

Course	Agricultural Science II
Unit	Introduction to Grassland Management
Subunit	Grasslands and Grassland Plants
Lesson	An Introduction to Grasslands
Estimated Time	50 minutes
Student Outcome	

Identify different types of grasslands and explain factors that create them.

Learning Objectives

1. Identify a grassland.
2. Describe forages.
3. Describe natural factors that affect the creation of grasslands.
4. Describe native grasslands.
5. Identify a prairie.
6. Identify a glade.
7. Identify a savanna.
8. Describe managed grasslands.
9. Describe grassland management.
10. Describe grassland conservation.

Grade Level Expectations

SC/ME/1/B/09-11/b	SC/EC/1/A/09-11/a	SC/EC/1/A/09-11/b
SC/EC/1/D/09-11/a	SC/EC/1/D/09-11/b	SC/EC/3/C/09-11/d
SC/ST/1/C/09-11/a	SC/ST/3/B/09-11/a	SC/ST/3/B/09-11/b
SC/ST/3/B/09-11/c		

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slide
☐ PPT 1 – A Missouri Glade
2. Activity Sheet
☐ AS 1 – Word Search
3. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
4. *Introduction to Grassland Management Curriculum Enhancement*, “Unit I – Grasslands and Grassland Plants.” University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ☐ Slides to visually represent grasslands, if available
- ☐ Pictures of a prairie, if available

Supplemental Information

1. Internet Sites

- ❑ Grassland Types. Grassland Habitat, Hamilton Naturalists' Club, Ontario, Canada. Accessed February 4, 2008, from http://www.hamiltonnature.org/habitats/grasslands/grass_types.htm.
- ❑ National Grasslands. USDA Forest Service. Accessed February 4, 2008, from <http://www.fs.fed.us/grasslands/>.

Interest Approach

Ask students what they think a grassland is. List their answers and discuss them. If possible, use slides to visually represent grasslands. Ask the following questions: Is an area a grassland if food for livestock is not raised on it? [Yes.] Is prairie grassland? [Yes.] Is a cornfield grassland? [Ecologically yes, agriculturally no.] What about your front yard? [Yes.]

Have students observe a lawn and explain what actions must take place to establish and maintain the area in grass. Have them answer the following questions: What would happen if weed control stopped? What would happen if mowing stopped? Have students visit another type of grassland convenient for them (pasture, prairie, glade) and evaluate it in the same way.

Communicate the Learning Objectives

1. Identify a grassland.
2. Describe forages.
3. Describe natural factors that affect the creation of grasslands.
4. Describe native grasslands.
5. Identify a prairie.
6. Identify a glade.
7. Identify a savanna.
8. Describe managed grasslands.
9. Describe grassland management.
10. Describe grassland conservation.

Instructor Directions	Content Outline
Objective 1 <i>Ask students for a definition of grassland. Discuss the different meanings of the word.</i>	Identify a grassland. 1. Ecologically, a plant community dominated by grasses, whether they exist naturally or because of management practices 2. Agriculturally, an area managed to grow grass, legumes, or other pasture or range plants used mostly for the production of forage
Objective 2 <i>Ask students to name some of the plants they consider to be forages. Discuss the definition of forages.</i>	Describe forages. Forages are primarily grasses and legumes grown for their soft, vegetative parts, which are used as feed for livestock

Instructor Directions	Content Outline
Objective 3 <i>Ask students to list natural factors that affect grasslands. Discuss the different factors.</i>	Describe natural factors that affect the creation of grasslands. 1. Climate a. Grasslands usually dominate in areas averaging 10 to 30 inches of rainfall. b. Most of Missouri receives 35 inches of precipitation or more each year, which places the state at the transition point between grassland and forest. 2. Soil a. Some soils (such as shallow or coarsely textured soils, hardpans, and soils with high water tables) discourage tree growth and favor grasslands. 3. Plants a. Many grassland plants have adapted to their environment by becoming dormant when conditions are harsh and producing new growth when conditions improve. b. This adaptation allows them to survive damage from fire, grazing/browsing, drought, and high winds, all of which can kill or limit the growth of trees and shrubs. 4. Grazing a. Grazing is natural to grassland communities. b. Unlike trees and shrubs, which are more severely damaged by grazing and browsing, grassland plants have adapted to grazing. 5. Fire a. Grassland plants tolerate fire better than trees and shrubs. b. Where fires occur often enough to limit forest, grasslands dominate.
Objective 4 <i>Ask students to explain what native grasslands are. Discuss the changes European settlers and modern agriculture made to the ecology and landscape of Missouri.</i>	Describe native grasslands. 1. Native grasslands are those that existed in America before the arrival of European settlers. 2. The trend toward conservation farming has led to new interest in native grasslands and their plants. 3. Most of Missouri's native grasslands are prairies, glades, or savannas.

Instructor Directions	Content Outline
Objective 5 <i>Ask students to describe what a prairie is. If possible, show them pictures of a prairie.</i>	Identify a prairie. 1. Prairies are large, continuous native grasslands in which trees and shrubs are nearly absent. 2. While grasses dominate, a rich diversity of native grasses, legumes, and forbs inhabit Missouri's remaining prairies. 3. Different kinds of prairies develop on different sites. a. Dry - Dominated by shorter grasses like little bluestem and sideoats grama - Mostly converted to pasture b. Wet - Dominated by taller grasses like big bluestem and Indiangrass, sometimes reaching 6 to 8 feet in height - Mostly converted to cropland
Objective 6 <i>Ask the following question: "While admiring a blossoming yucca, you fall from your horse, land seat first on a cactus, get stung by a scorpion, bitten by a tarantula, and struck by a rattlesnake. Aside from a world of hurt, where are you?" Point out that the answer could be a Missouri glade. Refer to PPt 1.</i>  PPt 1 – A Missouri Glade	Identify a glade. 1. Small, isolated native grasslands occurring on hilltops and southwest-facing slopes 2. Found where rocky outcrops, exposure to sunlight, and thin, dry soils create harsh desert-like conditions during the summer 3. Dominated by prairie grasses and forbs 4. Also have plants and animals from western prairies and deserts like yuccas, cacti, tarantulas, and scorpions
Objective 7 <i>Ask students to describe a savanna. When woodlands and grasslands meet, the sudden presence of trees may look like a distinct change, but actually a more gradual transition is taking place. Grasslands with widely spaced trees and woodlands with a</i>	Identify a savanna. 1. Specialized community that is intermediate between grassland and forest with widely spaced trees, a conspicuous absence of smaller trees and shrubs, and grasses as the dominant ground cover 2. Can be used for wood, wildlife habitat, and forages

Instructor Directions	Content Outline
<i>healthy stand of grass beneath the trees were common in presettlement Missouri.</i>	
Objective 8 <i>Point out that few native grasslands with their original plant communities are left in Missouri, yet grasslands can be easily found in every part of the state. Ask students about the origin of these grasslands.</i>	Describe managed grasslands. 1. Managed grasslands are areas managed for forage, pasture, or grassland habitat. 2. Over 95% of Missouri's grasslands are privately owned. 3. Most managed grasslands are used for forage production; pasture is the most common type of grassland in Missouri.
Objective 9 <i>Discuss how grasslands are used today. Have students list factors involved in establishing and maintaining a grassland.</i>	Describe grassland management. 1. Grassland management is the use and care of grasslands. 2. It involves managing the plants, animals, equipment, and practices needed for the successful use of grasslands.
Objective 10 <i>Ask the class whether grasslands are a natural resource. Have students list other natural resources found on grasslands (soil, water, wildlife, plants). Discuss why conservation is important. Have students complete AS 1.</i>  AS 1 – Word Search	Describe grassland conservation. Grassland conservation is the wise use of grasslands and other natural resources found on them to ensure their long-term productivity and sustainability.

Instructor Directions	Content Outline
Application  AS 1 – Word Search	Answers to AS 1 HH A B E C L I N T D N L L K B C R H A G J E P F I R A W M A N T Q G R S A V C S S S E Z O A R K R T M O B O E A C F A B D V N O R P L L O U A G G N D I N A O O P T I R K S F O R I K S O N I B R Y S V A P M E L T S N W I L B M B L E M O X T I A S I T Y M T E G L A D E I S O N R S J D Z S Q G D N T A C L I V S A A G R A C R F S L D I N T B Y P H B O A S O S T O N B L N I M A L S O S N A W M L O T E B M M L I V B E O A T I N A N I Z Y H A Z C N C O R H A R S G P L A K G U M O W I N G A N P E A R E E K D O E G N M E O R S P E N K W R L A N B E B G H R B G L S A N A N V R C K A O H I C D V M S E R O M I L G N A T T I Y Z A O B O H M Z C L O R I T I D I O N E L A S R H O P L I V E S T O C K I A M P G A S S I N R X N I D O R P B R N A T V E S S G U N P R A I R I E V P C O T T F T O N R B S J D Q E C H R L G L A M O R K D E A I T Z Y S R D A O O U T A T B L I T E Y A N T A O I N A T E O B O R T R S A K D X L A S I D Y G P H A I L B T P A Y R V A F I P R U D V E U L K O M A B U R I T M C A T V B P U B T I P O S S L E W D C K N A L X M O J I H Q O R N D O T Q W R X A A C E V E G E T A T I V E N K V R B E A T J C D M O E U N S V A O D L O S I E L I S H S E L S H W I L D L I F E W C A T F B Y R D T I V T L Q P D I N Y B S P N H W R C T G L A D U S J A D O M A I N U Z M O V A F J U G E S I R A P B H S Y R L I Q T R O K T V J C C Z L Q E V G R A S S E S S O L D E T E A W B K N O T Y X Other activities 1. Visit a prairie, glade, or savanna to distinguish between grasslands and other vegetation types. Emphasize the differences between native grasslands and converted grasslands. 2. Show range maps for the Eastern collared lizard, brush mouse, roadrunner, and prairie ringneck snake as examples of western desert and prairie species that live in glades in Missouri. 3. Have students visit a pasture and write a description of it, mentioning the amount of ground cover, the density of the plants, the amount of bare soil, signs of erosion, and the height and quality of the forage. Read descriptions of native grasslands. Compare

Instructor Directions	Content Outline
	these descriptions and ask students which land they would prefer to own. What do they think can be done to improve forage production on the pasture they observed?
Closure/Summary	In agriculture, a grassland is an area managed to grow grass, legumes, or other pasture or range plants for forage production. Forages are primarily grasses and legumes used as feed for livestock. Several basic environmental factors – climate, soil, plants, grazing, and fire – influence the growth of grasslands. Native grasslands, including prairies, glades, and savannas, once covered much of the state, but most have been converted to other uses. Most of Missouri’s grasslands now consist of pastures of nonnative plants, although native grasslands and native plants are showing new promise in livestock operations. The key to success in grassland farming is proper management, which focuses on sustaining the productivity of forage plants.
Evaluation: Quiz	Answers: 1. c 2. b 3. d 4. a 5. d 6. a 7. Managed grasslands are areas managed for forage, pasture, or grassland habitat. 8. Grassland management involves managing the plants, animals, equipment, and practices needed for the successful use of grasslands. 9. Forages are primarily grasses and legumes grown for their soft vegetative parts, which are used as feed for livestock. 10. Climate, soil, plants, grazing, fire 11. Agriculturally, a grassland is an area managed to grow grass, legumes, or other pasture or range plants used mostly for the production of forage.

Course	Agricultural Science II
Unit	Introduction to Grassland Management
Subunit	Grasslands and Grassland Plants
Lesson	Plant Classification
Estimated Time	Three 50-minute blocks
Student Outcome	

Identify plant classifications found in grasslands.

Learning Objectives

1. Describe how grassland plants can be classified.
2. Describe the characteristics of cool-season grasses.
3. Describe the characteristics of warm-season grasses.
4. Describe the characteristics of legumes.
5. Describe the characteristics of forbs.
6. Describe the characteristics of woody plants.
7. Identify what plant species are found in grasslands.

Grade Level Expectations

SC/LO/1/E/09-11/a

SC/LO/1/E/09-11/b

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - ☐ PPt 1 – Cool- and Warm-Season Grass Growth
 - ☐ PPt 2 – Grasses
 - ☐ PPt 3 – Legumes
 - ☐ PPt 4 – Forbs
 - ☐ PPt 5 – Woody Plants
2. Activity Sheets
 -  AS 1 – Constructing a Plant Press
 -  AS 2 – Identifying Grassland Plants
3. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
4. *Introduction to Grassland Management Curriculum Enhancement, “Unit I – Grasslands and Grassland Plants.”* University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ☐ Several samples of grassland plants or detailed pictures representing different types of foliage found in the local area.
- ☐ See AS 1 and AS 2 for materials and equipment needed to complete the Activity Sheets.

Supplemental Information

1. Internet Sites

- ☐ Classification. Plants Database, USDA Natural Resources Conservation Service. Accessed on February 7, 2008, from <http://plants.usda.gov/classification.html>.

2. Print

- ☐ *Crop and Grassland Plant Identification Manual* (Catalog #10-1203-S). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
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Interest Approach

Have students bring in plant samples from grassland areas near their homes. Discuss what types of plants are found in grasslands and why grassland areas are important to agriculture.

Communicate the Learning Objectives

1. Describe how grassland plants can be classified.
2. Describe the characteristics of cool-season grasses.
3. Describe the characteristics of warm-season grasses.
4. Describe the characteristics of legumes.
5. Describe the characteristics of forbs.
6. Describe the characteristics of woody plants.
7. Identify what plant species are found in grasslands.

Instructor Directions	Content Outline
Objective 1 <i>Bring in several samples of grassland plants that represent the different types of foliage found in the local area. Include at least one grass, legume, forb, and woody plant. Have the class, as a whole or in groups, brainstorm on what makes these plants similar and different. Make sure that annuals, perennials, and (if possible) biennials are among the samples. Compose a list and discuss the results as they relate to plant types and life cycles.</i> <i>Note: If live cuttings are not available, use detailed pictures of the different types of grassland plants from a reference, such as IML's Crop and Grassland Plant Identification Manual.</i>	Describe how grassland plants can be classified. 1. Life cycle: Classification system that identifies plants based on their yearly growth and seeding characteristics a. Annuals – complete life cycle occurs in one growing season b. Biennials – complete life cycle occurs over two growing seasons c. Perennials – grow year after year 2. Plant type: Classification system that identifies plant species and groups them according to their physical characteristics a. Grasses (cool- and warm-season) b. Legumes c. Forbs d. Woody plants
Objective 2 <i>Separate the grasses from the other plant samples. Discuss how</i>	Describe the characteristics of cool-season grasses. 1. Herbaceous 2. Hollow stems

Instructor Directions	Content Outline
<i>optimum temperature for growth divides them into cool-season or warm-season grasses, using PPt 1 to illustrate the differences in their growing seasons. Point out some examples of cool-season grasses from the samples, such as Kentucky bluegrass, orchardgrass, and smooth brome grass. Discuss the characteristics of cool-season grasses. PPt 2 can be used to illustrate the physical characteristics of grasses.</i> ☐ PPt 1 – Cool- and Warm-Season Grass Growth ☐ PPt 2 – Grasses	3. Blades and stems joined directly at sheath 4. Parallel venation on leaf blade 5. Grows when soil temperature reaches 40° F in early spring, with optimum growth occurring when air temperatures fall in the 59° to 77° F range in the spring and fall 6. Dormant in summer 7. Annuals or perennials
Objective 3 <i>Point out some examples of warm-season grasses, such as Indiangrass, big bluestem, and switchgrass. Discuss the characteristics of warm-season grasses.</i>	Describe the characteristics of warm-season grasses. 1. Herbaceous 2. Hollow stems 3. Blades and stems joined directly at sheath 4. Parallel venation on leaf blade 5. Grows when soil temperatures reach 60° F in spring, with optimum growth occurring when air temperatures fall in the 77° to 104° F range in summer 6. Dormant in winter 7. Annuals or perennials
Objective 4 <i>Grasses are beneficial plants, but they are not the only ones. Because grasslands are made up of ranges and pasture, another plant type that is used for forage and is beneficial to the grassland is the legume. Point out some examples of legumes, such as clovers, alfalfa, and birdsfoot trefoil, and</i>	Describe the characteristics of legumes. 1. One-chambered fruit with seeds in a single row within the pod 2. Alternate leaf arrangement with leaves usually connected to petiole 3. Network of veins 4. Annuals, perennials, or biennials 5. Nodules with nitrogen fixing capacity on most rooting systems

Instructor Directions	Content Outline														
<i>discuss the characteristics of legumes. PPt 3 may also be used as an illustration.</i>  PPt 3 – Legumes															
Objective 5 <i>Other herbaceous plants that are neither grasses or legumes are forbs. Show examples of forbs, like sunflowers, thistles, and ragweed, from the grassland plant samples. Use PPt 4 to further illustrate forbs. Discuss the characteristics of forbs with the class.</i>  PPt 4 – Forbs	Describe the characteristics of forbs. 1. Herbaceous (not woody) 2. Broadleaf plants 3. Annuals, perennials, or biennials														
Objective 6 <i>The only nonherbaceous plant type found in grasslands is woody plants. In a grassland pasture or range, most woody plants will be weedy saplings or small immature trees and shrubs. Use PPt 5 to illustrate woody plants. Show examples of woody plants from the grassland plant samples, such as wild rose, red cedar, and oak, and discuss their characteristics.</i>  PPt 5 – Woody Plants	Describe the characteristics of woody plants. 1. Woody (nonherbaceous) stems 2. Shrubs, vines, or trees 3. Perennials														
Objective 7 <i>Ask students to list the various plant species found in grasslands with which they are familiar. Discuss different plant species found in grasslands. Assign AS 1 and AS 2.</i>	Identify what plant species are found in grasslands. 1. Grasses and grasslike plants: <table><tr><td>Barley</td><td><i>Hordeum vulgare</i></td><td>Annual</td></tr><tr><td>Barnyardgrass</td><td><i>Echinochloa crusgalli</i></td><td>Annual</td></tr><tr><td>Bermudagrass</td><td><i>Cynodon dactylon</i></td><td>Perennial</td></tr><tr><td>Big bluestem</td><td><i>Andropogon gerardi</i></td><td>Perennial</td></tr></table>			Barley	<i>Hordeum vulgare</i>	Annual	Barnyardgrass	<i>Echinochloa crusgalli</i>	Annual	Bermudagrass	<i>Cynodon dactylon</i>	Perennial	Big bluestem	<i>Andropogon gerardi</i>	Perennial
Barley	<i>Hordeum vulgare</i>	Annual													
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Instructor Directions	Content Outline		
	Common lespedeza or Japanese bush clover	<i>Kummerowia striata</i>	Annual
	Common vetch	<i>Vicia sativa</i>	Annual
	Crimson clover	<i>Trifolium incarnatum</i>	Annual
	Crown vetch	<i>Coronilla varia</i>	Perennial
	Hairy vetch	<i>Vicia villosa</i>	Annual/ biennial
	Illinois bundleflower	<i>Desmanthus illinoensis</i>	Perennial
	Korean lespedeza	<i>Kummerowia stipulacea</i>	Annual
	Lead plant	<i>Amorpha canescens</i>	Perennial
	Little hop clover	<i>Trifolium dubium</i>	Annual
	Low hop clover	<i>Trifolium campestre</i>	Annual
	Partridge pea	<i>Cassia fasciculata</i>	Annual
	Red clover	<i>Trifolium pratense</i>	Biennial
	Sericea lespedeza or silky bush clover	<i>Lespedeza cuneata</i>	Perennial
	Slender lespedeza	<i>Lespedeza virginica</i>	Perennial
	Soybean	<i>Glycine max</i>	Annual
	Tick trefoil	<i>Desmodium spp.</i>	Perennial
	White clover	<i>Trifolium repens</i>	Perennial
	Yellow sweet clover	<i>Melilotus officinalis</i>	Biennial
	3. Forbs:		
	Black nightshade	<i>Solanum americanum</i>	Annual
	Bracted plantain	<i>Plantago aristata</i>	Annual
	Buckwheat	<i>Fagopyrum esculentum</i>	Annual
	Bull nettle	<i>Cnidoscolus texanus</i>	Perennial
	Bull thistle	<i>Cirsium vulgare</i>	Biennial
	Bur cucumber	<i>Sicyos angulatus</i>	Annual
	Butterfly milkweed	<i>Asclepias tuberosa</i>	Perennial
	Canada thistle	<i>Cirsium arvense</i>	Perennial
	Cinquefoil	<i>Potentilla simplex</i>	Perennial
	Common chickweed	<i>Stellaria media</i>	Annual
	Common chicory	<i>Cichorium intybus</i>	Perennial
	Common cocklebur	<i>Xanthium strumarium</i>	Annual
	Common milkweed	<i>Asclepias syriaca</i>	Perennial
	Common morning glory	<i>Ipomoea purpurea</i>	Annual
	Common plantain	<i>Plantago major</i>	Annual
	Common ragweed	<i>Ambrosia artemisiifolia</i> L.	Annual
	Common sunflower	<i>Helianthus annuus</i>	Annual
	Common yarrow	<i>Achillea millefolium</i>	Perennial
	Corn cockle	<i>Agrostemma githago</i>	Annual
	Cotton	<i>Gossypium hirsutum</i>	Annual

Instructor Directions	Content Outline		
	Croton	<i>Croton monanthogynus</i>	Annual
	Daisy fleabane	<i>Erigeron strigosus</i>	Annual
	Dandelion	<i>Taraxacum officinale</i>	Perennial
	Field bindweed	<i>Convolvulus arvensis</i>	Perennial
	Four-leaf milkweed	<i>Asclepias quadrifolia</i>	Perennial
	Giant ragweed	<i>Ambrosia trifida</i> L.	Annual
	Hedge bindweed	<i>Convolvulus sepium</i>	Annual
	Hemp	<i>Cannabis sativa</i>	Annual
	Henbit	<i>Lamium amplexicaule</i>	Perennial
	Horse nettle	<i>Solanum carolinense</i>	Perennial
	Ironweed	<i>Vernonia baldwini</i>	Perennial
	Ivyleaf morning glory	<i>Ipomoea hederacea</i>	Annual
	Jimsonweed	<i>Datura stramonium</i>	Annual
	Kochia or burning bush	<i>Kochia scoparia</i>	Annual
	Lamb's quarters	<i>Chenopodium album</i>	Annual
	Lance-leaf ragweed	<i>Ambrosia bidentata</i>	Annual
	Musk thistle	<i>Carduus nutans</i>	Biennial
	Ox-eye daisy	<i>Chrysanthemum leucanthemum</i>	Perennial
	Pale dock	<i>Rumex altissimus</i>	Perennial
	Pennsylvania smartweed	<i>Polygonum pennsylvanicum</i>	Annual
	Pepper grass	<i>Lepidium virginicum</i>	Annual
	Pigweed	<i>Amaranthus spp.</i>	Annual
	Prairie dogbane	<i>Apocynum cannabinum</i>	Perennial
	Prairie goldenrod	<i>Solidago missouriensis</i>	Perennial
	Prickly lettuce	<i>Lactuca serriola</i>	Biennial
	Prickly sida	<i>Sida spinosa</i>	Annual
	Queen Anne's lace or wild carrot	<i>Daucus carota</i>	Biennial
	Sheep sorrel or field sorrel	<i>Rumex acetosella</i>	Perennial
	Shepherd's purse	<i>Capsella bursa-pastoris</i>	Annual
	Smartweed	<i>Polygonum lapathifolium</i>	Annual
	Tabacco	<i>Nicotiana tabacum</i>	Annual
	Tall thistle	<i>Cirsium altissimum</i>	Perennial
	Three-seeded mercury	<i>Acalypha ostryaefolia</i>	Annual
	Velvetleaf	<i>Abutilon theophrasti</i>	Annual
	Venice mallow or flower of an hour	<i>Hibiscus trionum</i>	Perennial
	Water hemp	<i>Amaranthus tamariscinus</i>	Annual
	White avens	<i>Geum canadense</i>	Perennial
	White mustard	<i>Brassica hirta</i>	Annual

Instructor Directions	Content Outline
	Wild cucumber <i>Echinocystis lobata</i> Annual Wild garlic <i>Allium canadense</i> Perennial Wild strawberry <i>Fragaria virginiana</i> Perennial 4. Woody plants: Black cherry <i>Prunus serotina</i> Perennial Black locust <i>Robinia pseudoacacia</i> Perennial Black oak <i>Quercus velutina</i> Perennial Black raspberry <i>Rubus occidentalis</i> Perennial Coralberry or buckbrush <i>Symphoricarpus orbiculatus</i> Perennial Dewberry <i>Rubus flagellaris</i> Perennial Elm <i>Ulmus spp.</i> Perennial Flowering dogwood <i>Cornus florida</i> Perennial Grape <i>Vitis spp.</i> Perennial Hawthorn <i>Crataegus spp.</i> Perennial Hickory <i>Carya spp.</i> Perennial High bush blackberry <i>Rubus pensilvanicus</i> Perennial Honey locust <i>Gleditsia triacanthos</i> Perennial Osage orange <i>Maclura pomifera</i> Perennial Persimmon <i>Diospyros virginiana</i> Perennial Poison ivy <i>Rhus radicans</i> Perennial Redcedar <i>Juniperus virginiana</i> Perennial Rose <i>Rosa spp.</i> Perennial Sassafras <i>Sassafras albidum</i> Perennial Smooth sumac <i>Rhus glabra</i> Perennial White oak <i>Quercus alba</i> Perennial Wild plum <i>Prunus spp.</i> Perennial Willow oak <i>Quercus phellos</i> Perennial
Application	Other activities Take a field trip to a nearby pasture or range and discuss the different types of plants found there. Have the students explain the different uses of the plants found for farmers, consumers, wildlife, hunters, landowners, and wildlife enthusiasts.
Closure/Summary	All plants in the grassland, whether cultivated or native, can be classified as grasses, legumes, forbs, or woody plants. The plants in each classification share characteristics that make the plants in that group similar. With an understanding of these plants and their importance, it is possible to reach reasonable forage crop

Instructor Directions	Content Outline
	production goals and satisfy the needs of a healthy wildlife population.
Evaluation: Quiz	Answers: 1. c 2. b 3. h 4. d 5. a 6. e 7. f 8. g 9. b 10. c 11. They are nonherbaceous, with woody stems. 12. The life cycle classification system identifies plants based on their yearly growth and seeding characteristics. The plant type classification system identifies plant species and groups them according to their physical characteristics.

Course	Agricultural Science II
Unit	Introduction to Grassland Management
Subunit	Grasslands and Grassland Plants
Lesson	Botanical Characteristics
Estimated Time	Four 50-minute blocks
Student Outcome	

Recognize the characteristics of grassland plants that are used in plant identification.

Learning Objectives

1. Identify the structural parts of grasses.
2. Describe how leaf parts can help identify grasses.
3. Describe how the root or modified stem can be used to identify grassland plants.
4. Describe how the type of inflorescence can help identify grassland plants.
5. Identify leaf structures and leaf arrangements used in grassland plant identification.
6. Describe how stem shape can be used to identify plants.
7. Identify the external parts of the woody plant stem.

Grade Level Expectations

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. PowerPoint Slides
 - ☐ PPt 1 – Identifying Characteristics of Grasses
 - ☐ PPt 2 – Roots and Modified Stems
 - ☐ PPt 3 – Inflorescence
 - ☐ PPt 4 – Leaf Structure and Arrangement
 - ☐ PPt 5 – Stem Structure of Woody Plants
2. Activity Sheet
Refer back to the Activity Sheet on Identifying Grassland Plants from the previous lesson on Plant Classification.
3. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
4. *Introduction to Grassland Management Curriculum Enhancement, "Unit I – Grasslands and Grassland Plants."* University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ☐ Samples of grassland plants collected in the previous lesson

Supplemental Information

1. Internet Sites

- ❑ Grassland Plants. Missouri Botanical Garden, St. Louis. Accessed February 8, 2008, from <http://www.mbgnet.net/sets/grasslnd/plants/index.htm>.
- ❑ Missouri Forage and Grassland Council/Grazing Lands Conservation Initiative. Accessed February 8, 2008, from <http://agebb.missouri.edu/mfgc/index.htm>.

2. Print

- ❑ *Crop and Grassland Plant Identification Manual* (Catalog #10-1203-S). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
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Interest Approach

Have students observe botanical characteristics of the samples collected in the last lesson. Notice the structural parts that make each sample different, such as leaf shapes, leaf arrangement, root structure, flowers, and buds. List the differences for each part on the chalkboard.

Communicate the Learning Objectives

1. Identify the structural parts of grasses.
2. Describe how leaf parts can help identify grasses.
3. Describe how the root or modified stem can be used to identify grassland plants.
4. Describe how the type of inflorescence can help identify grassland plants.
5. Identify leaf structures and leaf arrangements used in grassland plant identification.
6. Describe how stem shape can be used to identify plants.
7. Identify the external parts of the woody plant stem.

Instructor Directions	Content Outline
Objective 1 <i>Ask students to name the different structural parts that may be used to identify grasses. Along with the schematic drawing of Cool- and Warm-Season Grass Growth provided in the PowerPoint slide from the previous lesson, display a grass sample so they can see the actual parts. Try to obtain a plant sample with roots and flowers.</i>	Identify the structural parts of grasses. 1. Roots 2. Culm (stem) 3. Node 4. Internode 5. Leaf sheath 6. Leaf blade 7. Collar 8. Auricle 9. Ligule 10. Inflorescence (flowering part of the plant)
Objective 2 <i>Ask students how the structural parts can help in identifying grasses. Discuss the differences in the leaf that can be observed to help distinguish one grass from another. Refer to PPT 1.</i> ☐ PPT 1 – Identifying Characteristics of Grasses	Describe how leaf parts can help identify grasses. 1. Leaf blade shape a. Tapering to tip b. Boat-shaped tip c. Parallel-sided d. Narrowed to base 2. Collar a. Broad b. Narrow c. Divided d. Oblique e. Hairy f. Hairy margins

Instructor Directions	Content Outline
	3. Leaf blade arrangement a. Rolled b. Folded 4. Sheath a. Split b. Split, margins overlapping c. Closed 5. Auricle a. Large b. Small c. Absent 6. Ligule shapes a. Acuminate b. Acute c. Rounded d. Truncate e. Absent
Objective 3 <i>Ask students to describe different types of root or modified stem structures they have seen on grassland plants, including trees, shrubs, grasses, forbs, and legumes. Discuss the basic structures found in grassland plants. Refer to PPt 2.</i> ☐ PPt 2 – Roots and Modified Stems	Describe how the root or modified stem can be used to identify grassland plants. 1. Roots a. Tap b. Fibrous 2. Modified stems a. Rhizomes b. Stolons
Objective 4 <i>Ask students to describe different arrangements of flowers they have seen on grassland plants. Display examples of typical grassland flowers for the students to observe. Discuss the six basic</i>	Describe how the type of inflorescence can help identify grassland plants. 1. Spike 2. Raceme 3. Panicle 4. Umbel 5. Terminal 6. Axillary

Instructor Directions	Content Outline
<i>inflorescence structures found in grassland plants. Refer to PPT 3.</i> ☐ PPT 3 – Inflorescence	
Objective 5 <i>Point out to students that the leaf on a legume, forb, or woody plant is just as important in identifying the plant as the leaf blade on a grass plant. Discuss the different parts and arrangements of leaves. Refer to PPT 4.</i> ☐ PPT 4 – Leaf Structure and Arrangement	Identify leaf structures and leaf arrangements used in grassland plant identification. 1. Parts of a leaf a. Petiole b. Stipules c. Base d. Blade, surface texture – Glabrous – Pubescent – Glaucous 2. Arrangement of leaves and buds a. Alternate b. Opposite c. Whorled d. Basal 3. Types of venation a. Parallel b. Netted – Palmate – Pinnate 4. Types of leaves a. Simple, may be lobed b. Compound – Palmate – Pinnate – Bipinnate – Trifoliate 5. Leaf anatomy a. Leaf shapes: ovate, obovate, oblong, oval, orbicular, linear, lanceolate, oblanceolate b. Margin shapes: entire, serrulate, serrate, doubly serrate, dentate, crenate, sinuate, undulate, lobed, incised c. Base shapes: truncate, cordate, rounded, cuneate d. Tip shapes: emarginate, obtuse, cuspidate, acute

Instructor Directions	Content Outline
Objective 6 <i>Display cross sections of plants with different stem shapes.</i> <i>Discuss how stem shape can be used to identify plants.</i>	Describe how stem shape can be used to identify plants. 1. Square 2. Round 3. Oval 4. Triangular
Objective 7 <i>Ask students to identify the external parts of the woody plant stem. Refer to PPt 5.</i>  PPt 5 – Stem Structure of Woody Plants <i>Have students complete the Activity Sheet on Identifying Grassland Plants from the previous lesson. The student's individual plant sheets should have the plant sample attached and the type of plant (forb, grass, legume, or woody plant) written in the blank provided. The students can use IML's Crop and Grassland Plant Identification Manual or any other illustrated guides available to identify the plant and fill in the other sections of the guide page. The instructor will need to show the students how to use the plant guide to identify the plants. This activity may be done individually or in groups.</i>	Identify the external parts of the woody plant stem. 1. Buds a. Terminal bud – Bud at the tip of the stem where new growth starts – Usually the largest bud – Can be flowering or vegetative b. Axillary or lateral bud – Bud found on the side of the stem – Can be flowering or vegetative 2. Nodes: joints from which leaves or branches grow 3. Internodes: distance between two adjacent nodes 4. Terminal bud scar: scar left from previous year's terminal bud 5. Lenticels: breathing pores found scattered around stem 6. Leaf scar: scar where leaf was attached to stem
Application	Other activities 1. Take a field trip to a grassland so that students can relate the drawings in this lesson to actual plants. 2. Supply students with examples of less common grassland plants and have them identify them based on their characteristics.

Instructor Directions	Content Outline
Closure/Summary	Plants can be identified by many characteristics. Grasses are usually identified in their vegetative state since they do not flower until late in the season. The structural parts of grasses are used to identify the plant. Each forb, legume, and woody plant is unique, with its own distinct stem structure, bud shape and size, leaf structure, leaf arrangement, and inflorescence. The types of plant species present determine the care a grassland needs.
Evaluation: Quiz	Answers: 1. c 2. b 3. a 4. a 5. d 6. c 7. a 8. d 9. b 10. b

Course	Agricultural Science II
Unit	Introduction to Grassland Management
Subunit	Grasslands and Grassland Plants
Lesson	Grassland Composition
Estimated Time	Two 50-minute blocks
Student Outcome	

Appraise the current conditions of the grassland.

Learning Objectives

1. Describe why it is important to determine grassland composition.
2. Describe how grassland composition is determined.
3. Identify what makes a grassland viable for livestock and wildlife.
4. Identify what factors affect forage quality.

Grade Level Expectations

SC/EC/1/A/09-11/a	SC/EC/1/A/09-11/b	SC/EC/1/C/09-11/a
SC/EC/1/C/09-11/b	SC/EC/1/D/09-11/a	SC/EC/1/D/09-11/b
SC/EC/3/B/09-11/a		

Resources, Supplies & Equipment, and Supplemental Information

Resources

1. Activity Sheets
 -  AS 1 – Grassland Composition Survey (Instructor)
 -  AS 1 – Grassland Composition Survey (Student)
2. *Introduction to Grassland Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.
3. *Introduction to Grassland Management Curriculum Enhancement*, “Unit I – Grasslands and Grassland Plants.” University of Missouri-Columbia: Instructional Materials Laboratory, 2003.

Supplies & Equipment

- ☐ See AS 1 for materials and equipment needed to complete the Activity Sheet.

Supplemental Information

1. Print
 - ☐ *Crop and Grassland Plant Identification Manual* (Catalog #10-1203-S). University of Missouri-Columbia: Instructional Materials Laboratory, 1997.

Interest Approach

Take a field trip to a nearby grassland area, preferably one used for livestock. Identify the factors that make the area good or bad for its current use. Discuss how all of these factors work together to make the grassland viable.

Communicate the Learning Objectives

1. Describe why it is important to determine grassland composition.
2. Describe how grassland composition is determined.
3. Identify what makes a grassland viable for livestock and wildlife.
4. Identify what factors affect forage quality.

Instructor Directions	Content Outline
Objective 1 <i>The quality of a grassland depends on the types of plants it contains. For example, a grassland with a lot of weeds and woody plant saplings would not be of as high quality as one with a mixture of cool-season grasses and legumes. Discuss the importance of determining grassland composition.</i>	Describe why it is important to determine grassland composition. 1. Livestock a. Helps when estimating production potential b. Used to determine the length of the grazing season c. Used to adjust plant composition to reach optimum economic yields 2. Wildlife a. Helps when estimating its potential for wildlife management b. Used to adjust plant composition to achieve successful wildlife management
Objective 2 <i>Ask students how they would determine the composition of a grassland. Have students complete AS 1.</i>  AS 1 – Grassland Composition Survey	Describe how grassland composition is determined. 1. Visual appraisal of a given area of land 2. By appraising the grassland using a stick to determine the percentages of different plants in the grassland
Objective 3 <i>Ask students if they think the basic needs of all animals are the same. Once they realize that animal needs are similar, list some of those needs on the board.</i>	Identify what makes a grassland viable for livestock and wildlife. 1. Food a. Livestock: need quality forages, including native warm-season grasses, cool-season grasses, and legumes

Instructor Directions	Content Outline
<i>Discuss with students the factors that make a grassland viable for both livestock and wildlife.</i>	b. Wildlife: need a greater mixture of plants, since different animals may feed on leaves, stems, twigs, bark, roots, fruits, seeds, insects, or small mammals supported by these plants 2. Shelter a. Livestock: use terrain and large plants like trees to reduce the effects of sun, heat, wind, and cold b. Wildlife: use brush piles, nearby woods, and tall grasslike plants for nesting and protection from predators 3. Water a. Livestock: require a surface source of water, such as a freeze-proof water tank located below a pond or at a water hydrant b. Wildlife: can drink from streams or ponds or obtain moisture from berries, plants, or dew, depending on the species
Objective 4 <i>Forage quality affects livestock feeding on the forage, the hay or silage produced from it, and the wildlife living off the land. Forage quality refers to the nutritive value of the forage needed to produce a desired level of animal performance. Ask students to list factors that affect forage quality.</i>	Identify what factors affect forage quality. 1. Laboratory analysis a. Moisture: water present in the forage b. Crude protein (CP): includes both true protein and nonprotein nitrogen; indicates the ability of the forage to meet an animal's requirements for protein c. Acid detergent fiber (ADF): percentage of indigestible plant material; as ADF increases, digestibility and energy decrease d. Neutral detergent fiber (NDF): percentage of structural or cell wall material; low NDF correlates to increased feed intake e. Total digestible nutrients (TDN): percentage of digestible material; higher ADF corresponds to lower TDN f. Net energy for lactation (NE_l): measurement indicating the energy available in a forage to meet the requirements of lactating cows g. Net energy for maintenance (NE_m): measurement indicating the energy available in a forage to meet the requirements for maintenance in meat-producing livestock

Instructor Directions	Content Outline
	h. Net energy for gain (NE_g): measurement indicating the amount of energy available in a forage to produce growth or gain 2. Field assessment a. Stage of growth: Nutritive value decreases as plants mature because the plants have more indigestible material due to higher fiber content. b. Type of forage: Plant species differ in digestibility and energy content. c. Growing conditions: Quality is affected by the environment, including the temperature, amount of sunlight, and amount of rainfall. d. Presence of noxious weeds: Weeds affect intake because they are less palatable and also less nutritious.
Application  AS 1 – Grassland Composition Survey	Answers to AS 1 Answers will vary.
Closure/Summary	Grassland composition refers to the quality and variety of plants that grow in the grassland; it can be determined by making an appraisal of the land. A knowledge of grassland composition can be used to benefit both livestock and wildlife. A viable grassland should include quality food, shelter, and water. Forage quality depends on many factors, with stage of growth being the most important.
Evaluation: Quiz	1. c 2. a 3. b 4. c 5. a 6. d 7. Quality food, shelter, water 8. Answers may include any four of the following: moisture, crude protein, acid detergent fiber, neutral detergent fiber, total digestible nutrients, net energy for lactation, net energy for maintenance, or net energy for gain. 9. A producer can determine grassland composition by making a visual appraisal of a given area of land or

Instructor Directions	Content Outline
	by using a stick to determine the percentages of different plants in the grassland.