TECHNICAL NOTE

USDA-Natural Resources Conservation Service

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FORAGE ZONES FOR WESTERN WASHINGTON

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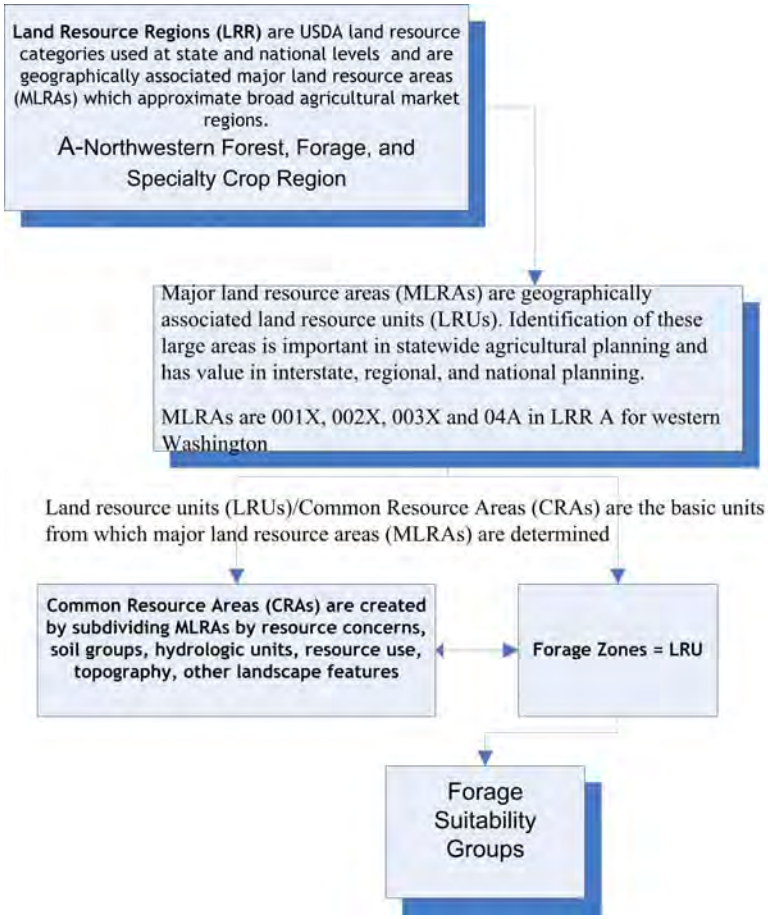
Forage Zones are land units with unique climatic and soils characteristics that affect establishment, growth, and production of forages. Forage Zones are further divided into Forage Suitability Groups. Forage Suitability Groups (FSG's) are management groupings composed of individual soil map unit components having similar potentials and limitations for forage production.

These forage zones are based on the subsidiary divisions of Major Land Resource Areas as described in Agriculture Handbook 296-Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin (for more information on Major Land Resource Areas, see the Appendix 2) The diagram below illustrates the relationships between these different levels of land divisions.



NRCS-WA has developed Forage Suitability Groups in western Washington State based on the following MLRA-LRU-CRA descriptions (Appendix 3) that is based on climatic conditions and elevation zones that impact forage growth and productivity Forage Zones are further subdivisions and aggregation of Common Resource Area (CRA) boundaries that more precisely reflect local climatic and soil conditions. Forage Suitability Groups (FSG) are developed for each Forage Zone. The Pasture Calendar (Appendix 1) describes in detail the localized seasonal climatic factors and the recommended management activities which will best take advantage of expected seasonal conditions as described in the Forage Suitability Group. The Forage Suitability Groups are not established for areas in the mountain zone; greater than 1500 feet of elevation. Forage Zone and CRA maps are included as the last pages of this document.

Forage Suitability Groups are numbered based on

Type of Ecological Site as Pasture	**Major Land Resource Area**	**Land Resouce Unit (LRU) =Forage Zone**	**site number**	**State Postal Code**
G	001X	N	XXX	WA
1-digit letter	3-digit number and a one-digit letter	1-digit letter assigned by state	3-digit number assigned by state	2-digit letter

There are several climatic controls which have a definite influence on the climate, namely; (a) terrain, (b) proximity to the Pacific Ocean, and (c) semi-permanent high and low pressure regions located over the North Pacific Ocean. The effects of these various controls combine to produce entirely different conditions within short distances.

While forage species in almost all Forage Zones in western WA never go truly dormant during the winter, there is a period of very slow growth when almost no harvestable growth occurs. This period is approximated by the average first and last freeze dates as measured at 24°F for **5** yr in 10 probability. Average dates for first freeze in the fall and last freeze in the spring are listed in the tables below for the various Forage Zones.

The freeze/frost data probabilities (1 yr in 10 or 5 years in 10) expressed as percentages indicate how likely it is that a frost will occur. For fall the percentages show the likelihood of the first frost before the the given date.

For example, (5 year in 10 probability)a 50% value for October 17th (2S – Lowlands) means that there is a 10% chance that there will be a frost before that date. This is the same as saying there is a 90% chance that the first frost of the year will occur on or after that date.

For example, (1 year in 10 probability) a 10% value for November 30th (2S – Lowlands) means that there is a 50% chance that there will be a frost before that date. This is the same as saying there is a 50% chance that the first frost of the year will occur on or after that date.

For spring the percentages show the likelihood of that the last frost before the given date. For example, (5 year in 10 probability)a date March 10 (2S – Lowlands) means that there is a 50% chance that there will be no more frost after this. In other words there is only a 50% chance that another frost will occur that year.

For some warm locations, the before and after dates are close together and may occur in the same season, usually winter. For example, (1 year in 10 probability) a date April 11 (2S – Lowlands) means that there is a 90% chance that there will be no more frost after this. In other words there is only a 10% chance that another frost will occur that year.

For some warm locations, the before and after dates are close together and may occur in the same season, usually winter.

Climate-Frost Dates Forage Zones - 5 yr in 10 probability- 50%

MLRA_FZONE	First freezing temperature in fall	Last freezing temperature in spring	Tsum 200 order
1F - FOOTHILLS	1/4	1/23	9. Elwha
1Y - COAST RANGE LOWLANDS	10/8	2/2	4. Forks
2F - FOOTHILLS	12/7	2/11	5. Buckley
2N - NORTH LOWLANDS	10/17	2/22	6. Mt Vernon
2S - SOUTH LOWLANDS	11/30	2/28	7. Olympia
2V - VANCOUVER/COWLITZ BASIN	12/8	2/10	2. Centralia
3F - FOOTHILLS	12/2	2/18	8. Clearbrook
4AC - COASTAL LOWLANDS	1/3	1/12	1. Aberdeen
4AF - FOOTHILLS	12/21	2/7	3. Elma

Climate-Frost Dates Forage Zones - 1 yr in 10 probability- 10%

MLRA_FZONE	First freezing temperature in fall	Last freezing temperature in spring
1F - FOOTHILLS	11/18	3/8
1Y - COAST RANGE LOWLANDS	11/9	3/10
2F - FOOTHILLS	11/7	3/14
2N - NORTH LOWLANDS	11/9	3/6
2S - SOUTH LOWLANDS	10/24	3/30
2V - VANCOUVER/COWLITZ BASIN	11/4	3/11
3F - FOOTHILLS	11/2	3/21
4AC - COASTAL LOWLANDS	11/27	2/23
4AF - FOOTHILLS	11/10	3/19

These tables are compiled with data from several weather stations in each Forage Zone. Because of the many variable microclimates in western Washington, for site specific information use climate data from weather stations immediately adjacent to project areas.

Climate-GDD and Growing Season Length - 9 years in 10

MLRA_FZONE	AvgOfGDD40	MaxOfGDD40	MinOfppt_avg	AvgOfppt_avg	MaxOfppt_avg
1F - FOOTHILLS	3692	3692	87	87	87
1Y - COAST RANGE LOWLANDS	3731	3982	55	100	121
2F - FOOTHILLS	3596	4268	43	56	77
2N - NORTH LOWLANDS	4190	4679	22	46	90
2S - SOUTH LOWLANDS	4265	4483	51	59	69
2V - VANCOUVER/COWLITZ BASIN	4535	4796	42	47	53
3F - FOOTHILLS	3898	4401	57	87	116
4AC - COASTAL LOWLANDS	3318	4168	69	84	113
4AF - FOOTHILLS	3526	3526	135	135	135

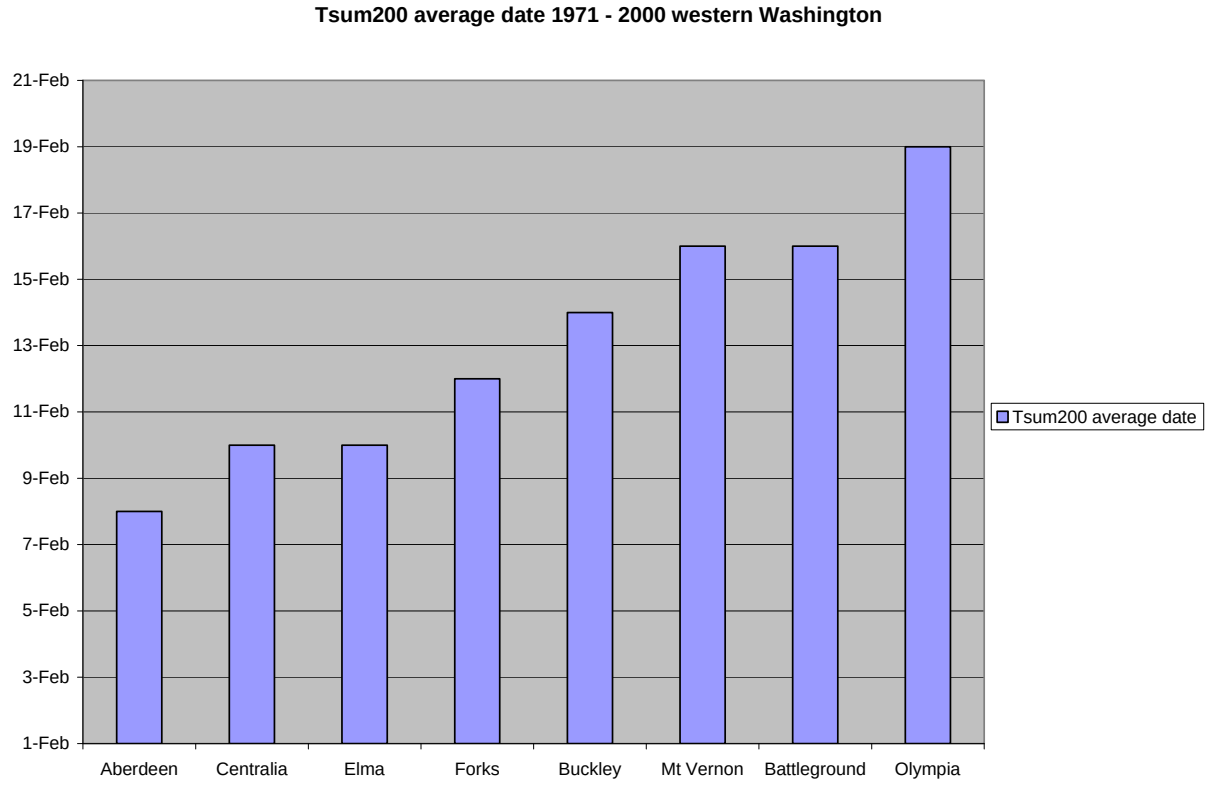
Most of the rainfall occurs as low-intensity, Pacific frontal storms. About 75% of the precipitation occurs during the fall and winter, and 15% in the spring months. Summers are cool and relatively dry. Snowfall occurs in all of the areas although accumulations are usually small and of short duration.

Climate-Growing Season LRU - 9 years in 10

MLRA_FZONE	AvgOfdays_24F	AvgOfdays_28F	AvgOfdays_32F
1F - FOOTHILLS	283	214	159
1Y - COAST RANGE LOWLANDS	262	203	146
2F - FOOTHILLS	252	195	152
2N - NORTH LOWLANDS	272	221	171
2S - SOUTH LOWLANDS	229	163	130
2V - VANCOUVER/COWLITZ BASIN	254	199	149
3F - FOOTHILLS	244	194	141
4AC - COASTAL LOWLANDS	291	239	170
4AF - FOOTHILLS	278	205	139

The above factors interacting together create the growth patterns seen in the pastures at any point in time. The Pasture Growth Calendar outlined in this publication (see Appendix 1) describes how to manage in coordination with these factors to achieve your pasture goals. Initiation of growth and especially fertilization is based on the T-Sum 200 calculation. Beginning January 1, calculate each day's heat units. A quick way to do this is by using this computer-based web address: http://ippc2.orst.edu/OR/

The T-Sum 200 method is based on an accumulation of 200 heat units in °C. If the temperature is in Fahrenheit (°F), fertilize when you reach 360 heat units. Heat units are based the average of each day's high and low temperatures.
For °C, heat units can be calculated by adding the maximum temperature to the minimum temperature (use 0 for negative values) and dividing by 2.
For °F, add maximum temperature to minimum temperature, divide by 2, then subtract 32.



APPENDIX 1 PASTURE GROWTH CALENDAR

Pasture Growth Calendar - Western Washington

Month	Portion of Month	Vancouver/Cowlitz Basin		Puget Lowland		Foothills	Coastal Valleys
Soil Moisture Status during growing season:		Droughty to adequate	Optimal	Droughty to adequate	Optimal	all	all
MLRA or Common Resource Area:		2.3, 2.4	2.1, 2.2, 2.3, 2.9	2.5 - 2.8, 2.10 - 2.13		4a.3, 2.5, 2.10, 3.1, MLRA 1	4a.1, 4a.2
September **	1st 1/2	1	1	1	2a	2a	2a
September **	2nd 1/2	2a	1	1/2a	2a	2a	2a
October	1st 1/2	2a	2a	2a	2a	2b	2a
October	2nd 1/2	2b	2b	2b	2b	2b	2b
November	1st 1/2	2b	2b	2b	2b	3	2b
November	2nd 1/2	3	3	3	3	3	2b
December	1st 1/2	3	3	3	3	4	2b
December	2nd 1/2	4	4	4	4	4	3
January	1st 1/2	4	4	4	4	4	4
January	2nd 1/2	4	4	4	4	4	5
February	1st 1/2	5	5	4	4	4	5
February	2nd 1/2	5	5	5	5	4	5
March	1st 1/2	6a	5	5	5	5	6a
March	2nd 1/2	6a	6a	6a	6a	5	6a
April	1st 1/2	6a	6a	6a	6a	6a	6a
April	2nd 1/2	6b	6b	6b	6b	6a	6b
May	1st 1/2	6b	6b	6b	6b	6b	6b
May	2nd 1/2	6b	6b	6b	6b	6b	6b
June	1st 1/2	7	7	7	7	6b	6b
June	2nd 1/2	7/8	7/8	7	7	7	7
July	1st 1/2	9	9	8	8	7	7
July **	2nd 1/2	10	9	9	8	8	8
August **	1st 1/2	10	10	10	9	8	8
August **	2nd 1/2	10	10	10	9	9	8

Grassland Growth Period	Title	Brief Description
1	***Semi-dormancy***	Recovering from summer dormancy, root growth
2a	***Steady regrowth***	New green sprigs with much brown, root growth
2b	***Steady regrowth***	Looks mostly green with little brown, root growth
3	***Declining regrowth***	Slowing plant top & root growth, tops may yellow
4	***Very slow growth***	Plants semi-dormant, maintenance growth
5	***Increasing growth***	Plant uses reserves to increase growth of shoots & roots
6a	***Rapid growth - cool soils***	Plant uses reserves as in 5, above, but at a faster rate
6b	***Rapid growth - warming soils***	Tops show rapid growth, quality declines w/o harvest
7	***Slowing growth***	Top growth slows, managed harvest maintains quality
8	***Steady growth***	Less top growth, root shedding begins
9	***Slow growth***	Rapid root shedding, drought/heat may start dormancy
10	***Dormancy***	Dormancy w/o irrigation, stubble mgmt critical for regrowth

APPENDIX 1 PASTURE GROWTH CALENDAR

PASTURE CALENDAR DETAIL				
Grassland Growth Period - Title	**Growth Activity**	**Environment**	**Management Action**	**Avoid these Actions**
1 – Semidormancy	Limited growth unless irrigated; root growth starts; growing points developing; protein increasing; carbohydrates being stored in stem bases; winter weeds sprout	Rains return; temperatures cooler, esp. at night; days shorter; soils warm	Fall soil test, lime or fertilize; use confinement area.	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers. Over-fertilization
2a – Steady regrowth	New green growth with much brown; roots and growing points establishing and growing; carbohydrates stored in stem bases; high protein and carbohydrate levels, highest digestibility of the year.	Day length decreasing (fall equinox), regular rains; soil and air temperatures cool; soil nitrogen mineralization increasing if moisture available.	Fall soil test, lime or fertilize; use confinement area	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers. Over-fertilization
2b – Steady regrowth	Mostly green with little brown, root growth continues; high protein and carbohydrate levels, highest digestibility of the year.	Soil nitrogen mineralization rapid, steady rainfall; soils cool further.	Fall soil test, lime; monitor soils for saturation and remove livestock to avoid compaction; use confinement area.	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers. Over-fertilization
3 – Declining regrowth	Slowing forage and root growth; root shedding; tops yellow; protein levels drop, carbohydrate levels remain high	Short day length slows forage growth; heavy rains; soil nutrients less available; flooding possible on low-lying fields.	Use confinement area.	Grazing or equipment use on saturated soils. Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches sodformers. Over-fertilization
4 - Very slow growth	Semi-dormant; maintenance growth; root shedding; protein levels drop, carbohydrate levels stay high	Short days; cold air temperatures; heavy rains; soil nutrients less available; soil temperatures cool; flooding possible on low-lying fields.	Use confinement area. Start tracking T-Sum.	Grazing or equipment use on saturated soils. Over fertilization. Grazing below increased residual heights: 4 inches-bunchgrasses, 3 inches-sodformers.
5 – Increasing growth	Stem base reserves used for shoot and root growth; production increasing; protein and carbohydrate levels low.	Day length increasing; air temperatures warming; soil nutrients increasingly available after T-Sum 200 but mineral deficiency symptoms may occur due to cool soils; soils warming and drying	Monitor T-Sum. First application of nutrients and lime. Check for weed problems. Use confinement area.	Grazing or equipment use on saturated soils. Over fertilization. Grazing below increased residual heights: 4 inches-bunchgrasses, 3 inches-sodformers.
6a – Rapid growth - cool soils	Stem base reserves used for shoot and root growth at a faster rate; seedhead developing; protein and carbohydrate levels low; digestibility high, fiber low.	Day length increasing (spring equinox); air temperatures increasing, nights cool; soils cool; soil nutrients increasingly available.	Apply nutrients and lime if not previously done; use confinement area; overseed confinement areas; reseed scheduled pastures; control weeds.	Grazing or equipment use on saturated soils. Over fertilization. Grazing below increased residual heights: 4 inches-bunchgrasses, 3 inches-sodformers.

APPENDIX 1 PASTURE GROWTH CALENDAR

PASTURE CALENDAR DETAIL				
Grassland Growth Period - Title	**Growth Activity**	**Environment**	**Management Action**	**Avoid these Actions**
6b - Rapid growth - warming soils	Rapid growth; quality declines w/o harvest; seedheads emerging; regrowth rapid; root growth slowing, carbohydrate levels increasing in lower leaves and stem; digestibility high, fiber low.	Day length significantly longer; air temperatures increasing; nights cool, but not frosting; soils warming; soils nutrients more available, but may not meet plant needs.	1st/2nd application of nutrients and lime; reseed scheduled pastures; over-seed confinement areas; control weeds.	Grazing or equipment use on saturated soils. Over fertilization. Grazing below increased residual heights: 4 inches-bunchgrasses, 3 inches-sodformers.
7 – Slowing growth	Slowing growth, mostly from vegetative tillers; digestibility lower but still high quality; seedheads emerge on late species such as timothy; regrowth time increasing; root growth slowing, carbohydrate levels declining.	Longest days of the year (summer solstice); soil moisture adequate but less available; air temperatures warming day and night; soil temperatures warming; soil nutrients very available.	Monitor growth rates; control weeds; monitor irrigation needs; 2nd/3rd application of nutrients. Cut hay before mature seed-setting phase.	Grazing below increased residual heights: 4 inches-bunchgrasses, 3 inches-sodformers.
8 - Steady growth	Less forage growth, root shedding begins; protein levels adequate; carbohydrate levels decline; digestibility lower and fiber higher; lack of moisture and high temperatures slows growth, may start dormancy.	Air temperatures (day and night) and soil temperatures are warm; little rainfall; evaporation increases.	Monitor growth rates. Use confinement area if stubble height can't be maintained. Cut hay before mature seed-setting phase.	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers.
9 - Slow growth	Rapid root shedding; forage growth slowing; drought/heat result in very little growth or start dormancy; protein levels adequate, low carbohydrate levels, digestibility improving	Air temperatures usually higher than optimum for forage growth; little rainfall; soil temperatures warm, day length decreasing.	Use confinement area to maintain stubble height. Cut hay before mature seed-setting phase.	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers.
10 – Dormancy	Dormancy w/o soil moisture or irrigation; protein levels adequate, carbohydrate levels low and static because no growth is occurring.	Day length decreasing; air temperatures peak; little or no rainfall; soil temperatures peak	Use confinement area to maintain stubble height.	Grazing below minimum residual heights: 3 inches-bunchgrasses, 2 inches-sodformers

TSum200:

Jagtenberg, W.D. Predicting the Best Time to Apply Nitrogen to Grassland in Spring. 1970. Journal of the British Grassland Society, vol 25, no 4. pp 266-270.

Early Spring Forage Production for Western Oregon Pastures Jan 2004 http://extension.oregonstate.edu/catalog/pdf/em/em8852-e.pdf

Pasture Calendar:

Fransen, S., G. Pirelli, M. Chaney, and L. Brewer. 2003. The Westside Pasture Calendar. Oregon State Univ. Ext. Bull., Corvallis, OR (in review).

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APPENDIX 2 MLRA AND LRU IN NRCS Forage Zones

(U.S. Department of Agriculture Handbook 296, 2006)
http://soils.usda.gov/survey/geography/mlra

Major Land Resource Area (MLRA)

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.
The 278 major land resource areas are designated by Arabic numbers and identified by a descriptive geographic name in Agriculture Handbook 296. For example, MLRA 1 (Northern Pacific Coast Range, Foothills, and Valleys) is on the west coast. Where preexising MLRAs have been revised an alphabetic suffix is often added to the original Arabic number (e.g., MLRA 4A).

The dominant physical characteristics of the major land resource areas are described briefly in Agriculture Handbook 296. 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.

MLRA Definitions

The USDA land resource categories used at state and national levels are land resource units (LRUs), major land resource areas (MLRAs), and land resource regions (LRRs).

Land Resource Region (LRR)

Land resource regions (LRRs) are geographically associated major land resource areas (MLRAs) which approximate broad agricultural market regions.
Land resource regions (LRRs) are designated by capital letters identified by a descriptive name. For example, the descriptive name for Land Resource Region A is the Northwestern Forest, Forage, and Specialty Crop Region.

Land Resource Unit (LRU)/Common Resource Area (CRA)

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 coextensive 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.
Common Resource Areas (CRAs) are created by subdividing MLRAs by resource concerns, soil groups, hydrologic units, resource use, topography, other landscape features, and human considerations affecting use and treatment needs. A national, digital geographic coverage for CRAs is presently under development and in some portions of the Nation is associated with the Development of a Common Spatial Framework of Ecological Units, an interagency effort involving eight Federal agencies.

LRUs have historically only had wide use in the southwestern portion of the U.S., whereas CRAs are more widely accepted across the nation. LRUs are used in western Washington to designate forage zones for pasture management. These forage zone LRUs are aggregated bases on CRAs.

APPENDIX 2 MLRA AND LRU IN NRCS Forage Zones

http://soils.usda.gov/survey/geography/mlra/mlra_definitions.html

A Common Resource Area (CRA) map delineation is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) map delineation or polygon. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determine the geographic boundaries of a Common Resource Area.

http://soils.usda.gov/survey/geography/cra.html

APPENDIX 3 MLRA-LRU-CRA Descriptions

MLRA	LRU	MLRA_LRU Description
001X	F	This LRU includes Forage Suitability Groups and descriptions in the Foothills Zone of MLRA1 and includes portions of CRA 1.1, 1.2, and 1.5. . This corresponds to Forage Zones. The Foothills Zone occurs on the low foothills and plateaus surrounding the Olympic Mountain range and Willapa Hills. Slopes are gentle to steep. Valleys are mostly narrow and of small extent. Elevation ranges from 500 to 1,500 feet (150 to 450 meters). This zone has been repeatedly glaciated and consists primarily of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with volcanic rocks of the same age as well as glacial till and outwash deposits in the northern half of the zone. The soils in the area dominantly have a mesic soil temperature regime and an udic soil moisture regime. The soils are shallow to very deep, well drained, medial, and loamy or clayey.
001X	Y	This LRU includes Forage Suitability Groups and ecological site descriptions in the Lowlands Zone of MLRA1 and includes portions of CRA 1.1, 1.2, 1.4 and 1.5. The Lowlands Zone occurs on the low foothills and plateaus surrounding the Olympic Mountain range and Willapa Hills. Slopes are gentle to steep. Valleys are mostly narrow and of small extent. Elevation ranges from sea level to 500 feet (0 to 150 meters). This zone has been repeatedly glaciated and consists primarily of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with volcanic rocks of the same age as well as glacial till and outwash deposits in the northern half of the zone. The soils in the area dominantly have a mesic soil temperature regime and an udic soil moisture regime. The soils are shallow to very deep, well drained, medial, and loamy or clayey.
002X	F	This LRU is the Foothills Zone of MLRA 2X and includes portions of CRA 2.1, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, and 2.13 with elevations between 500 and 1500 feet, as well as CRA 2.6M, which is the portion of CRA 2.6 in Mason County and includes elevations starting at 300 feet. This zone occurs on the low foothills and plateaus leading to mountain slopes. Slopes range from gentle to steep. Valleys are mostly narrow and of small extent. Elevation ranges from 300 to 1,500 feet (90 to 450 meters). The portion of the zone near the Cascades is made up of a mixture of a variety of sedimentary rocks. Thin deposits of alluvium are at the lower elevations along the major streams draining the Cascades. All of the Cascades have been glaciated and isolated remnants of till and outwash deposits are at the lower elevations on the flanks of the mountains. The soils dominantly have a mesic soil temperature regime and an udic soil moisture regime. The soils are shallow to very deep, well drained, medial, loamy or clayey, and often contain volcanic ash. Historic native vegetation is forest.

APPENDIX 3 MLRA-LRU-CRA Descriptions

MLRA	LRU	MLRA_LRU Description
002X	N	This LRU is the North Puget Trough Zone of MLRA 2X and includes portions of CRA 2.5, 2.6, 2.10, 2.11, 2.12, and 2.13This zone includes the lowlands on the north end of Puget Sound and along the Strait of Juan de Fuca. This zone is bordered by the Cascade Mountains to the east, the Olympic Mountains to the west, and the Black Hills and Bald Hills to the south. Elevation ranges from sea level to approximately 500 feet (150 meters). This zone has been repeatedly glaciated. The Puget Sound Valley consists of nearly level lacustrine deposits as well as dissected glacial till and glacial outwash. River valley floodplains are overlain with alluvial deposits. The soils have a mesic soil temperature regime, a xeric soil moisture regime, and mixed mineralogy. Soils vary widely in their characteristics and range from moderately deep to very deep, very poorly drained to excessively drained, and sandy or gravelly to loamy or clayey. Nearly level, somewhat poorly drained, poorly drained, and moderately well drained soils formed in lacustrine sediments on terraces. Somewhat excessively drained soils formed in outwash sediments and alluvium on terraces and moraines. Moderately well drained soils formed in till on till plains and moraines. Gently sloping to steep, well drained soils formed in colluvium and residuum on foothills. Moderately well drained soils formed in a mixture of till, loess, and volcanic ash on hills.
002X	S	This LRU is the South Puget Trough Zone of MLRA 2X and includes CRA 2.7 and those portions of CRA 2.8 that are less than 500 feet in elevation. This zone includes the lowlands on the south and east side of Puget Sound. This zone is bordered by the Cascade Mountains to the east, the Black Hills and Willapa Hills to the west, and Columbia River to the south. Elevation ranges from sea level to approximately 500 feet (150 meters). The northern portion of this zone has been repeatedly glaciated. The Puget Sound Valley consists of nearly level lacustrine deposits as well as dissected glacial till and glacial outwash. River valley floodplains are overlain with alluvial deposits. The soils have a mesic soil temperature regime, a xeric soil moisture regime, and mixed mineralogy. Soils vary widely in their characteristics and range from moderately deep to very deep, very poorly drained to excessively drained, and sandy or gravelly to loamy or clayey. Nearly level, somewhat poorly drained, poorly drained, and moderately well drained soils formed in lacustrine sediments on terraces. Somewhat excessively drained soils formed in outwash sediments and alluvium on terraces and moraines. Moderately well drained soils formed in till on till plains and moraines. Gently sloping to steep, well drained soils formed in colluvium and residuum on foothills. Moderately well drained soils formed in a mixture of till, loess, and volcanic ash on hills.

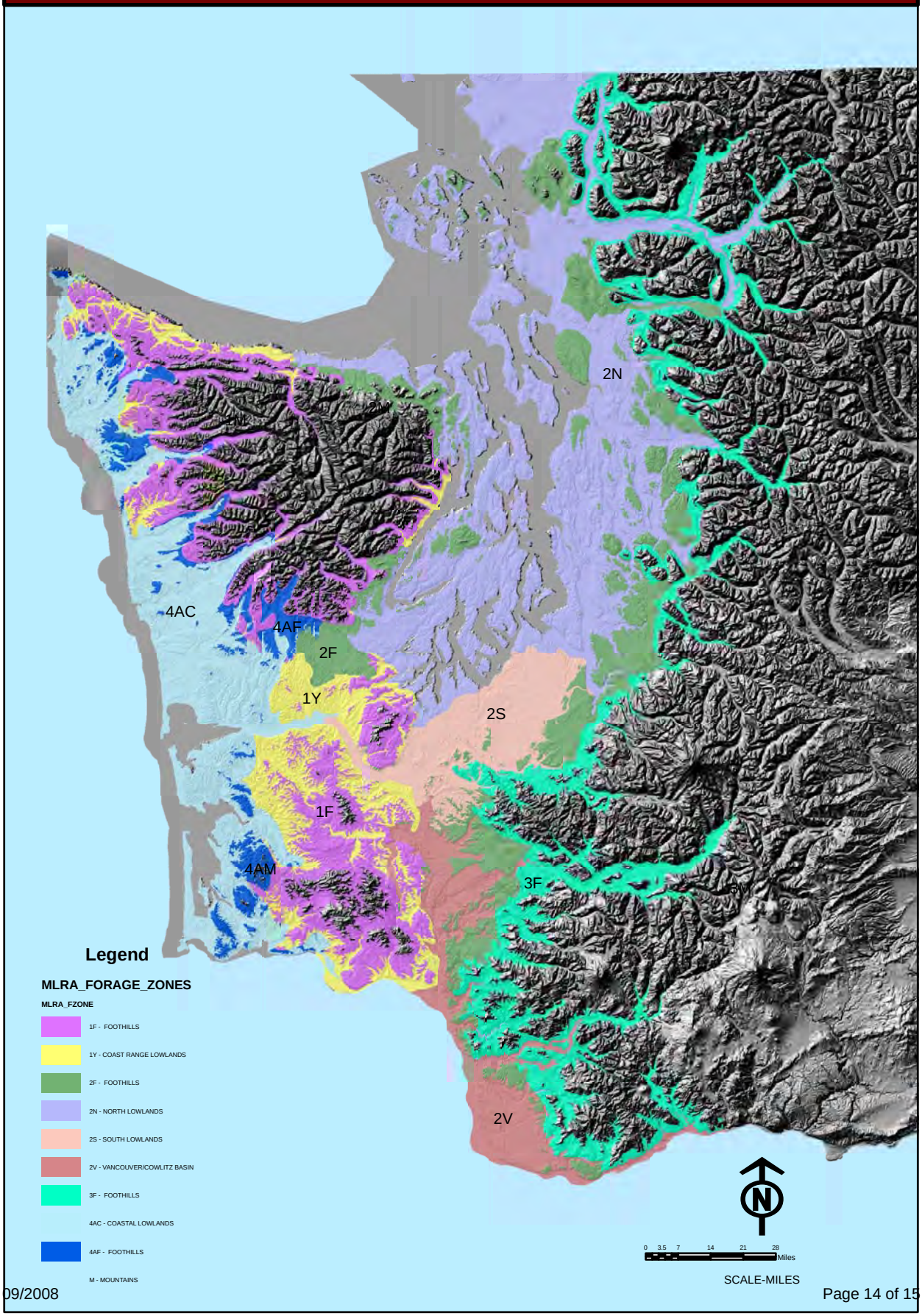
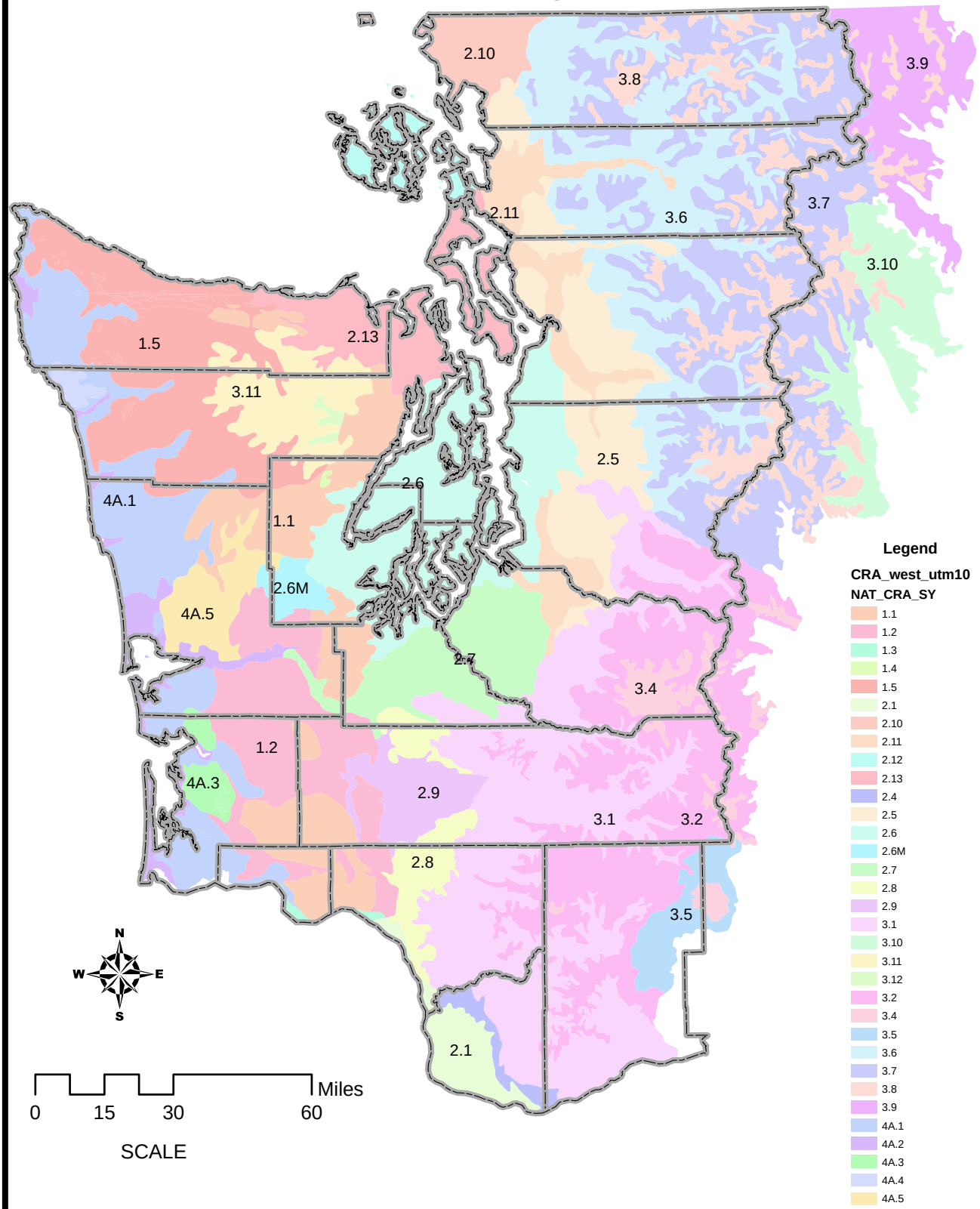
APPENDIX 3 MLRA-LRU-CRA Descriptions

MLRA	LRU	MLRA_LRU Description
002X	V	This LRU is the Vancouver and Cowlitz Basin Zone of MLRA 2X and includes CRA 2.1, 2.4, and 2.9. This zone is located in the Columbia River Valley Vancouver Basin, and extends north along the Cowlitz River to the Newaukum and Cowlitz Valleys. This zone is bordered by the Cascade Mountains to the east, and the Willapa Hills to the west. This zone continues into the Willamette Valley of Oregon. Elevation ranges from 25 to 800 feet (8 meters to 250 meters) on nearly level to gently sloping flood plains bordered by higher terraces that are cut by river tributaries. The geology of this zone is sediments from many sources, including alluvium, glacial drift, volcaniclastic, glacial outburst floods, and landslide sources. This area was not glaciated. The soils have a mesic soil temperature regime, a xeric soil moisture regime, and mixed mineralogy. The soils are moderately deep to very deep, poorly drained to well drained, and loamy or clayey.
003X	F	This LRU includes Forage Suitability Group is in the Foothills zone of MLRA 3 and includes portions of CRA 3.1, 3.2, 3.6, 3.7, 3.8, and 3.12. This Foothills zone occurs on the low foothills and plateaus along the western slopes of the Cascade Mountains. Slopes range from gentle to steep. Valleys in the foothills are mostly narrow and of small extent. Elevation ranges from 500 to 1,500 feet (150 to 450 meters). The portion of the zone near the Cascades consists of a mixture of a variety of sedimentary rocks. Thin deposits of alluvium are at the lower elevations along the major streams draining the Cascades. All of the Cascades have been glaciated and isolated remnants of till and outwash deposits are at the lower elevations on the flanks of the mountains. The soils dominantly have a mesic soil temperature regime and an udic soil moisture regime. The soils are generally shallow to very deep, well drained, medial, and loamy or clayey and occur on foothills, mountain slopes and ridges. Soils near the Cascades often contain volcanic ash.

APPENDIX 3 MLRA-LRU-CRA Descriptions

MLRA	LRU	MLRA_LRU Description
004A	C	This LRU is a Coastal Valleys Zone that occurs in portions of CRAs 4A1, 4A2, 4A.3, 4A4 and 4A.5 in the relatively level lowlands between the ocean and the Olympic Mountains and Willapa Hills. Elevation ranges from sea level to 500 feet (150 meters). Often, a cliff 50 to 200 feet (15 to 60 meters) high forms most of the western edge of the part of this zone. From the edge of the cliff, the land slopes up onto glacial drift deposits, marine terraces, or young, continental sedimentary rocks in the northern portion. In the southwest corner of Washington, the land slopes from the edge of the cliff up onto alluvial or marine terraces or flood plains and beach dunes. This zone consists primarily of glacial and alluvial sediments and some scattered areas of young Tertiary sedimentary rocks (siltstone). Glacial deposits are dominant in the northern half of the area, and alluvium and beach dune deposits are more prominent in the southern half of the part of the zone. Snowfall accumulation is rare on the ocean side of this area, but some snowfall occurs on the eastern boundary. This area lies within the coastal fog belt zone, and heavy fogs are common in summer. Supplemental moisture is provided by fog condensation. The soils have either an isomesic or isofrigid soil temperature regime. They have a udic or perudic soil moisture regime. They are acid throughout; most are very strongly acid or strongly acid. The undulating to hilly marine and glacial outwash terraces are shallow or moderately deep to cemented materials or are deep or very deep. They are poorly drained to well drained. They have ferrihydritic or isotic mineralogy. The soils on the nearly level flood plains and in the estuaries are very deep and typically are very poorly drained or poorly drained. They have mixed mineralogy.
004A	F	This LRU is a Foothills Zone. The Foothills zone of MLRA 4a occurs in portions of CRAs 4A1, 4A2, 4A.3, 4A4 and 4A.5. This Foothills zone generally occurs on the low foothills and plateaus surrounding the Olympic Mountain range and includes the Willapa Hills. Slopes range from gentle to steep. Valleys are mostly narrow and of small extent. Elevation typically ranges from 500 to 1,500 feet (150 to 450 meters). This zone has been repeatedly glaciated. The portion of the zone surrounding the Olympia Mountains and extending through the Willapa Hills consists primarily of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with volcanic rocks of the same age as well as glacial till and outwash deposits in the northern half of the zone. Snowfall accumulation is rare on the ocean side of this area, but some snowfall occurs on the eastern boundary. This area lies within the coastal fog belt zone, and heavy fogs are common in summer. Supplemental moisture is provided by fog condensation. The soils have either an isomesic or isofrigid soil temperature regime. They have a udic or perudic soil moisture regime. They are acid throughout; most are very strongly acid or strongly acid. The undulating to hilly marine and glacial outwash terraces are shallow or moderately deep to cemented materials or are deep or very deep. They are poorly drained to well drained. They have ferrihydritic or isotic mineralogy.

FORAGE ZONES BY MAJOR LAND RESOURCE AREA



Common Resource Areas
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