

## INTRODUCTION FORAGE SUITABILITY GROUPS FOR MONTANA

The Forage Suitability Group (FSG) subsection contains the FSG criteria, Land Resource Unit (LRU) criteria, FSG descriptions, and county soils lists occurring in each Major Land Resource Area (MLRA). A forage suitability group consists of one or more soil map unit components having similar potentials and limitations for forage production and grazing management within the specified Major Land Resource Area (MLRA). The soils comprising a FSG are sufficiently uniform to:

- support the same adapted forage plants under the same management conditions.
- have comparable potential productivity.
- require similar conservation treatment and management to produce adapted forages in optimum amounts and qualities.

All soil map unit components in the state have been placed in a forage suitability group, and a report has been prepared for each group. Refer to the individual county soil and FSG correlation tables in Section II, Field Office Technical Guide for those groupings.

The soil and FSG correlation tables are interpretive reports from the National Soil Information System (NASIS) data that provide the soil and plant science basis for planning individual tracts of grazed or mechanically harvested forage lands. Forage suitability groups order, condense, and simplify soil and vegetation information. They are interpretive narratives providing the soil and plant science basis for planning individual tracts of grazing land where detailed soil mapping has been done. Refer to **Table 1. Soil Physical and Chemical Properties Used to Differentiate Forage Suitability Groups in Montana** in Section II, Field Office Technical Guide, for an overview of the properties that apply to each FSG.

The information contained in the Forage Suitability Groups is not absolute. As with all Field Office Technical Guide (FOTG) material, it is intended as a guide for planners and clients to assist in the resolution of identified resource concerns leading to resource sustainability. Planners must utilize local sources of information, other agency personnel, result of applicable research, their own experience and professional judgment, and the experiences and observations of the client in preparing inventory, evaluation, alternatives, and alternative evaluations to the client for decision-making.

The following describes the different sections of the Forage Suitability Group narratives, and additional guidance on the LRU and MLRA criteria used for FSG development. For more detailed information, refer to the National Range and Pasture Handbook (NRPH).

**Descriptive Name and Number.** The first section identifies the group by a descriptive name and by a number that is unique to that group across the whole United States. It also identifies the Major Land Resource Area (MLRA) that the group occurs in.

The numbering convention for an FSG consists of 11-digit alphanumeric code (i.e., G053AG001MT):

- the first letter G identifies it as a forage suitability group.
- the next three digits and one letter identify the MLRA for that FSG (the letter X is used if no MLRA letter has been assigned).
- a single letter for the LRU designation follows the MLRA number (use the letter Y if no LRU is delineated and the FSG can be used across the entire MLRA with reasonable accuracy and similar responses to management).
- a three-digit chronological number is assigned to that particular FSG (e.g., 001-Clayey).
- the second-character state postal code is used to identify which state is responsible for development and maintenance of the FSG (e.g., MT).

**Physiographic Features.** This section describes the types of landforms within the landscape occupied by the forage suitability group. It serves to identify landscape factors that have a bearing on forage adaptation and management. For instance, a FSG's flooding or ponding frequency effects both plant adaptability and grazing or harvest management. Slope effects runoff, erosion, production potential, and forage management.

**Climate Features.** This section describes the climate for the MLRA and Land Resource Unit (LRU) being represented. Information in this section is tailored for its applicability to forage production and management. As such it is not so much concerned with climatic averages as it is with probabilities. For example, it is more important to know that a forage variety will have a 90 percent (nine years in ten) chance of escaping frost if it is planted after a certain date than it is to know that it has an average, (one year in two) chance.

**Soil Interpretations.** This section lists the chemical and physical properties of the soils that impact forage plant adaptation, management, or production potential.

**Adapted Species List.** This section identifies forage species that are adapted to the landscape positions, climate conditions, and soil properties listed in the report. Not all the listed species have the same yield potential, and considerable differences exist in their management needs. Adapted species should be selected from those listed based on the needs and management goals of the land user.

**Production Estimates.** This section provides for a means to communicate the yield potential of several commonly grown forage crops and mixtures relative to each other within the FSG. Great care should be taken if these figures are used for estimating future forage yields.

The management steps taken by a forage producer to arrive at an ultimate forage yield occur in two interrelated phases. The first is the production phase in which the management (species selection, fertility, etc.) is geared towards growing the forage crop. The production estimates listed in the reports represent the results of this phase as total annual aboveground plant production on an air-dry-matter basis. Estimates are provided for both high and low levels of production potential.

The second phase is harvest, during which management is geared towards removal of the forage crop either by mechanical means or grazing. Actual yields are dependent on the efficiency of the harvest management system employed. Careful consideration needs to go into choosing a harvest efficiency when estimating potential yields.

Mechanical harvest efficiency is generally higher than grazed efficiency. A 70 percent harvest efficiency for haying may be a reasonable figure to use. If total annual aboveground production of a forage mixture were estimated to be 6,000 lbs./ac., a 70 percent harvest efficiency would equate to 4,200 lbs./ac., or 2.1 tons/ac.

Grazing efficiency is highly dependent on the grazing management system employed. In Montana, the following conversion will be applied. Production on pastures in many instances is species dependent and depends if the pasture is a single species pasture or a mixture of grass species. To convert the information to AUMs (Animal Unit Months), multiply the pounds per acre by 30 percent (harvest efficiency) and then divide by 915 lbs./year/AU (Animal Unit). Example: Assume 2,800 pounds per acre (2,800 x 30)/ 915 = .90 AUMs).

Harvest management, especially grazing management, strongly impacts forage plant growth and total annual production because of its effects on plant vigor. This inter-relationship of production management and harvest management results in a wide range of yield potentials from the same forage crops grown on the same soil. Therefore, the production estimates provided in the FSG reports should only be used for broad planning purposes. Site-specific conservation planning must include consideration of the inter-relationship of forage production and forage harvest management when predicting forage and/or pasture yields.

**Forage Growth Curves.** This section estimates the seasonal distribution of growth of the various forage crops. They are valuable as management tools for predicting mechanical harvest dates, and for identifying periods of forage surplus or deficit during the grazing season.

**Soil Limitations.** This section identifies soil and/or landscape factors that adversely effect forage production or impact management flexibility.

**Management Interpretations.** This section suggests management strategies that may be employed to mitigate the impacts of identified soil limitations. For rangeland and dryland pastures, the 528-Prescribed Grazing standard and specification offer management guidance. For irrigated pastures, the Irrigated Pasture Management Guides are still available in the Pasture and Hayland Interpretations (Section II, FOTG) for reference. Those guides are found in the following tables: **Table 3. Irrigated Pasture Management Guide for High-Producing Sites; Table 4. Irrigated Pasture Management Guide for Moderate-Producing Sites; and, Table 5. Irrigated Pasture Management Guide for Low-Producing Sites.**

**FSG Documentation.** This section lists similar FSGs that resemble or may be confused with the current FSG, and notes the differences between them. References used for assembling the FSG data are listed, as well as the author(s) and approval person for the FSG.

**Land Resource Units (LRU).** Land Resource Units (LRUs) are the basic units from which Major Land Resource Areas (MLRAs) are determined. They are also the basic units for State land resource maps. They are typically co-extensive with State general soil map units, but some general soil map units are subdivided into land resource units because of significant geographic differences in climate, water resources, or land use.

Montana has subdivided its Major Land Resource Units (MLRAs) into Land Resource Units (LRUs). The LRUs are characterized by a combination of the amount of average annual precipitation and the length of the freeze-free season. Refer to **Table 2. Land Resource Units (LRU) in Montana for use with Forage Suitability Groups** for the LRU designations.

**Major Land Resource Units (MLRAs).** Major Land Resource Areas (MLRAs) are geographically associated Land Resource Units (LRUs). Identification of these large areas is important in statewide agricultural planning and has value in interstate, regional, and national planning. There are 15 different MLRAs in Montana.

The dominant physical characteristics of the Major Land Resource Areas (MLRAs) are described briefly in Agriculture Handbook 296 (<http://soils.usda.gov/survey/geography/mlra/>). The first paragraph lists the extent of each MLRA in each state and the total area. Major cities, highways, and culturally significant Federal- and State-owned lands within each MLRA are also listed. The remaining headings for each MLRA include physiography, geology, climate, water, soils, biological resources, and land use.

**Table 1. Soil Physical and Chemical Properties Used to Differentiate Forage Suitability Groups in Montana**

FSG Number	FSG name	AWC (RV) to 60 inch depth (inches)	ECe Max from 0-24" depth (dS/m)	SAR Max from 0-12" depth	Soil Surface clay (RV) from 0-8" depth (%)	RV depth of Water Table (inches)	Soil Reaction (RV) from 0-40" depth (pH)	CaCO3 eq. (RV) from 0-12" depth (%)	Flooding (frequency/duration)	Ponding (duration)	Slope (RV) (%)
001	Clayey	>6	<4	<13	>35	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
002	Clayey, acid	>6	<=16	<13	>35	>72	4.5-<5.5	<15	< Freq/Long	< Long	<=15
003	Clayey, dry	3-6	<4	<13	>35	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
004	Clayey, dry-acid	3-6	<=16	<13	>35	>72	4.5-<5.5	<15	< Freq/Long	< Long	<=15
005	Clayey, dry-mod. saline	3-6	4-8	<13	>35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
006	Clayey, dry-saline	3-6	>8-16	<13	>35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
007	Clayey, limy	>3	<4	<13	>35	>72	any	>=15	< Freq/Long	< Long	<=15
008	Clayey, mod. saline	>6	4-8	<13	>35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
009	Clayey, saline	>6	>8-16	<13	>35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
010	Deep subirr, acid	>3	<=16	<13	any	>48-72	4.5-<5.5	<15	< Freq/Long	< Long	<=15
011	Deep subirr, clayey	>3	<4	<13	>35	>48-72	>5.5	<15	< Freq/Long	< Long	<=15
012	Deep subirr, limy	>3	<4	<13	any	>48-72	>5.5	>=15	< Freq/Long	< Long	<=15
013	Deep subirr, loamy	>3	<4	<13	7-35	>48-72	>5.5	<15	< Freq/Long	< Long	<=15
014	Deep subirr, mod saline	>3	4-8	<13	any	>48-72	>5.5	any	< Freq/Long	< Long	<=15
015	Deep subirr, saline	>3	>8-16	<13	any	>48-72	>5.5	any	< Freq/Long	< Long	<=15
016	Deep subirr, sandy	>3	<4	<13	<7	>48-72	>5.5	<15	< Freq/Long	< Long	<=15
017	Loamy	>6	<4	<13	7-35	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
018	Loamy, acid	>3	<=16	any	<=35	>72	4.5-<5.5	<15	< Freq/Long	< Long	<=15
019	Loamy, dry	3-6	<4	<13	7-35	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
020	Loamy, dry-mod. saline	3-6	4-8	<13	<=35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
021	Loamy, dry-saline	3-6	>8-16	<13	<=35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
022	Loamy, limy	>3	<4	<13	<=35	>72	any	>=15	< Freq/Long	< Long	<=15
023	Loamy, mod.saline	>6	4-8	<13	<=35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
024	Loamy, saline	>6	>8-16	<13	<=35	>72	5.5-8.5	any	< Freq/Long	< Long	<=15
025	Sandy	>6	<4	any	<7	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
026	Sandy, dry	3-6	<4	any	<7	>72	5.5-8.5	<15	< Freq/Long	< Long	<=15
027	Sodic, Sodic/Saline	>3	<=16	>13	any	>18	>5.5	any	< Freq/Long	< Long	<=15
028	Subirr, acid	>3	<=16	<13	any	18-48	4.5-<5.5	<15	< Freq/Long	< Long	<=15
029	Subirr, clayey	>3	<4	<13	>35	18-48	>=5.5	<15	< Freq/Long	< Long	<=15
030	Subirr, limy	>3	<4	<13	any	18-48	any	>=15	< Freq/Long	< Long	<=15
031	Subirr, loamy/sandy	>3	<4	<13	<=35	18-48	>=5.5	<15	< Freq/Long	< Long	<=15
032	Subirr, mod. Saline	any	4-8	<13	any	18-48	>=5.5	any	< Freq/Long	< Long	<=15
033	Subirr, Saline	>3	>8-16	<13	any	18-48	>=5.5	any	< Freq/Long	< Long	<=15
034	Wet	any	<=8	<13	any	<18	>=4.5	any	any	<v.long	<=15
035	Wet, saline	any	>8-16	any	any	<18	>=4.5	any	any	<v.long	<=15
049	Steep Slopes	any	any	any	any	any	any	any	any	any	> 15
050	Needs Field Review	<3	>16	any	any	any	<4.5	any	>=Freq/Long	>=Long	<=15

**Table 2. Land Resource Units (LRU) in Montana for use with Forage Suitability Groups**

LRU id	LRU "name" (PPT inches/ FFS days)	PPT low (inches)	PPT high (inches)	PPT low (mm)	PPT high (mm)	FFS low (days)	FFS high (days)
A	<10/<70	0.1	<10	1	253	1	69
B	<10/70-90	0.1	<10	1	253	70	89
C	<10/90-120	0.1	<10	1	253	90	120
D	<10/>120	0.1	<10	1	253	121	365
E	10-14/<70	10	14.5	254	369	1	69
F	10-14/70-90	10	14.5	254	369	70	89
G	10-14/90-120	10	14.5	254	369	90	120
H	10-14/>120	10	14.5	254	369	121	365
I	15-19/<70	>14.5	20	370	508	1	69
J	15-19/70-90	>14.5	20	370	508	70	89
K	15-19/90-120	>14.5	20	370	508	90	120
L	15-19/>120	>14.5	20	370	508	121	365
M	>20/<70	>20	N/A	509	5000	1	69
N	>20/70-90	>20	N/A	509	5000	70	89
O	>20/90-120	>20	N/A	509	5000	90	120
P	>20/>120	>20	N/A	509	5000	121	365
Y*	any	all	all	all	all	all	all

Notes:

LRU = Land Resource Unit.

LRU "name" = the combination of PPT amount (inches) and FFS length (days).

PPT = Precipitation. Note: PPT is reported in mm in NASIS. 5000mm is approx. 200 inches.

FFS = Freeze-free season length (number of days).

\* LRU Y means that the FSG applies throughout the entire climate range of the MLRA.

Null values in NASIS for PPT and/or FFS will fail LRU assignment.

These PPT and FFS values will be assigned in NASIS using selective queries, not the Interp. Generator.

**Table 3. Irrigated Pasture Management Guide for High-Producing Sites**

MANAGEMENT LEVEL	HIGH	GOOD	FAIR	LOW
<b>Grazing Management</b> <sup>1/</sup>				
1. Intensity of Rotation	7 or more pastures grazed for 2 to 4 days per rotation, or strip grazed.	4 or 5 pastures grazed for 4 or 10 days per rotation.	2 or 3 pastures grazed for 10 to 20 days per rotation.	1 pasture grazed for long periods or continuously.
2. Available foliage (average height with leaf held in vertical position)	Foliage height at beginning of grazing season--12 inches or more.	Foliage height at beginning of grazing season--8 to 10 inches.	Foliage height at beginning of grazing season--6 inches.	Foliage height at beginning of grazing season--4 inches.
3. Degree of Use	Stubble height at end of grazing period--4 inches or more.	Stubble height at end of grazing period--3 to 4 inches.	Stubble height at end of grazing period--2 or 3 inches.	Stubble height at end of grazing period--less than 2 inches.
4. Maintenance of stand (average height with leaf held in vertical position)	Foliage height regrowth at freeze-up--8 inches or more.	Foliage height regrowth at freeze-up--5 to 8 inches.	Foliage height regrowth at freeze-up--3 inches.	Foliage height regrowth at freeze-up--less than 2 inches.
5. Regrowth period	4 or more weeks for regrowth between grazings.	3 weeks for regrowth between grazings.	2 weeks for regrowth between grazings.	Continuously grazed with no regrowth period.
<b>Irrigation</b>				
1. Frequency	Soil moisture maintained above the level where plant stress occurs. 2 or more irrigations during the regrowth period.	Soil moisture usually adequate. 1 or 2 irrigations during the regrowth period.	Plant stress frequently apparent between irrigations. Rarely more than 1 irrigation during the regrowth period.	Too much or too little irrigation.
2. Time	Irrigated <u>immediately</u> after livestock are removed from pasture.	Irrigated several days after livestock are removed from pasture.	Irrigation frequently delayed a week after livestock are removed.	Too much or too little irrigation.
3. Time lapse after irrigation before grazing	Soil firm when grazed.	Soil usually firm before grazing is resumed.	Soil frequently wet and soft when grazed.	Irrigated while grazing.
<b>Composition</b>				
1. Legumes	Approximately 50 percent of production comes from a high yielding legume, usually alfalfa.	30 to 40 percent of production comes from a high yielding legume.	20 percent legume.	Usually less than 10 percent legume. Usually white clover.
2. Grass	Good stands of adapted, high-producing species.	Good stands of adapted, high-producing species.	Stands lack vigor or may include enough weeds and poorly adapted or low-producing species to reduce pasture yield.	Poor stand, low vigor, weeds, low-producing species, etc.
<b>Fertilizer</b>				
1. Nitrogen	Apply about 50 lbs. of available N/ac. (or 120 to 200 lbs. N/ac. to straight grass in 2 or 3 applications).	Apply 20 to 40 lbs. of available N/ac. (or 100 to 200 lbs. N/ac. to straight grass in 2 applications).	Apply less than 20 lbs. of available N/ac. (or 30 to 60 lbs. N/ac. to straight grass).	No nitrogen applied.
2. Phosphorus	Apply in quantity sufficient to supply 60 to 70 lbs. P <sub>2</sub> O <sub>5</sub> /ac./year.	Apply in quantity sufficient to supply 40 to 50 lbs. P <sub>2</sub> O <sub>5</sub> /ac./year.	Apply less than 30 lbs. of available P <sub>2</sub> O <sub>5</sub> at seeding time and only occasionally thereafter.	No phosphorus applied.
<b>Maintenance</b>				
1. Clipping	Rough stemmy growth clipped.	Rough stemmy growth clipped.	Stemmy growth rarely clipped.	Never clipped.
2. Dragging	Droppings spread by dragging in spring and occasionally in mid-summer.	Droppings spread by dragging in spring and occasionally in mid-summer.	Droppings seldom spread by dragging.	Never dragged.
<b>Expected Production--Animal Unit Months per acre per 120-day growing season</b>	9 or more	9 to 6	6 to 3	3 or less

<sup>1/</sup> The measurements are for good stands of recommended pasture plants.

**Table 4. Irrigated Pasture Management Guide for Moderate-Producing Sites**

MANAGEMENT LEVEL	GOOD	FAIR	LOW
<b>Grazing Management</b> <sup>1/</sup>			
1. Intensity of Rotation	4 or 5 pastures grazed for 4 to 10 days per rotation.	2 or 3 pastures grazed for 10 to 20 days per rotation.	1 pasture grazed for long periods or continuously.
2. Available foliage (average height with leaf held in vertical position)	Foliage height at beginning of grazing season--8 to 10 inches.	Foliage height at beginning of grazing season--6 inches.	Foliage height at beginning of grazing season--less than 4 inches.
3. Degree of Use	Stubble height at end of grazing season--3 to 4 inches.	Stubble height at end of grazing season--2 or 3 inches.	Stubble height at end of grazing season--less than 2 inches.
4. Maintenance of stand (average height with leaf held in vertical position).	Foliage height regrowth at freeze-up--5 to 8 inches.	Foliage height regrowth at freeze-up--3 inches.	Foliage height regrowth at freeze-up--less than 2 inches.
5. Regrowth period	3 weeks or more for regrowth between grazings.	2 weeks for regrowth between grazings.	Continuously grazed with no regrowth period.
<b>Irrigation</b>			
1. Frequency	Soil moisture usually adequate. 1 or 2 irrigations during regrowth period.	Plant stress frequently apparent between irrigations. Rarely more than 1 irrigation during the regrowth period.	Too much or too little irrigation.
2. Time	Irrigated several days after livestock are removed from pasture.	Irrigation frequently delayed a week after livestock are removed from pasture.	Too much or too little irrigation.
3. Time lapse after irrigation before grazing.	Soil usually firm before grazing is resumed.	Soil frequently wet and soft when grazed.	Irrigated while grazing.
<b>Composition</b>			
1. Legumes	30 to 50 percent legume, usually alfalfa.	20 percent legume, usually alfalfa.	Usually less than 10 percent legume. Usually white clover.
2. Grass	Good stands of adapted, high-producing species.	Stand lacks vigor or may include weeds and poorly adapted or low-producing species.	Poor stand, low vigor, weeds, low-producing species, etc.
<b>Fertilizer</b>			
1. Nitrogen	Apply more than 20 lbs. of available N/ac. (or 100 to 120 lbs. N/ac. to straight grass in 2 applications).	Apply less than 20 lbs. of available N/ac. (or 30 to 60 lbs. N/ac. applied to straight grass).	No nitrogen applied.
2. Phosphorus	Apply in quantity sufficient to supply 40 to 50 lbs. P <sub>2</sub> O <sub>5</sub> /ac./year.	Apply less than 30 lbs. of available P <sub>2</sub> O <sub>5</sub> at seeding time and only occasionally thereafter.	No phosphorus applied.
<b>Maintenance</b>			
1. Clipping	Rough stemmy growth clipped as needed.	Stemmy growth rarely clipped.	Never clipped.
2. Dragging	Droppings spread by dragging in spring and occasionally in mid-summer.	Droppings are seldom spread by dragging.	Never dragged.
<b>Expected Production</b> --Animal Unit Months per acre per 120-day growing season	5 to 3	4 to 2	2 or less

<sup>1/</sup> The measurements are for good stands of recommended pasture plants.

**Table 5. Irrigated Pasture Management Guide for Low-Producing Sites**

MANAGEMENT LEVEL	GOOD	LOW
<b>Grazing Management</b>		
1. Intensity of Rotation	More than 1 pasture grazed for 10-30 days per rotation.	1 pasture grazed continuously.
2. Available foliage (average height with leaf held in vertical position)	Foliage height at beginning of grazing season--4 inches or more.	Foliage height at beginning of grazing season--4 inches or more.
3. Degree of Use	Stubble height at end of grazing season--3 inches or more.	Stubble height at end of grazing season--less than 3 inches.
4. Maintenance of stand (average height with leaf held in vertical position)	Foliage height regrowth at freeze-up--3 inches or more.	Foliage height regrowth at freeze-up--less than 3 inches.
5. Regrowth period	2 weeks for regrowth between grazings.	Continuously grazed with no regrowth period.
<b>Irrigation</b>		
1. Frequency	Soil moisture usually adequate. 1 or 2 irrigations during regrowth period.	Too much or too little irrigation.
2. Time lapse after irrigation	Soil sometimes wet and soft when grazed. Sometimes irrigated during grazing.	Irrigated while grazing.
<b>Composition</b>		
1. Legumes	25 to 50 percent adapted legume.	Little or no legume.
2. Grass	Mostly desirable species.	Low-producing species with large percent of weeds and invaders.
<b>Fertilizer</b>		
1. Nitrogen	Light application used.	No nitrogen applied.
2. Phosphorus	Usually not used.	No phosphorus applied.
<b>Maintenance</b>		
1. Clipping	Stemmy growth rarely clipped.	Never clipped.
2. Dragging	Droppings seldom spread by dragging.	Never dragged.
<b>Expected Production--Animal Unit Months per acre per 120-day growing season</b>	2 to 1	1 or less