75 \text{ AUMs} \times 1.0 \text{ month (30 days)} = 75 \text{ AUMs}$$

We wrote this number on Worksheet D in the April cell of the irrigated pasture row:

Unit	Description	Acres	J	F	M	A
3	irrigated pasture	200				75

4. There are 50 first calf heifers on owned crested wheatgrass (A) for 30 days:

$$50 \text{ heifers} \times 1.0 \text{ AU per heifer} = 50 \text{ AUMs}$$

$$50 \text{ AUMs} \times 1.0 \text{ month (30 days)} = 50 \text{ AUMs}$$

We wrote this number on Worksheet D in the April cell of the owned crested wheatgrass row:

Unit	Description	Acres	J	F	M	A
1	owned crested wheatgrass	288				147 50

5. There are 60 yearling heifers on owned crested wheatgrass (A) for 30 days:

$$60 \text{ yearling heifers} \times 0.75 \text{ AU per yearling} = 45 \text{ AUMs}$$

$$45 \text{ AUMs} \times 1.0 \text{ month (30 days)} = 45 \text{ AUMs}$$

We wrote this number on Worksheet D in the April cell of the owned crested wheatgrass row:

Unit	Description	Acres	J	F	M	A
1	owned crested wheatgrass	288				147 50 45

There will be a more or less constant number of AUMs by month, in our case, 390. At some time of the year, culling would be done and the actual replacement of culls made. That is taken into consideration in the example.

SAMPLE

Worksheet D—Current Forage Available by Production Source and Month in AUMs															
Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
	Owned crested wheatgrass					147 50 45	50				75				367
	native					75	50	25 35				295			478
	irr. pasture					75	75 45	75 50 45	75 50 45	75 50 45	38 45 25				813
	rented range								70	70	35				175
	BLM						170	85							255
	Natl Forest							75	150	150	75				450
	Aftermath										38 25 35	50 45	295 50 45		583
	Hay		295 50 45	295 50 45	295 50 45									295 50 45	1560
Total			390	390	390	390	390	390	390	390	390	390	390	390	4680
<p>Mature cow (including first calf heifers) with or without calf = 1.0 AU Weaner calf or yearling = 0.75 AU Bull = 1.5 AU Horse = 1.5 AU Sheep = 0.20 AU</p> <p>Note: This worksheet corresponds to Table 3 on page 5 of EM 8527.</p>															



Worksheet D Instructions

Current forage available

Now you will record the quantities of the various types of forage that you currently have available on your own Worksheet D.

You will need your completed Worksheet C for this step.

1. List all the forage sources down the left column of Worksheet D. If you can, include the acreage for each source. You will not need acreages for this step but you will later. For example:

Description	Acres
BLM	
National Forest	
hay	
owned crested wheatgrass	288
owned native range	846
irrigated pasture	200

2. Refer back to your Worksheet C. Locate the January cell for the first class of animal. For example:

Class of Stock	January
bulls	A 16 10 days

3. Multiply the number of animals on the first source times the AU conversion factor shown at the bottom of Worksheet D. For example:

$$16 \text{ bulls} \times 1.5 \text{ AUs per bull} = 24 \text{ AUMs}$$

4. Multiply the result times the fraction of the month that the animals are on that source. For example:

$$24 \text{ AUMs} \times 0.33 \text{ month (10 days)} = 8 \text{ AUMs}$$

5. Write this figure on Worksheet D in the January cell for the appropriate feed source. For example:

Unit	Description	Acres	J
1	owned crested wheatgrass	288	8

6. Repeat steps 2-5 for each class of animals for January.
 7. Repeat steps 2-6 for February-December.
 8. Sum the AUMs for each month. For example:

Description	Acres	J	F	M	A
owned crested wheatgrass	288				147 50 45
owned native range	846				73
irrigated pasture	200				75
hay		295 50 45	295 50 45	295 50 45	
Total		390	390	390	390

9. Sum the AUMs across each line to obtain a total for each feed source. For example:

owned crested wheatgrass					147 50 45	50				75				367
--------------------------	--	--	--	--	-----------------	----	--	--	--	----	--	--	--	-----

10. The total AUMs across months should equal the total AUMs by source. This number is in the bottom right-hand corner of Worksheet D.

Worksheet D—Current Forage Available by Production Source and Month in AUMs

Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total															

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 3 on page 5 of EM 8527.

STEP 4

Determining the Forage Shortfall that Must Be Replaced

In this step you will identify sources of forage that are insecure and may need to be replaced.



Worksheet E Instructions

Expected forage shortfalls

You will need your completed Worksheet D for this step.

1. Evaluate information contained on Worksheet D. Are there sources of forage that you may need to replace, either now or in the future? If so, identify them and, perhaps, place some priority of importance on the replacement need. For example:

★	BLM
★★	National Forest

2. Transfer the information on forage replacement needs to Worksheet E. Write the forage amounts in each month in terms of AUMs. If there are different priorities of importance, e.g., critical times of need, identify them on the worksheet by color or some appropriate manner. The information might look like that of Table 4 (page 6) and Appendix 1, Table 3 in EM 8527. For example:

	J	F	M	A	M	J	J	A	S	O	N	D	Total
BLM					170	85							
National Forest							75	150	150	75			

Worksheet E—Expected Forage Shortfalls (AUMs)

Forage Source or Ownership	Time of Forage Loss												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Shortfall													

Note: This worksheet corresponds to Table 4 on page 6 of EM 8527.

At this stage, you should have completed Worksheets A through E, which tell you:

- The monthly feed/forage demand for the entire ranch operation expressed in AUMs of forage (Worksheet B)
- The sources of that forage/feed for each class of stock during each month of the year (Worksheet D)
- The times within the year for which you will need to develop replacement forage (Worksheet E). You will know how much forage and of what quality is needed to be a replacement for the same classes of stock. You cannot tell at this point whether or not replacement forage could satisfy requirements for other classes of stock.

STEP 5

Forage Replacement Alternatives

You now have identified the following:

- Time during the year a forage shortfall may occur
- Sources of the shortfall
- Amount of forage available in AUMs

We need to review possible ways to meet these forage replacement needs.



READ Figure 1 on PAGE 7 of EM 8527. Then return here.

Figure 1 contains several possible ways to get more forage to meet various seasonal needs. Most ranches can provide at least some of the alternatives suggested in Figure 1. **Note:** Figure 1 is by no means a complete listing of alternatives. It is provided as information to help you start thinking about some of your alternative sources.

Part of Step 5 is to have a comprehensive understanding of how to develop more forage. Without this knowledge you will not be able to accomplish Step 6, which may be the most important part of the entire process.

The authors of EM 8527 wrote pages 12 through 27 and added supporting reference material in Appendices 3 through 15 for the purpose of showing various alternative land management activities. If you are thoroughly conversant with these various range and hay land improvements, you may not need to read those pages. If so, you can skip to Step 6.

However, we believe you will do a much better job in Step 6 if you **review** the text material at this point. The information is intended to help you gain insight on grazing management and rangeland improvement strategies as they may be applied to lands under your control.

Subject information is organized in EM 8527 with a specific appendix item to accompany or support it. You may wish to read pages 12 through 27 and then read the appendices. Or, you may find it more helpful to read each section and its accompanying appendix together. After reviewing this material, you should be prepared to address Step 6.

The topics and their accompanying appendices are found as follows:

Contents	Page Number	Appendix Number
Introductory Material	12-13	—
Changes in Grazing Strategies	14-15	3, 4, 7
Winter Grazing	15	5
Rake Bunched Hay	15	6
Grazing Haylands	15-16	7
Outside Forage Sources	17	3, 8
Rangeland Improvements	18	9
Seeding Rangeland	19-21	9 (540-3&4)
Chemical Control	22	10
Mechanical Control	23	11,12
Fire Control	23-25	13
Fertilization	25	14
Managing Livestock	26	—
Thinning Trees	26	—
Rangeland Developments	26-27	4, 15

STEP 6

Inventorizing Your Resources to Meet Your Forage Shortfalls

Step 6 may be the most important part of the entire process. It is the analysis of your ranch land and vegetation base in the context of what could be done to improve it. In order to accomplish Step 6 successfully, you need to use the knowledge gained in Step 5 and apply it to all of the ranch's land situations. There is no set procedure. The intensity of the analysis will vary, based on the extent of the expected forage shortfalls and the complexities of the land and resource base.

After completing Step 6 for our sample ranch, we arrived at the completed Tables 5 and 6 on pages 10 and 11 of EM 8527, as well as Tables 4 and 5 in Appendix 1.



READ pages 8–12 now. Then come back here.

Following the step-by-step instructions below, you will be able to complete the following objectives for Step 6:

- Provide the following information for all lands under your control *other than forage shortfall lands*:
 - Type of vegetation and number of acres
 - Current forage production in AUMs (grazing, hay, other) and when available (months)
 - Possible changes in vegetation use, vegetation management, or vegetation improvement
 - AUMs resulting from changes
 - Times when AUMs are available, if they change
- Allocate forage on a monthly basis and assign a class of stock to each type of forage
- Total AUMs available by month

- Compare the monthly total AUMs against the AUM requirements you found on Worksheet B. You will then compute the new forage shortfall (if there is one) in terms of when it occurs and how much it is. By then you will be in a position to begin to decide whether to meet the shortfall by finding other forage, modifying the animal demand, or both.

First you will assess each of your forage management areas and determine their current productivity and how you might increase their productivity.

Worksheet F allows you to evaluate your forage sources in detail. A more complete version of the worksheet is found in Appendix 2 of EM 8527. The Appendix 2 worksheet may request more information than you need or can develop. For example, pH of range soils is not critical, but pH of meadow soils may be important in order for production to be increased using soil amendments or fertilizers. As long as you know the base objectives, almost any approach should be satisfactory.

By this stage, you should be aware of the importance of a good forage inventory for each of your management units. Ideally, all range vegetation should be characterized into ecological sites and ecological status within sites. All non-range vegetation should be described by current kinds of vegetation, its production, and how it is used. Since this degree of description probably is not available in most cases, use either the Appendix 2 worksheet or the following brief Worksheet F for each unit.

This step probably cannot be accomplished indoors unless you have intimate knowledge of all the range conditions. In most cases, you will need to drive, ride, or walk over the land and make estimates of appropriate treatments, acres to treat with each practice, the forage production expected after treatment, and the priorities of treatment to consider within each management unit.



Worksheet F Instructions

Management unit inventory

Worksheet F will help you make a detailed analysis of each management unit, its productivity, and possible improvements.

1. First decide how to break down your ranch operation into management units. You could categorize by vegetation types or just by different management areas. Each situation is so different that there may be no one best way. It probably is easiest to get information for each field that is fenced separately. However you decide to classify your management units, you will need as many copies of Worksheet F as you have management units. Additional copies are located at the back of this Workbook.
2. Complete each Worksheet F in as much detail as possible.

Examples of vegetation type are irrigated hayland and aftermath, non-irrigated hayland, grazed pastures (seeded or alternative uses of croplands), crop residue, seeded rangeland, native range by vegetation type, and grazable forest. Examples are shown in Tables 5 and 6 on pages 10 and 11 of EM 8527 and Tables 4 and 5 in Appendix 1.

If you do not feel capable of realistically assessing the management and improvement needs in each unit, seek professional assistance from SCS, Extension, or qualified consultants. Alternatively, you may wish to start the process and then have someone review it with you.

Worksheet F—Management Unit Inventory	
Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

After completing the individual Worksheet F's, you can summarize the information onto Worksheet G. A sample completed Worksheet G is shown in Table 5 (page 10) and Appendix 1 (Table 4) of EM 8527.

The important information is the following:

- Kind of vegetation type (source of forage)
- Current production (AUMs), stocking rate, and month(s) of use
- Possible improvements, potential production, stocking rate, and month(s) of use

Information you develop on Worksheet G will start to show you how well you can meet your forage shortfall through improvements and whether you will need to bring in off-ranch feed.

Because of the magnitude and complexity of this exercise, it may make good sense to confine efforts to irrigated forage resources or at least to those areas where the highest production either exists already or can be improved in the shortest time period. This is an individual decision, but this approach may address serious forage shortfalls most expeditiously.



Worksheet G Instructions

Forage resource inventory

Completing Worksheet G is simply a matter of transferring information from the Worksheet F's as follows:

1. Choose the Worksheet F's for those units that you wish to concentrate on improving first. Set aside the others for future analysis.
2. For each unit, transfer the information from the Worksheet F to one line on Worksheet G. For example:

Unit	Description of Unit	Current AUMs	Kind of Improvement Practice	Potential AUMs	Use Periods
1	sagebrush-grass; 846 ac; 6 ac/AUM; Apr-Jun; fair condition	141	spray sagebrush	282	Apr-Jun Oct-Nov

Now you will allocate or budget out the forage over the 12 months of the year to meet your seasonal demand.

In EM 8527, this was done in Table 6 (page 11) for the scenario of selling weaned calves from the hypothetical herd and in Appendix 1, Table 5 for the scenario where yearlings were sold off grass. In both of these examples, there was no attempt to change seasonal animal demand or numbers.



REVIEW Table 6 (page 11) and Appendix 1, Table 5 of EM 8527.

ALSO REVIEW the narrative on pages 8, 9, and 12 at this time. Then return here.



Worksheet H Instructions

Seasonal forage availability (AUMs) after improvements

Worksheet H will aid you in developing a new seasonal feed/forage budget. This will take some concentrated time and effort. You already know your herd demand from Worksheet B. Worksheet H tells you when and how much forage will be available. It then becomes a “mix and match” exercise.

You will need your completed Worksheets B and G for this step.

Follow these steps:

1. From the information in column 2 of Worksheet G, fill in each forage source and acreage in the left-hand columns of Worksheet H. For example:

Unit	Description	Acres
1	sagebrush-grass	846
2	juniper-sagebrush-grass	568

2. For the first unit, write the estimated AUMs after improvements (from column 5 of Worksheet G) under each month on Worksheet H for which they are available (from column 6 of Worksheet G). For example:

From Worksheet G:

Unit	Description of Unit	Current AUMs	Kind of Improvement Practice	Potential AUMs	Use Periods
1	sagebrush-grass; 846 ac; 6 ac/AUM; Apr-Jun; fair condition	141	spray sagebrush	282	Apr-Jun Oct-Nov

To Worksheet H:

Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
1	sagebrush-grass	846				282	282	282				282	282		

3. Repeat step 2 for the remaining units.
4. Now look at Worksheet B. Choose a month, e.g., May, and look at your forage needs for that month on Worksheet B compared to your forage available for the same month on Worksheet H. Decide how best to allocate the available forage to meet demand, taking into account variations in quality of forage based on the type of animal and the time of year. For each unit with forage available during that month, indicate which animals will be on that source. You can footnote them as on Table 6 (page 11 of EM 8527) or use colors. For example:

Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
3	grassland	420					96(1)								
4	Irrigated meadow-grazing	500					31B								

(1) 90 heifers and 4 bulls

5. Repeat step 4 for the remaining months.
You probably will make several attempts before you are satisfied that you have allocated all the potential new forage to its most effective use.
6. When you have done the best job you can, add up the forage AUMs provided each month. Write this total in the Total Available line. For example:

Unit	Description	Acres	J	F	M	A
1	sagebrush-grass	846				282
2	juniper-sagebrush-grass	568				171
3	grassland	420				
4	crested wheatgrass	288				24
5	Hay	226	189	414	414	
Total Available			189	414	414	477

7. Compare this number to the AUMs needed each month in the bottom row of Worksheet B.

From Worksheet B:

Class of Stock	J
16 bulls	24
60 weaner heifers	
300 mature cows	300
45 2-year-old heifers	45
60 yearling replacement heifers	45
Total	414

If there are fewer AUMs provided than needed, you are short. Write the shortfall number in the Shortfall line. If there are more provided than needed, you are surplus. For example:

$$414 \text{ AUMs needed} - 189 \text{ AUMs available} = 225 \text{ AUMs shortfall}$$

Total Available			189
Shortfall			225

8. See if you can use any surplus to make up shortfalls. If, for example, you find a shortfall of winter hay but an excess of summer pasture (irrigated), can you divert some of the pasture acres to hay production?

In many cases, you will be tempted to alter the whole operation through some form of demand change, e.g., reduced numbers, shipping cattle off-ranch, or changing basic enterprise mixes. You are strongly encouraged to go through the exercise of developing Worksheet H for the **current** herd demand before you make any decisions to alter numbers. In this way, you can determine more clearly how much of each improvement you may need in order to match the herd demand as closely as possible.

Worksheet H—Seasonal Forage Availability (AUMs) after Improvements

Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Available															
Shortfall															

Note: This worksheet corresponds to Table 6 on page 11 of EM 8527.

STEP 7

Making Your Economic Analysis

➔ **READ pages 28-37 of EM 8527.** Then return here.

This section explains one approach to analyzing various improvement practices. Keep in mind that we are only looking at costs of various practices. The largest challenge is not in doing the improvement practice. Rather, it is in managing the resulting improved forage in ways that allow the land's productivity to be sustained and profits to be produced. Management skills vary greatly. Thus, profitability is not a given even though you use practices that cost the least per unit of new production.

Pages 33-37 of EM 8527 show how to determine the costs for each **new** AUM of forage. This analysis assumes each new AUM is equal in value. Of course, not all forage is equal in quality within a season, let alone from one season to another. Ideally, we would like to be able to evaluate a cost in relation to benefit received. That would be possible if you could place an economic value on the forage produced from a particular practice at a particular time. If a forage shortfall were to occur at a particularly critical part of the year, the value of the replacement forage might be higher than during other times. The cost-to-benefit ratio could be different than for that same practice at another time of year.

Look closely at Table 7 on page 30 of EM 8527. As stated in the text, these are estimated costs obtained in spring 1992 through an informal survey of central and eastern Oregon Extension agents. We used an average between the low and high costs in our examples. If you have your own actual costs, use them. If not, use those that you believe best fit your situation.

Table 8 shows alfalfa hay, grass hay, and grass seed straw costs. No doubt you will be able to find current costs for these commodities for your area. The same may be said of Table 9—costs of leased pasture, rangeland, or winter range.

You should be certain you **read** and **understand** pages 33-37 of EM 8527. The material in this workbook is only intended to supplement those pages. You can see how important it is for you to know the capability of your land resources when we apply the information for each improvement practice.

Example

Let's walk through an example. For the hypothetical 300-cow operation selling weaner calves, we identified:

- When and how much the forage shortfall would be (Table 4 on page 6 of EM 8527)
- The land's current AUM capability and what its capability could be after it received appropriate improvements (Table 5 on page 10)
- How we fit these improvements into a year-round feed budget (Table 6 on page 11)

Your resource capability inventory will give you comparable information for your operation on Worksheets E, G, and H. Step 1 on page 33 of EM 8527 should be complete, i.e., you have identified which practices you need to evaluate and have obtained the costs of doing them.

Although you will incur costs on an area basis, you need to know how much additional production you will get for a certain amount of cost. Consequently, you must determine how much land to treat in order to achieve the necessary production levels. This is not hard to do as long as you know: (1) the current capability in terms of number of acres per AUM, and (2) the future capability in the same terms.

Look at the example on pages 33 and 34 of EM 8527.

The example says we have sagebrush-grass rangeland that supports only 1 AUM for every 10 acres (10 acres per AUM). After using 2,4-D with two growing seasons' deferment, the vegetation would improve enough for the land to support 1 AUM for every 3 acres (3 acres per AUM). How many acres do we need to treat to obtain one additional AUM of forage? We calculated the answer as follows:

1. We divided 1 AUM by the current number of acres per AUM (10):

$$1 \text{ AUM} / 10 \text{ acres} = 0.1 \text{ AUM per acre}$$

Each acre now produces 0.1 AUM.

2. We divided 1 AUM by the number of acres per AUM after treatment (3):

$$1 \text{ AUM} / 3 \text{ acres} = 0.333 \text{ AUM per acre}$$

After spraying, each acre will produce 0.333 AUM (1/3).

3. We subtracted the current AUMs per acre (0.1) from the new AUMs per acre (0.333):

$$0.333 - 0.1 = 0.233 \text{ additional AUMs per acre}$$

Each treated acre yields 0.233 **additional** AUMs.

4. We divided 1 acre by the additional AUMs per acre (0.233):

$$1 / 0.233 = 4.29$$

We must treat 4.29 acres to get one new AUM.

Here is another way to look at the same situation. Let's say you have a 500-acre pasture that has a 10-acre per AUM stocking capacity under current conditions.

1. The pasture produces 50 AUMs (500 acres/10 acres per AUM).
2. You treat the vegetation with 2,4-D at 2 pounds of active ingredient per acre. After two growing seasons, the 500 acres produce 167 AUMs or 3 acres per AUM (500 acres/3 acres per AUM).
3. We subtracted the 50 old AUMs from 167 total AUMs to get 117 **new** AUMs.
4. Therefore, you need to treat 4.27 acres to get one new AUM (500 acres/117 new AUMs). The slight difference of 0.02 acre is due to rounding error.

What if the current capacity were 6 acres per AUM (the range was in higher condition)? In this case, each acre supports 1/6 AUM. Then, after spraying, each acre would support 1/3 AUM (3 acres per AUM). So, each acre treated adds only 1/6 AUM (1/3 - 1/6 AUM per acre). You would have to treat 6 acres in order to get one additional AUM.



Worksheet I Instructions

Acres per new AUM

Now you are ready to complete Worksheet I, which will help you decide how many acres you need to treat to achieve each new AUM of forage.

You will need your completed Worksheet G for this step.

For each potential improvement within each identified management unit, do the following:

1. Locate the current acres per AUM in column 3 of Worksheet G. Write this number in column 2 of Worksheet I. For example:

Unit	Current Acres per AUM
1. sagebrush-grass	12

2. Locate the number of acres in the unit in column 2 of Worksheet G. Divide this number by the estimated AUMs after improvement (column 5 of Worksheet G). Write this number in column 3 of Worksheet I. For example:

Unit	Current Acres per AUM	Treated Acres per AUM
1. sagebrush-grass	12	2

3. Divide 1 AUM by the **current** number of acres per AUM (from column 2 of Worksheet I):

$$1 \text{ AUM} / \text{ ____ acres} = \text{ ____ AUM per acre (current)}$$

For example:

$$1 \text{ AUM} / 12 \text{ acres} = 0.083 \text{ AUM per acre}$$

4. Write this number in column 4 of Worksheet I. For example:

Unit	Current Acres per AUM	Treated Acres per AUM	Current AUMs per Acre
1. sagebrush-grass	12	2	.083

5. Divide 1 AUM by the number of **treated** acres per AUM (from column 3 of Worksheet I):

$$1 \text{ AUM} / \text{ ____ acres} = \text{ ____ AUM per acre (after treatment)}$$

For example:

$$1 \text{ AUM} / 2 \text{ acres} = 0.5 \text{ AUM per acre}$$

6. Write this number in column 5 of Worksheet I. For example:

Unit	Current Acres per AUM	Treated Acres per AUM	Current AUMs per Acre	Treated AUMs per Acre
1. sagebrush-grass	12	2	.083	.5

7. Subtract the current AUMs per acre (column 4) from the new AUMs per acre (column 5):

$$\text{ ____ } - \text{ ____ } = \text{ ____ additional AUMs per acre}$$

For example:

$$0.5 - 0.083 = 0.4167 \text{ additional AUM per acre}$$

8. Write this number in column 6 of Worksheet I. For example:

Unit	Current Acres per AUM	Treated Acres per AUM	Current AUMs per Acre	Treated AUMs per Acre	Additional AUMs per Acre
1. sagebrush-grass	12	2	.083	.5	.4167

9. Divide 1 acre by the additional AUMs per acre (column 6):

$$1 / \text{ ____ } = \text{ ____ }$$

For example:

$$1 / 0.4167 = 2.4$$

This is the number of acres you must treat to get one new AUM.

10. Write this number in column 7 of Worksheet I. For example:

Unit	Current Acres per AUM	Treated Acres per AUM	Current AUMs per Acre	Treated AUMs per Acre	Additional AUMs per Acre	Acres to Treat for 1 New AUM
1. sagebrush-grass	12	2	.083	.5	.4167	2.4

Worksheet I—Acres per New AUM

1 Unit	2 Current Acres per AUM	3 Treated Acres per AUM	4 Current AUMs per Acre	5 Treated AUMs per Acre	6 Additional AUMs per Acre	7 Acres to Treat for 1 New AUM

Now you will calculate the costs of the various improvement options you have identified. In addition to the treatment costs identified on page 30 of EM 8527, you will need to add in costs of fencing, water developments, and deferring grazing until the new forage production comes on line. You also need to estimate the life of any practice and amortize costs over that period. The paragraph in the center of page 34 explains this, and you will see how it is done in the examples.

Example 1

Start with the spray sagebrush example (bottom of page 34 of EM 8527). The facts are as follows:

- a. Treatment cost = \$12 per acre
- b. Fencing and water development = \$3 per acre (estimate)
- c. Defer grazing 2 seasons = \$10 per AUM per year
- d. Amortize over 15 years at 10 percent
- e. Stocking rate will go from 6 acres per AUM to 3 acres per AUM

We calculated the costs as follows:

1. To calculate the acres we needed to spray to get one new AUM, we subtracted current capability from new capability:

$$1/3 - 1/6 = 1/6 \text{ AUM per each treated acre}$$
 Thus, it takes 6 acres sprayed to get one new AUM.
2. We multiplied the treatment cost for 1 acre (\$12) times the number of acres we needed to spray to get one new AUM (the answer from step 1):

$$\$12 \text{ per acre} \times 6 \text{ acres} = \$72 \text{ per new AUM}$$
3. We multiplied the fencing and water costs for 1 acre (\$3) times the number of acres we needed to spray to get one new AUM (the answer from step 1):

$$\$3 \text{ per acre} \times 6 \text{ acres} = \$18 \text{ per new AUM}$$
4. We added the treatment cost per new AUM (the answer from step 2), the fencing and water costs per new AUM (the answer from step 3), and the deferment cost per AUM (given above):

$$\$72 + \$18 + \$20 = \$110 \text{ (total cost per new AUM)}$$
5. We amortized the cost per new AUM (the answer from step 4) over 15 years at 10 percent:

$$\text{Annual Cost} = \$14.50 \text{ per new AUM}$$

(You can use a calculator with interest rate and time functions or you can estimate this from standard amortization tables.)

Example 2

Suppose you had good experience with prescribed burning and wished to use fire instead of 2,4-D. Would it be less expensive, and, if so, how much?

Using fire may have the same or different effects on the vegetation, depending on the current range condition and moisture situation (see explanations on pages 22-24 of EM 8527).

But, on to the calculations.

- a. Fire cost = \$8 per acre
- b. Fencing and water development = \$3 per acre
- c. Fuel buildup (one growing season) in order to be able to have a successful burn is 1/6 AUM/ac lost to use; $1/6 \times \$10$ per AUM = \$1.67 per acre
- d. Deferment after fire (2 seasons) = \$10 per AUM per year
- e. Stocking rate will go from 6 acres per AUM to 3 acres per AUM

We calculated the cost as follows:

1. The acres we needed to burn are the same as those we needed to treat in Example 1:

$$1/3 - 1/6 = 1/6 \text{ AUM per each treated acre}$$

Thus, it takes 6 acres burned to get one new AUM.

2. We multiplied the treatment cost for 1 acre (\$8) times the number of acres we needed to burn to get one new AUM (the answer from step 1):

$$\$8 \text{ per acre} \times 6 \text{ acres per AUM} = \$48 \text{ per new AUM}$$

3. We multiplied the fencing and water costs for 1 acre (\$3) times the number of acres we needed to burn to get one new AUM (the answer from step 1):

$$\$3 \text{ per acre} \times 6 \text{ acres} = \$18 \text{ per new AUM}$$

4. We added the treatment cost per new AUM (the answer from step 2), the fencing and water costs per new AUM (the answer from step 3), the cost of fuel buildup, and the cost of deferment:

$$\$48 + \$18 + \$10 + \$20 = \$96 \text{ (total cost per new AUM)}$$

5. We amortized the cost over 15 years at 10 percent:

$$\text{Annual cost} = \$12.36 \text{ per new AUM}$$

The cost of burning is about \$2 less than spraying per new AUM.

Page 35 of EM 8527 contains three sets of calculations for the examples we used with our hypothetical beef operation. As you can see, juniper management can be quite expensive using our assumptions. Often, we believe that seeding rangeland is less expensive as a means of obtaining new forage. In our example on page 35, that turned out not to be the case. However, let's change some of the example situation and see what happens.

Example 3

Suppose your resource inventory shows that you have some poor condition native range with good soil that could grow much more forage if it were seeded.

- a. Seeding treatment cost = \$38 per acre
- b. Fences and water = \$3 per acre
- c. Deferment cost = \$10 per AUM per year
- d. Stocking rate now is only 12 acres per AUM but can be improved to 2 acres per AUM
- e. Amortize costs at 10 percent over 20 years (Seedings should last indefinitely, but we must assign a life to the treatment.)

The calculations are as follows:

1. To calculate the acres we needed to treat to get one new AUM, we subtracted current capability from new capability:

$$0.5 \text{ AUM per acre} - 0.083 \text{ AUM per acre} = 0.4167 \text{ AUM per each seeded acre}$$

2. To calculate how many acres we needed to seed to obtain one new AUM, we divided 1 AUM by the AUMs per seeded acre (the answer to step 1):

$$1 \text{ AUM} / 0.4167 \text{ AUM} = 2.4 \text{ acres seeded to obtain one new AUM}$$

Let's do this another way. You have 500 acres that currently have a 12 acre per AUM stocking rate. They produce 41.667 (let's say 42) AUMs ($500/12 = 41.667$). After seeding and deferring two growing seasons, the production is now 2 acres per AUM or 250 AUMs ($500/2 = 250$). Subtracting the original 42 AUMs from 250 AUMs equals 208 **new** AUMs produced on 500 acres. So each 2.4 acres seeded produce one new AUM ($500/208 = 2.4$).

3. We multiplied the treatment cost for 1 acre (\$38) times the number of acres we needed to seed to get one new AUM (the answer from step 2):

$$\text{\$38 per acre} \times 2.4 \text{ acres per AUM} = \text{\$91.20 per new AUM}$$

4. We multiplied the fencing and water costs for 1 acre (\$3) times the number of acres we needed to seed to get one new AUM (the answer from step 2):

$$\text{\$3 per acre} \times 2.4 \text{ acres} = \text{\$7.20 per new AUM}$$

5. We multiplied the deferment cost per year times the number of years we needed to defer use:

$$\text{\$10 per AUM per year} \times 2 \text{ years} = \text{\$20 per AUM}$$

6. To obtain the total cost, we added the treatment cost per new AUM (the answer from step 3), the fencing and water costs per new AUM (the answer from step 4), and the deferment cost :

$$\text{\$91.20} + \text{\$7.20} + \text{\$20} = \text{\$118.40 (total cost per new AUM)}$$

7. We amortized the cost per new AUM over 20 years at 10 percent:

$$\text{Annual cost} = \text{\$13.73 per AUM}$$

This analysis also shows the principle that treating lower condition rangeland with the same potential as higher condition rangeland is more cost efficient—\$13.73 per new AUM as compared to \$16.80 per new AUM on page 35 of EM 8527.

If the land to be seeded is of a meadow character, it can often be improved at relatively low costs. Look at the third example on page 35. When the current stocking rate of 1 acre per AUM (1 AUM per acre) is improved to 1/3 acre per AUM (3 AUMs per acre), the annual cost drops to \$3.70 per new AUM. If you have very many acres like this, there is good economic incentive to treat as many of them as you can afford to set aside. Also, only one year's deferment would be needed because of higher site productivity.

If the land has the **same** capability but is in varying current condition (as it will be in the real world), treating the areas with lower current capability first will give you more **new** AUMs per dollar spent. How can this be? Let's say the cost per acre is \$10. If we determine it would take 4.29 acres for each new AUM, $\text{\$10} \times 4.29 = \text{\$42.90}$ per each new AUM. If we find it would take 6 acres to obtain one new AUM, $\text{\$10} \times 6 \text{ acres} = \text{\$60}$ to get each new AUM.



Worksheet J Instructions

Costs of improvements

Before continuing with your analysis, you need to gather cost information for each treatment practice you are considering.

Use Worksheet J to construct your cost picture. You can take the treatment cost (column 3) from Table 7 on page 30 of EM 8527 or you can use your own estimates. Base the other costs on your own knowledge and experience. For example:

Unit	Improvement Practice	Cost of Treatment	Fencing and Water Cost	Deferment Cost	Other Costs
sagebrush-grass	spray	\$12 per acre	\$3 per acre	\$10 per AUM per year (2 years)	

Worksheet J—Costs of Improvements

1 Unit	2 Improvement Practice	3 Cost of Treatment	4 Fencing and Water Cost	5 Deferment Cost	6 Other Costs



Worksheet K Instructions

Annual cost per new AUM

Now that you have seen how the examples work, you should be ready to do your own economic analysis. On this worksheet, you will calculate the annual cost per new AUM using the various improvement methods you have identified.

You will need your completed Worksheets I and J for this step.

The steps are as follows:

1. Write the number of acres you must treat to get one new AUM (from column 7 of Worksheet I) in column 2 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM
sagebrush-grass	2.4

2. Multiply the treatment cost for 1 acre (from column 3 of Worksheet J) times the number of acres you must treat to get one new AUM (column 2 of Worksheet K). For example:

$$\$38 \text{ per acre} \times 2.4 \text{ acres per AUM} = \$91.20 \text{ per new AUM}$$

3. Write this number in column 3 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM	Treatment Cost per New AUM
sagebrush-grass	2.4	\$91.20

4. Multiply the fencing and water costs for 1 acre (from column 4 of Worksheet J) times the number of acres you must treat to get one new AUM (column 2 of Worksheet K). For example:

$$\$3 \text{ per acre} \times 2.4 \text{ acres} = \$7.20 \text{ per new AUM}$$

5. Write this number in column 4 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM	Treatment Cost per New AUM	Fencing and Water Cost per New AUM
sagebrush-grass	2.4	\$91.20	\$7.20

6. Multiply the deferment cost per year (from column 5 of Worksheet J) times the number of years you must defer use. For example:

$$\$10 \text{ per AUM per year} \times 2 \text{ years} = \$20 \text{ per AUM}$$

7. Write this number in column 5 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM	Treatment Cost per New AUM	Fencing and Water Cost per New AUM	Deferment Cost per New AUM
sagebrush-grass	2.4	\$91.20	\$7.20	\$20

8. Repeat Step 6 if you have any other costs. Write this number in column 6 of Worksheet K.
9. To obtain the total cost, add the treatment cost per new AUM (column 3), the fencing and water costs per new AUM (column 4), the deferment cost (column 5), and any other costs (column 6). For example:

$$\$91.20 + \$7.20 + \$20 = \$118.40 \text{ (total cost per new AUM)}$$

10. Write this number in column 7 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM	Treatment Cost per New AUM	Fencing and Water Cost per New AUM	Deferment Cost per New AUM	Other Costs per New AUM	Total Cost per New AUM
sagebrush-grass	2.4	\$91.20	\$7.20	\$20	---	\$118.40

11. Amortize the cost per new AUM over 20 years at 10 percent. Use standard amortization tables or a calculator with an interest rate and time function. For example:

$$\text{Annual cost} = \$13.73 \text{ per AUM}$$

12. Write this cost in column 8 of Worksheet K. For example:

Unit	Acres to Treat for 1 New AUM	Treatment Cost per New AUM	Fencing and Water Cost per New AUM	Deferment Cost per New AUM	Other Costs per New AUM	Total Cost per New AUM	Amortized Cost per New AUM
sagebrush-grass	2.4	\$91.20	\$7.20	\$20	---	\$118.40	\$13.73

Worksheet K—Annual Cost per New AUM

1 Unit	2 Acres to Treat for 1 New AUM	3 Treatment Cost per New AUM	4 Fencing and Water Cost per New AUM	5 Deferment Cost per New AUM	6 Other Costs per New AUM	7 Total Cost per New AUM	8 Amortized Cost per New AUM

Now we will examine how much **more** or **less** the change in management strategy would cost as compared to your current situation. An example is shown on pages 36 and 37 of EM 8527.

Example

Table 10 on page 36 of EM 8527 is a compilation of the costs for the AUMs we could produce on our land using certain improvement practices suited to each situation. Most of the information needed to calculate these costs comes from Table 5 on page 10 of EM 8527. One item—the shortfall in hay that would need to be brought in—comes from Table 6 on page 11.

Let's see how we got the costs.

1. Our improvement/management scenario in Table 5 gives us current AUMs (column 3) and new AUMs (column 5). We subtracted the number of current AUMs from the new number after improvement. For example, for the spraying sagebrush-grass treatment:

$$282 \text{ AUMs} - 141 \text{ AUMs} = 141 \text{ AUMs}$$

The difference is the AUMs we need to develop.

2. The annual cost of this treatment, which we calculated above, is \$14.50 per AUM. We multiplied this cost times the number of new AUMs:

$$\$14.50 \text{ per AUM} \times 141 \text{ AUMs} = \$2,044.50$$

This number is in column 2 of Table 10 on page 36.

3. We also had a grass hay shortfall of 834 AUMs or 333.6 tons of hay. At \$60 per ton, this is \$20,016. (There is a small error in Table 10; 336 tons should be 333.6 tons, and the total should be \$20,016.)
4. We added up the total of new costs. It came to \$42,657 in Table 10. This is what the improvement changes will cost throughout their respective lives on an annual basis.
5. In the new situation we need to subtract the cost of the forage we lose in the forage shortfall. This is explained on page 37 of EM 8527. In the example, we will not have to pay for 936 BLM AUMs and 900 USFS AUMs. We do not just value them at the grazing fee level. As you can see on page 37, an OSU study (Obermiller, 1992) showed it cost \$15.07 per BLM AUM and \$18.97 per USFS AUM in 1990. Private rangeland lease costs averaged \$15.03 per AUM in Oregon that year.

Consequently, we need to find the costs of the shortfall forage:

$$936 \text{ BLM} \times \$15.07 \text{ per AUM} = \$14,106$$

$$900 \text{ USFS} \times \$18.97 \text{ per AUM} = \$17,073$$

$$\$14,106 + \$17,073 = \$31,179$$

6. We subtracted these costs from the development cost:

$$\$42,657 - \$31,179 = \$11,478$$

This is the yearly development cost.

Is this the bottom line of costs? **No.** We need to add back what it costs us to harvest the new AUMs.

7. We added up the new AUMs to be grazed. They come to 2,307 AUMs (page 37).

8. A Utah State University study (Nielsen, 1991) showed an annual average private range lease cost of \$4.35 per AUM. In Oregon, the private lease cost was \$15.03. Subtracting these gives \$10.68 per AUM to harvest the new AUMs; hence the addback of \$24,639:

$$2,307 \text{ AUMs} \times \$10.68 \text{ per AUM} = \$24,639$$

9. We added this amount to the total costs in Table 10.

10. When this is all put together in Table 10, it shows that \$36,117 would be needed each year for the development and servicing of new AUMs to replace those lost through the hypothetical forage shortfall. This assumes the operator could borrow or otherwise make available the total investment costs for the improvements when they were made.



Worksheet L Instructions

Total cost of improvements

Now you can complete Worksheet L, which will calculate the total costs of your identified forage improvements. This worksheet corresponds to Table 10 on page 36 of EM 8527.

You will need your completed Worksheets G and K for this step.

The steps are as follows:

1. In the first column of Worksheet L, write the description of the forage to be improved and the amortized cost per new AUM (from column 8 of Worksheet K). For example:

Forage to Be Replaced
spray sagebrush-grass @ \$14.50

2. From Worksheet G, subtract the number of current AUMs (column 3) from the new number after improvement (column 5). For example, for the spraying sagebrush-grass treatment:

$$282 \text{ AUMs} - 141 \text{ AUMs} = 141 \text{ additional AUMs}$$

The difference is the AUMs you need to develop.

3. Write this number in column 2 of Worksheet L. For example:

Forage to Be Replaced	Number of AUMs to Develop
spray sagebrush-grass @ \$14.50	141

4. Multiply the annual treatment cost (in column 1 of Worksheet L) times the number of new AUMs. For example:

$$\$14.50 \text{ per AUM} \times 141 \text{ AUMs} = \$2,044.50$$

5. Write this number in column 3 of Worksheet L. For example:

Forage to Be Replaced	Number of AUMs to Develop	Net Annual Cost
spray sagebrush-grass @ \$14.50	141	\$2,044.50

6. Repeat steps 1–5 for each treatment.

7. Add up the total of new costs. This is what the improvement changes will cost throughout their respective lives on an annual basis. Write this total in column 3 of the Total Treatment Costs line. For example:

Forage to Be Replaced	Number of AUMs to Develop	Net Annual Cost
spray sagebrush-grass @ \$14.50	141	\$2,044.50
grass hay @ \$60/T	834 AUMs or 336 tons	\$20,160
cut juniper @ \$43.25	118	\$5,103
plow-seed range land @ \$16.80	140	\$2,352
plow-seed natural meadow @ \$3.70	540	\$1,998
fertilize meadow @ \$22/ac	500 acres	\$11,000
Total Treatment Costs		\$42,657

8. Multiply the AUMs lost times the cost per AUM. An OSU study (Obermiller, 1992) showed it cost \$15.07 per BLM AUM and \$18.97 per USFS AUM in 1990. Private rangeland lease costs averaged \$15.03 per AUM in Oregon that year. For example:

$$936 \text{ BLM} \times \$15.07 \text{ per AUM} = \$14,106$$

$$900 \text{ USFS} \times \$18.97 \text{ per AUM} = \$17,073$$

$$\$14,106 + \$17,073 = \$31,179$$

9. Write this number on Worksheet L in the Less Costs of Forage Lost line. For example:

Less Costs of Forage Lost		-\$31,179
----------------------------------	--	-----------

10. Subtract these costs from the development cost and write this number on Worksheet L in the Difference line. For example:

Total Treatment Costs		\$42,657
Less Costs of Forage Lost		-\$31,179
Difference		\$11,478

This is the yearly development cost.

11. Add up the new AUMs to be grazed (column 5 of Worksheet G).
12. You need to add back what it costs to harvest these new AUMs. A Utah State University study (Nielsen, 1991) showed an annual average private range lease cost of \$4.35 per AUM. In Oregon, the private lease cost was \$15.03. Subtracting these gives \$10.68 per AUM to harvest the new AUMs. If you have your own AUM harvest figures, use them for your situation. Multiply the number of new AUMs times the per AUM harvest fee. For example:

$$2,307 \text{ AUMs} \times \$10.68 \text{ per AUM} = \$24,639$$

13. Write this number on Worksheet L in the Add Back Cost line. For example:

Add Back Cost to Graze New AUMs		\$24,639
--	--	----------

14. Add the Difference and the Add Back Cost lines. For example:

Difference		\$11,478
Add Back Cost to Graze New AUMs		\$24,639
Net Cost		\$36,117

This is the total that would be needed each year for the development and servicing of new AUMs to replace those lost through the hypothetical forage shortfall. This assumes you can borrow or otherwise make available the total investment costs for the improvements when they are made.

Conclusion

Significant consideration

None of the analyses in EM 8527 relates to expected returns. However, it is important to note that when forage improvements occur, animal production almost always improves. For example, if public land forage is replaced by irrigated hayland from late spring to early fall, as well as seeded range and natural meadow forage, significant improvements in total animal production may be expected. The form of this improvement would depend on managerial skills and decisions. For example, reducing brood cow numbers and retaining only highly repeatable breeders would reduce winter feed demand, a purchased item in this scenario. Or, pasturing stocker cattle (either owned or on a fee basis) could add to seasonal production. These are only two alternatives of many.

Final thoughts

 **READ pages 37–38 of EM 8527.** Then return here.

Note: There is an error in the second sentence of the Conclusion on page 37 of EM 8527. It should read, “We assumed a long-term shortfall of April through *September* range forage.”

Pages 37 and 38 discuss how to set priorities for the practices to consider. One management practice that we did not evaluate was improved forage utilization and animal production through grazing management. This practice, in and of itself, can yield great benefits. Providing timely rest to plants allows significant range recovery without great costs. Improvements in fencing technology and water distribution are occurring at a rapid pace.

Planning to meet forage shortfalls is an inherent part of management in the arid and semiarid West. Many range operators in western states do not have many alternatives when their public land forage supply is threatened, reduced, or lost. This Workbook was intended to help you search for viable alternatives on lands under your control. If forage shortfalls do materialize, you likely will find other alternatives as well.

Worksheet B—Current Forage Requirements in AUMs

Class of Stock	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total													

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 2 on page 4 of EM 8527.

Worksheet B—Current Forage Requirements in AUMs

Class of Stock	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total													

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 2 on page 4 of EM 8527.

Worksheet C—Forage Sources for the Herd (January-June)

Class of Stock	January	February	March	April	May	June

Feed Source Legend:

Worksheet C—Forage Sources for the Herd (July-December)

Class of Stock	July	August	September	October	November	December

Feed Source Legend:

Worksheet C—Forage Sources for the Herd (January-June)

Class of Stock	January	February	March	April	May	June

Feed Source Legend:

Worksheet C—Forage Sources for the Herd (July-December)

Class of Stock	July	August	September	October	November	December

Feed Source Legend:

Worksheet D—Current Forage Available by Production Source and Month in AUMs

Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total															

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 3 on page 5 of EM 8527.

Worksheet D—Current Forage Available by Production Source and Month in AUMs

Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total															

Mature cow (including first calf heifers) with or without calf = 1.0 AU
 Weaner calf or yearling = 0.75 AU
 Bull = 1.5 AU
 Horse = 1.5 AU
 Sheep = 0.20 AU

Note: This worksheet corresponds to Table 3 on page 5 of EM 8527.

Worksheet E—Expected Forage Shortfalls (AUMs)

Forage Source or Ownership	Time of Forage Loss												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Shortfall													

Note: This worksheet corresponds to Table 4 on page 6 of EM 8527.

Worksheet E—Expected Forage Shortfalls (AUMs)

Forage Source or Ownership	Time of Forage Loss												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Shortfall													

Note: This worksheet corresponds to Table 4 on page 6 of EM 8527.

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet F—Management Unit Inventory

Name of Unit	
Acres	
Vegetation	
How Used	
When Used	
Present Production (AUMs or tons)	
Stocking Rate (acres per AUM)—for each major type in unit, if more than one	<hr/> <hr/> <hr/>
<p>Then, for each vegetation situation in that unit, estimate what appropriate improvement practice(s) might produce in terms of AUMs at particular times of the year. Summarize at the bottom of the sheet (for each type):</p>	
Acres To Be Treated	
Practice To Be Used	
Expected New Production Level	
Months of Best Use	
Expected New Stocking Rate	

Worksheet G—Forage Resource Inventory—Current and Potential (AUMs)

1 Unit	2 Description of Unit	3 Current AUMs	4 Kind of Improvement Practice	5 Potential AUMs	6 Use Periods
Total					

Note: This worksheet corresponds to Table 5 on page 10 of EM 8527.

Worksheet H—Seasonal Forage Availability (AUMs) after Improvements

Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Available															
Shortfall															

Note: This worksheet corresponds to Table 6 on page 11 of EM 8527.

Worksheet H—Seasonal Forage Availability (AUMs) after Improvements															
Source			Time												
Unit	Description	Acres	J	F	M	A	M	J	J	A	S	O	N	D	Total
Total Available															
Shortfall															
<p>Note: This worksheet corresponds to Table 6 on page 11 of EM 8527.</p>															

Worksheet I—Acres per New AUM

1 Unit	2 Current Acres per AUM	3 Treated Acres per AUM	4 Current AUMs per Acre	5 Treated AUMs per Acre	6 Additional AUMs per Acre	7 Acres to Treat for 1 New AUM

Worksheet J—Costs of Improvements

1 Unit	2 Improvement Practice	3 Cost of Treatment	4 Fencing and Water Cost	5 Deferment Cost	6 Other Costs

Worksheet K—Annual Cost per New AUM

1 Unit	2 Acres to Treat for 1 New AUM	3 Treatment Cost per New AUM	4 Fencing and Water Cost per New AUM	5 Deferment Cost per New AUM	6 Other Costs per New AUM	7 Total Cost per New AUM	8 Amortized Cost per New AUM

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