



A Project Year 1 Final Report for
New Mexico Department of Game and Fish, Share with Wildlife Program
Professional Services Contract #25-516-0000-00034

April 2026

***Ecological Immersion: Teaching High School Students Through
Lesser Prairie-Chicken Habitat Improvement Research***



Picture by Matt Mathis

Submitted by:
CEHMM
505 N Main Street
Carlsbad, NM 88220

Funding for this project was provided by:
New Mexico Department of Game and Fish, Share with Wildlife Program,
and the Land of Enchantment Legacy Fund

Table of Contents

Project Objective.....	2
Project Year 1 Accomplishments.....	2
Future Tasks.....	8
References.....	8
Appendix A Educational Materials	9
Pre/Post Assessment.....	10
PowerPoint Lesson.....	12
Survey Methods.....	24
Appendix B Data and Data Analyses.....	38
Monitoring Grazing Protocols.....	39
Monitoring Invertebrate Diversity.....	49
Monitoring Bird Diversity.....	50
Monitoring Wildlife Diversity.....	51
Pre/Post Assessment.....	52

Project Objective

Center for Environmental Health Monitoring and Management (CEHMM) is a non-profit organization committed to working towards solutions that are beneficial for conserving the Lesser Prairie Chicken (*Tympanuchus pallidicinctus*) while cooperating with anthropogenic activities, such as agricultural development and livestock grazing. Through Candidate Conservation Agreements (CCA) and Candidate Conservation Agreements with Assurances (CCAA; collectively CCA/As), collaborative conservation efforts with local ranchers promote the livelihoods of ranchers while also advocating for threatened and endangered species and habitat conservation. By enrolling in the CCA/As, ranchers agree to follow grazing protocols that support Lesser Prairie Chicken habitat conservation. Projects conducted on enrolled ranches, such as the installation of fences and water tanks, are funded through the CCA/As to aid ranchers in meeting these grazing requirements, thereby benefiting both the habitat of the Lesser Prairie Chicken and the ranching activities of the enrollees.

Through these agreements, CEHMM strives to engage in educational outreach to increase community awareness of, and participation in, the CCA/As. Our educational outreach efforts offer opportunities for students and other members of the community to learn about the importance of protecting the Lesser Prairie Chicken and grassland environments.

Project Year 1 Accomplishments

This final report outlines how the New Mexico Department of Game and Fish (NMDGF) Share with Wildlife grant was utilized throughout NMDGF's FY25 (1 April 2025 to 30 June 2025) and part of FY26 (1 July 2025 to 9 April 2026) for CEHMM's *Ecological Immersion: Teaching High School Students Through the Lesser Prairie Chicken Habitat Improvement Research* Project Year 1 (10 April 2025 to 9 April 2026). The primary objective was an educational outreach with a local high school to instruct high school students on grassland ecology, the Lesser Prairie Chicken, and CEHMM's CCA/A's programs. CEHMM collaborated with Dora High School, Roosevelt County, NM.

- **Purchased and created supply kits for each field day station.** A kit was created for each field day station. Kits contained supplies for that station's data collection method(s), safety gear, and educational materials. Supplies and safety gear were provided using the Share with Wildlife grant funds, with the exception of a couple items provided by CEHMM biologists. Educational materials were created by CEHMM biologists and are shown in Appendix A. Bottled water and sun protection hats were provided through Share with Wildlife grant funding and were readily available to students and teachers throughout the field day. A total of 4 kits were arranged: 1) Monitoring Grazing Protocols Kit contained clipboards, snake gaiters, gloves, 300 foot measuring reel, 300 g spring scale, pruning shears, Robel pole, Daubenmire frame, gloves, record sheets, and field guides; 2) Monitoring Invertebrate Diversity Kit contained 95% denatured ethyl alcohol, plastic cups, 20 ml glass vials, forceps, dissecting microscope, tape, markers, and invertebrate identification guide; 3) Monitoring Bird Diversity Kit contained clipboards, binoculars, snake gaiters, bird identification guides, and record sheets; and 4) Monitoring Wildlife Diversity Kit contained game cameras and record sheets. **Developed a one-hour PowerPoint lesson**

that focused on the importance of protecting Lesser Prairie Chicken, conserving grassland ecosystems, the impact of anthropogenic activities, CEHMM's CCA/As programs and grazing protocols, grassland diversity, and various data collection methods for investigating grassland diversity (*Appendix A PowerPoint Lesson*). The lesson included criteria from multiple Next Generation Science Standards, including LS2.A: Interdependent Relationships in Ecosystems, LS2.C: Ecosystem Dynamics, Functioning, and Resilience, LS4.D: Biodiversity and Humans, ESS3.C: Human Impacts on Earth Systems, ESS3.D: Global Climate Change, and ETS1.B: Developing Possible Solutions. Next Generation Science Standards and their inclusion on the PowerPoint lesson are further described in *Appendix A PowerPoint Lesson*.

- **Developed a pre-assessment** including 10 questions composed of short-answer and multiple-choice questions centered around the lesson topics (*Appendix A Pre/Post Assessment*). The assessment was created with the intention of being administered to the students prior to any teaching activities to establish an understanding of their initial knowledge on the topics. The assessment would then be administered again following the lesson and field day to determine the extent of the knowledge gained by the students.
- **Developed and executed a field day with the students.** Field modules were created to demonstrate numerous data collection methods that CEHMM uses to monitor CCA/As grazing protocols and Lesser Prairie Chicken habitat, as well as other data collection methods often used to monitor grassland ecology and diversity, including pitfall traps, visual observation surveys, and game camera monitoring. Every student was provided with a field module that included a description of each survey method procedure, its purpose, and the associated data record sheet (*Appendix A Survey Methods*). The field modules were reviewed with the students in the field as they engaged with each method. The field day took place at CEHMM's property in Milnesand on September 15, 2025, during which 17 students



and one teacher were provided with the unique opportunity to gain hands-on learning experiences performing these various data collection methods. Students were divided into four groups that rotated to a new station hourly. Students received an in-field demonstration of each method at each station and were accompanied by a CEHMM biologist at all times. Additional resources for each station were also created by CEHMM biologists, such as species identification guides and record sheets. The four stations are described below.

1. Monitoring Grazing Protocols Students were taught how to perform four data collection methods used by CEHMM to determine if enrolled ranches are following the CCA/As grazing protocols for protecting Lesser Prairie Chicken habitat. Each student received a field module detailing how each survey method is performed and a record sheet for each method, and appropriate safety gear and data collection supplies organized into a station kit. Each group of students was given a demonstration on how to execute the survey method. A total of four sites were surveyed for each method. Each group of students completed the data sheet for a single site, allowing every student the chance to gather at least one observation independently. Documented observations were verified by a CEHMM biologist. Throughout the field activity, students were shown various classes of vegetation and numerous species essential for Lesser Prairie Chicken brooding, nesting, lekking, and predation cover. The four methods CEHMM uses to monitor CCA/A grazing protocols that the students were taught are outlined below and explained further in Appendix A *Survey Methods*.

- Daubenmire Cover Class – This data collection method measures and characterizes ground cover.
- Robel Pole – This data collection method measures visual obstructions.
- Line-Point Intercept – This data collection method measures canopy cover.
- Grazing Exclosures - This data collection method measures forage utilization by grazing cattle.

2. Monitoring Invertebrate Diversity

Students learned how pitfall traps function to collect invertebrates in order to monitor species diversity and biomass. A total of 72 pitfall traps were placed by CEHMM biologists 24 hours prior to the field day. Pitfall traps were arranged into two 6x6 arrays of plastic solo cups placed at randomized locations on CEHMM's property. Each student received a field module describing the purpose of pitfall traps and the survey method procedure, and a



data sheet to record invertebrate identifications. Each group of students was led by a CEHMM biologist into the field to collect the catch from 18 pitfall traps. Students then returned to the CEHMM office located on the property, learned how ethyl alcohol is used to store and preserve invertebrates, used tweezers to move captured invertebrates to individual vials, and worked as a group to identify their collected invertebrates to the Family level using an invertebrate identification guide (*Insectidentification.org*) and dissecting microscope. Identifications were confirmed by a CEHMM biologist.

3. Monitoring Bird Diversity

Students learned how visual observation surveys are utilized to monitor bird species diversity and abundance. Each group of students was led by a CEHMM biologist along a 450-meter transect line for a duration of 1 hour. Each student received a pair of binoculars to use during the field day. Each student also received a field module describing how the survey should be conducted and the purpose, a bird identification guide created by CEHMM biologists containing bird

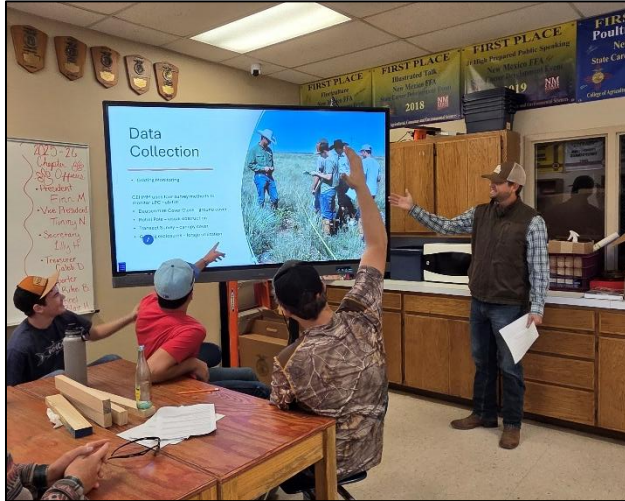


species commonly observed in Roosevelt County, NM, and a data sheet to record observations.

4. Monitoring Wildlife Diversity

Four game cameras were deployed within CEHMM's 300-acre property parcel for one week. Cameras were programmed to be motion activated during daytime and nighttime. Game camera SD cards were collected by CEHMM staff the day before the field day. Each group of students worked together to identify and count all captured images on their assigned SD cards. Each student received a field module explaining the importance of Game Camera Monitoring and how the survey method is performed and each group of students received a data sheet to record the identified species and the count for each. This gave the students the opportunity to collectively make decisions about identification and determine whether each image depicted a unique individual or an individual depicted by a prior image. Some animals that were observed were deer, coyotes, and various birds. A CEHMM biologist was present to answer any questions and verify species identifications.

- **Submitted the classroom lesson, field day modules, and pre-assessment to the NMDGF Share with Wildlife Education Coordinator for review.** On August 8, prior to the classroom visits and field day, we submitted a completed draft of the classroom curriculum, field day modules, and pre-assessment to the Share with Wildlife coordinator. Feedback/edits were provided by the education team and we incorporated that into the final drafts.



- **Delivered the classroom lesson and pre-assessment.** On September 15, CEHMM biologists visited Dora High School where they delivered the pre-assessment and presented the one-hour PowerPoint lesson to 17 students in Dora High School's Agriculture class.

- **Executed a field day with the students.** On September 15, 17 students and one teacher visited CEHMM's property in Milnesand and experienced the field day described

above. Immediately following the classroom visit, students were bused to CEHMM's property. The field day took approximately 6 hours to complete with 1 hour of safety briefing, 4 hours of station time, a 30-minute lunch, and a 30-minute opportunity at the end of the day for students to ask questions.

- **Analyzed data.** CEHMM biologists organized and analyzed data collected by the students for each survey method that occurred during the field day (Daubenmire Cover Class, Robel Pole, Line-Point Intercept, Grazing Exclosures, Pitfall Traps, Visual Observation Surveys, and Game Camera Monitoring). Data record sheets, analyses, figures, and tables are included in Appendix B. The overall results are as follows:

1. **Grazing Monitoring** – Data for each survey method was collected from a total of 4 randomly selected sites on CEHMM's property. Data record sheets and data analyses are included in Appendix B *Monitoring Grazing Protocols*.

- **Daubenmire Cover Class/Ground Cover** – The Daubenmire Cover Class table is used to determine whether a property is a grassland community or a shinnery-oak dune. According to this table found in Appendix B *Monitoring Grazing Protocols*, grassland communities have a coverage of 15-52% grasses and forbs, 3-12% shrubs and trees, 14-60% bare ground, and 8-44% litter, while shinnery-oak dunes have a coverage of 16-40% grasses and forbs, 3-17% shrubs and trees, 5-20% bare ground, and 25-70% litter. The four sites averaged 41% grasses and forbs, 13% shrubs and trees, 24% bare ground, and 22% litter, categorizing CEHMM's property as a grassland community.
- **Robel Pole/Visual Obstruction** – The goals of grazing protocols are to average 1 decimeter of visual obstructions and at least 10% of the readings be greater than 3.25 decimeters to provide adequate brood rearing and nesting habitat for the Lesser Prairie Chicken. The four sites averaged 3.13 decimeters and 67% of the readings were greater than 3.25 decimeters.

- Line-point Intercept/Canopy Cover – Bare ground and litter must be less than 42% combined. The four sites averaged a canopy cover of 69%, a litter cover of 31%, and bare ground 3%.
 - Grazing Exclosures/Forage Utilization – The four sites averaged 145 grams of clipped and weighed forage grasses within the exclosures. This will be compared to the data collected in September 2026, after the property has been grazed and a growing season has passed.
- 2. Pitfall Traps/Invertebrate Diversity
 - A total of 70 invertebrate specimens were collected; 66 of these specimens were identified into 23 families and 4 were unidentifiable. A list of the invertebrate families is included in Appendix B *Monitoring Invertebrate Diversity*.
- 3. Visual Observation Surveys/Bird Diversity
 - A total of 219 specimens were observed, and 19 bird species were identified. The species list is included in Appendix B *Monitoring Bird Diversity*.
- 4. Game Camera Monitoring/Wildlife Diversity
 - Images of a total of 236 animals were captured on the wildlife cameras. These animals were identified to species level or into a broad category; 225 birds, 1 coyote, and 10 deer were identified. The species list is included in Appendix B *Monitoring Wildlife Diversity*.
- **Attended a follow-up classroom visit to demonstrate the data to the students and educate them on how to analyze it.** In addition to providing lessons on grassland ecology and a hands-on experience, another key objective of this project was to educate students on how the data collected during the surveys is analyzed. CEHMM biologists attended a second classroom visit on September 22. During this visit students were shown the overall data collected from monitoring invertebrate, bird, and wildlife diversity. Additionally, students were taught how CEHMM analyzes data from the four collection methods used to monitor grazing and LPC habitat (Daubenmire cover class, Robel pole, line-point intercept, and grazing exclosures) to determine if grazing protocols are being met. All data, analyses, figures, and tables contained in Appendix B were presented and explained to the students. All steps of the data analyses were carried out and calculated with the students, ensuring they gained a comprehensive understanding of how to perform these. At this time, the pre-assessment was given again.
- **Compared the pre- and post-assessment to determine whether the student's gained knowledge.** The pre- and post-assessments displayed a significant increase in the students' understanding and knowledge of grassland and Lesser Prairie Chicken ecology and conservation (Appendix B *Pre/Post Assessment*). The pre-assessment average score was 51%, while the post-assessment average score was 90%.

Future Tasks

In Project Year 2 (April 10, 2026, to March 31, 2027) we will do the following:

- Reevaluate the classroom curriculum and field day modules and make necessary alterations to increase effectiveness.
- Provide updated classroom curriculum and field day modules to NMDOW Share with Wildlife Coordinator for review before administering to students.
- Provide project images and information to, and schedule a meeting with, the NMDOW Share with Wildlife Coordinator by May 29, 2026.
- Draft and submit an interim report to NMDOW Share with Wildlife Coordinator detailing progress made on activities between the project start date and the end of FY26 by June 30, 2026.
- Schedule and attend a classroom visit in September 2026 to deliver the PowerPoint lesson.
- Schedule a field day in September 2026 for the students to visit CEHMM Milnesand property to gain hands-on experience.
- Analyze and compare data collected between the 2025 field day and the 2026 field day.
- Schedule and attend a second classroom visit in September 2026 to demonstrate to the students the trend over a multi-year period.
- Draft and submit Project Year 2 final report detailing all work performed for the entirety of the project to NMDOW Share with Wildlife Coordinator by March 31, 2027.

References

1. <https://www.insectidentification.org/insects-by-state.php?thisState=New+Mexico>

Appendix A

Educational Materials

Contents

Pre/Post Assessment

Introductory PowerPoint Lesson

Monitoring Grazing Protocols

Monitoring Invertebrate Diversity

Monitoring Bird Diversity

Monitoring Wildlife Diversity

Pre/Post Assessment

“Lesser Prairie-Chicken Habitat Improvement Research”

Pre- and Post-Assessment

- 1.) Define a grassland.
- 2.) Name at least 2 threats to grassland habitats.
- 3.) What are the breeding grounds of the lesser prairie-chicken called?
 - a. Brooding Nests
 - b. Leks
 - c. Roosts
 - d. Breeding Colonies
- 4.) What type of habitat does the lesser prairie chicken need for successful breeding and survival?
 - a. Open prairies with tall, dense vegetation and a few shrubs
 - b. Desert landscapes with scattered cacti and limited vegetation
 - c. Mixed-grass prairies with native shrubs and minimal tree cover
 - d. Forested areas with dense tree canopy and high moisture levels
- 5.) True or False? The lesser prairie-chicken is listed as federally endangered.
- 6.) Why is sustainable grazing management essential for preserving rangeland health and supporting wildlife populations?
- 7.) How can implementing proper grazing management practices contribute to the restoration of degraded rangelands?
 - a. By encouraging vegetation recovery through rotational grazing and controlled stocking rates
 - b. By eliminating native plant species to prevent competition with forage crops
 - c. By increasing livestock stocking rates to maximize grazing efficiency.
 - d. By removing all vegetation from the rangelands to prepare for replanting
- 8.) Match the vegetation research method to its description:
 1. Transect Surveys: ____
 2. Daubenmire Surveys: ____
 3. Robel Surveys: ____

- A. A method that involves placing a frame on the ground to count and identify plants within a specific area.
 - B. A method which utilizes a vertical pole with a series of colored segments to identify vegetation height and visual obstruction.
 - C. A method that measures plant species along a set line to assess diversity and density
- 9.) True or False? Grazing utilization monitoring is primarily used to assess the impact of grazing on soil erosion, rather than on plant health and wildlife habitats.
- 10.) Invertebrate diversity is an indicator of _____.
- A. Grassland health
 - B. Cattle health
 - C. Habitat fragmentation
 - D. Clear cutting

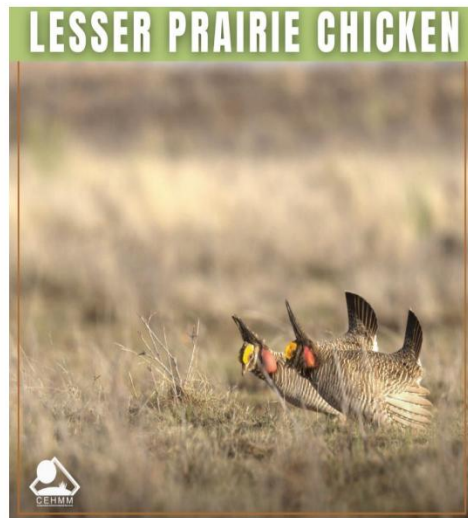
What are you hoping to learn from this experience?

PowerPoint Lesson

Share with Wildlife Ecological Immersion through Lesser Prairie Chicken Habitat Improvement



New Mexico Department
of Game & Fish



Center for Environmental Health
Monitoring and Management

Zane Corman – Wildlife Biologist

Education

- Bachelors of Science in Agriculture w/ an emphasis in Wildlife Science – New Mexico State University 2015
- Graduate Certificate in Sustainable Natural Resources – Oregon State University 2021

Career Path

- NMDA Forest Service – Recreation field technician – (2015)
- CEHMM – Environmental Services field technician – (2016)
- CEHMM – Conservation field technician – (2016 to 2018)
- CEHMM – Wildlife Biologist – (2018 to Present)



Ashlyn Corman – Wildlife Biologist

Education

- Bachelors of Science in Wildlife and Fisheries Sciences – Eastern New Mexico University 2023
- Masters of Science in Biology w/ an emphasis in freshwater ecology – Eastern New Mexico University – In progress

Career Path

- ENMU – Field technician
- ENMU – Graduate assistantship
- CEHMM – Wildlife Biologist



What is a Grassland?

Grasslands are ecosystems dominated by grass species with few to no trees or large shrubs.

Healthy grasslands have a diversity of native plant species that vary in size, height, and rooting depth

- Called structural layers:
 - Shrubs
 - Tall grasses and forbs
 - Medium and low grasses and forbs
 - Ground cover

A healthy grassland can support a diversity of plant and animal species



Threats to Grasslands

- Agricultural development
- Invasive species
- Pesticides
- Climate change
- Urban expansion
- Fire
- Overgrazing
- Industrial development

CEHMM's Mission

Preserve and improve grassland habitats for the Lesser Prairie Chicken and their grassland habitat.



Lesser Prairie Chicken (LPC)

Prairie grouse species

Inhabit grasslands of southern and central plains of the U.S.

Morphology

- 1 – 2 lbs.
- Brown and buff colored barring on feathers
- Short tails
- Males have:
 - pinnae: long tufts of feathers on the sides of their neck that stand upright
 - Pale reddish air sacs that inflate
 - Bright yellow eye combs



Lesser Prairie Chicken (LPC) Life History

Mating

- Occurs on leks: specific areas where males and females gather to mate
 - Leks are active in the spring and visited by males and females during sunrise and sunset
 - Males showcase their physical attributes (pinnae, air sacs, and eye combs), vocalizations, and “dancing” display to court females
 - Males compete, sometimes fight, for lekking position

Nesting

- Females use tall grass and forbs for nesting habitat. Tall grasses conceal the nests from predators.



Lesser Prairie Chicken (LPC) Status

Listing Status

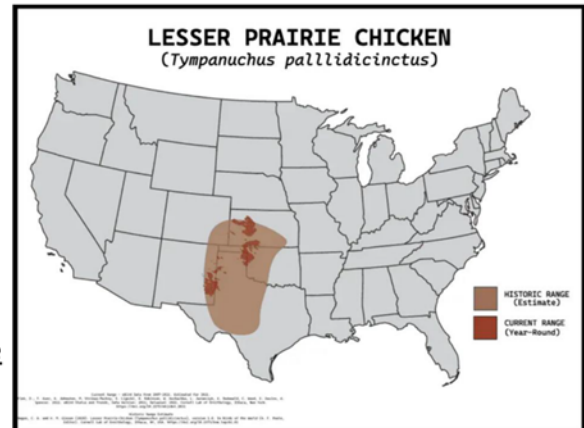
- Recently removed from the endangered species list
 - Under review by the U.S. Fish and Wildlife Service; Conservation programs still in place
 - Endangered: a species of animal or plant that is at serious risk of extinction

Threats

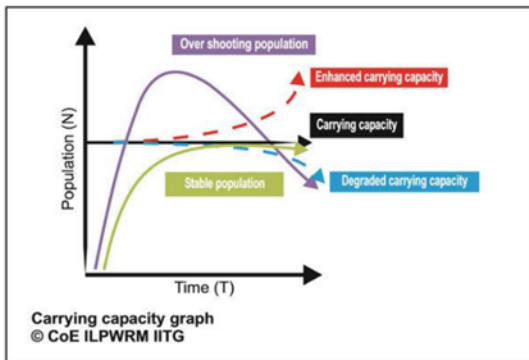
- Loss of habitat due to:
 - Drought
 - Overgrazing
 - Under grazing
 - Encroachment of invasive species
 - Energy development
 - Land use conversion (grassland to cropland)

CEHMM's Mission

Estimated to occupy less than 3% of their historic range
 Preserve and improve grassland habitats for the Lesser Prairie Chicken and their grassland habitat.



Carrying Capacity



- Every ecosystem has a carrying capacity

What is a carrying capacity?

Carrying capacity (K) is the maximum number of individuals of a species that the environment can sustain without depleting the resources

- K is limited by available living and nonliving resources
 - These resources are impacted by factors such as predation, competition, and disease

K (carrying capacity) affects the number of species and the number of individuals within each species in any given ecosystem

Relationship between Cattle and LPC

Cattle and LPC compete for vegetation

- Cattle eat vegetation
- LPC use vegetation for shelter from predators, nesting habitat, and food resources (seeds and invertebrate production)
 - Open prairies with tall, dense vegetation and a few shrubs are key to successful breeding and survival



Limits the abundance of cattle and LPC that a grassland ecosystem can support (i.e., carrying capacity)



Overgrazing

Livestock or wildlife excessively feeding on and depleting vegetation.

When cattle overgraze, they've exceeded the carrying capacity of the grassland.

Causes

- Reduced plant cover
- Reduced soil quality
- Soil erosion

Leads to

- Biodiversity loss
- Desertification
- Decrease in LPC populations

How does CEHMM manage cattle grazing for the LPC?

Candidate Conservation Agreement

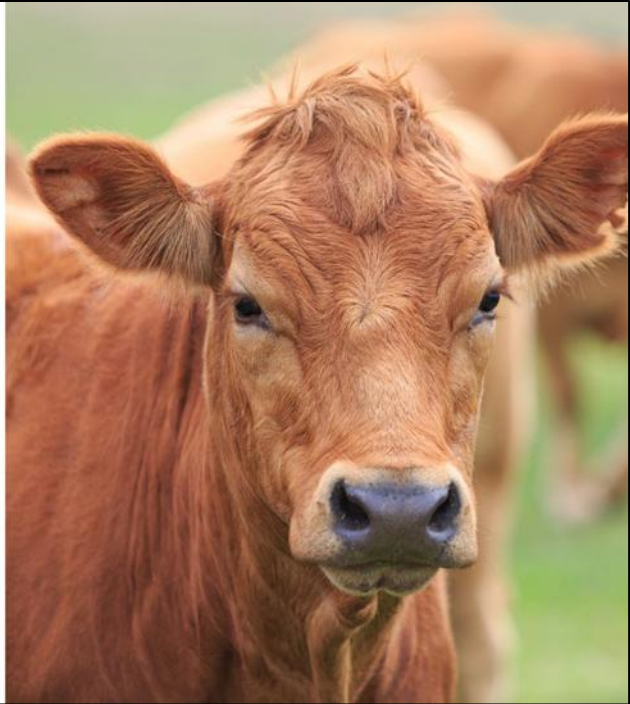
What is it?

A program/contract between enrollees (ranchers) and CEHMM.

How does it work?

Ranchers enroll in the program → agree to follow grazing protocols for their cattle → in turn receive funding for projects on their ranch from CEHMM

- Projects can be anything that benefits a ranching operation: fencing, tank installation, etc.



Grazing Protocols

Grazing protocols are guidelines that enrollees must follow to ensure grassland health for LPC.

Basic habitat needs for the Lesser prairie chicken were set by U.S. Fish & Wildlife Service according to the Bureau of Land Management RMPA (Resource Management Plan Amendment).

Habitat quality indicators are monitored by CEHMM through four survey methods.

Ground Cover (%)		
	Grassland Community	Shinnery Oak-Dune
Grasses and Forbs	15-52	16-40
Shrubs and Trees	3-12	3-17
Bare Ground	14-60	5-20
Litter	8-44	25-70

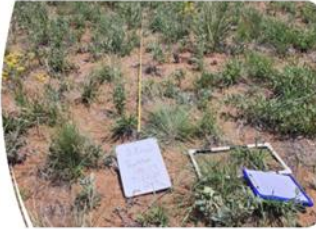
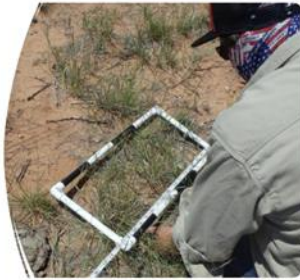
Forage Utilization Rates: the amount of vegetation that cattle has grazed cannot exceed 45% of the grassland vegetation.

Why? - maintains food and nesting resources for LPC.

Visual Obstructions: Enrollees' property must average 4 inches of visual obstructions.

Why? – provides shelter and nesting habitat for LPC and protection from predators.

Canopy Cover (%)			
Grasses	Shrubs	Forbs	Bare Ground and Litter
30-50	25-40	3-10	Less than 42% combined



How do we monitor if these protocols are being followed?

Through Data Collection.

We use various methods to collect data

- Line point intercept – canopy cover
- Robel Pole – visual obstructions
- Daubenmire cover class – ground cover
- Grazing exclosures – forage utilization



What we will be showing students in the field.



Benefits of Grazing Monitoring

Critical habitat for LPC is preserved and improved.

Cattle grazing mimics historic ungulate (bison) populations that supported a healthy grassland ecosystem.

- Hoof action sows seeds
- Increases organic litter
- Promotes soil health



Bird Diversity

- New Mexico is the fourth highest state in bird diversity - 549 bird species
- Roosevelt County has approximately 200 bird species

CEHMM office in Milnesand is a well-known destination for bird watchers

Ecological Importance

- Species diversity is an important indicator of grassland health
- Seed dispersal by birds leads to vegetation growth

Invertebrate Diversity

Ecological Importance

- Indicator of grassland health
 - Greater invert. diversity = greater plant diversity = healthier grassland
- Important food source for LPC and other wildlife (e.g., birds, lizards)

Data Collection Method

- Pitfall traps



Wildlife Diversity

- CEHMM observes wildlife via game camera monitoring
- Allows detection of species presence over long term intervals
- Species diversity is an indicator of rangeland health



References

- *Conserving the lesser prairie-chicken* | U.S. Fish & Wildlife Service. (2023, January 23). FWS.gov. <https://www.fws.gov/lpc>
- <https://southwest.audubon.org/>

Next Generation Science Standards

Next Generation Science standards were included in the above PowerPoint lesson. The following descriptions outline each Next Generation Science Standard's core ideas and how they were incorporated into the PowerPoint Lesson.

LS2.A: Interdependent Relationships in Ecosystems – Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. This Next Generation Science Standard was integrated into the PowerPoint lesson by educating students about the concept of carrying capacity. Carrying capacity is pertinent to the overarching lesson theme due to the interdependent relationship between cattle and the Lesser Prairie Chicken. As both species rely on vegetation for different resources, they restrict the availability of these resources for one another. Consequently, CEHMM oversees cattle grazing, and the CCA/A's have established grazing protocols to guarantee that resources are not excessively depleted by the cattle, thereby preserving what is necessary to support Prairie Chicken populations.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience – A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original state (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. The PowerPoint presentation emphasizes various methods for monitoring organisms within a grassland ecosystem, including Visual Observation Surveys, Pitfall Traps, Daubenmire Cover Class, and Line-Point Interception. The relationships among these different categories of organisms sustain the overall dynamics of the grassland ecosystem. Ensuring a stable dynamic within the grassland ecosystem is crucial to prevent its collapse in the event of disturbances, such as those outlined in the PowerPoint presentation, including overgrazing, fire, and development.

LS4.D: Biodiversity and Humans – Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus, sustaining biodiversity so that ecosystem functioning and productivity also aids humanity by preserving landscapes of recreational or inspirational value. This Next Generation Science Standard is incorporated into the PowerPoint lesson as a key focus in the manner in which humans utilize

grasslands for grazing their cattle. The diversity of life found in grasslands, which includes birds, invertebrates, and other wildlife, plays a crucial role in maintaining a robust grassland ecosystem, thereby supporting its sustainable use by humans and their cattle. Consequently, we instruct in both the lesson and the field modules on the significance of and various techniques for measuring and observing biodiversity among vegetation, birds, invertebrates, and wildlife. Additionally, we highlight the different ways in which human activities adversely affect grasslands, including agricultural expansion, the introduction of non-native species, and excessive grazing.

ESS3.C: Human Impacts on Earth Systems – The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. The PowerPoint lesson highlights various threats and adverse effects on grassland ecosystems, with a particular focus on overgrazing. Overgrazing occurs when livestock excessively consume and exhaust vegetation. This phenomenon results in diminished plant cover, compromised soil quality, and increased soil erosion, ultimately leading to a loss of biodiversity, desertification, and a decline in Prairie Chicken populations. One of the primary objectives of CEHMM is to monitor cattle grazing to ensure that ranchers do not engage in overgrazing, which would deplete resources and habitat for the Prairie Chicken. This monitoring and survey methodology is taught to the students. The students receive instruction on CEHMM's CCA/A programs, which facilitate effective management efforts by monitoring grassland ecosystems and enabling informed management decisions.

ESS3.D: Global Climate Change - Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. Climate change is briefly acknowledged as a major threat to grasslands. While this lesson does not place a strong emphasis on climate change, students learn how CEHMM conducts ongoing monitoring to inform adaptive management strategies. Through the continuous observation of vegetation communities and invasive species in the grassland, CEHMM is able to foresee potential future impacts and make suitable decisions.

ETS1.B: Developing Possible Solutions – When evaluating solutions, it is important to take into account the range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental. In the section of the PowerPoint lesson regarding the instruction of students on CEHMM's CCA/A programs, it is emphasized that these programs are voluntary for local ranches that may host Prairie Chickens on their property or have suitable or potentially suitable habitat. The success of the program and the effective conservation of Prairie Chicken populations and their habitats depend significantly on a collaborative initiative in which ranchers voluntarily opt to participate.

Survey Methods

Daubenmire Cover Class Survey Method

Field Module

Daubenmire Cover Class

Purpose. The purpose of the Daubenmire Cover Class survey method is to determine the percentage of ground cover of each vegetation class and to determine the property's community type. This method helps estimate the percentage of vegetation cover across the landscape for the prairie chicken.

Procedure. Data collection for ground cover will occur along the same transect as the Line-Point Intercept survey. A 20 cm x 50 cm quadrat will be placed every 10 feet, starting at the 1500-foot mark and ending at the 10-foot mark. The quadrat will be placed horizontally along the tape every 10-feet and be oriented with the bottom right corner every 10th foot and the bottom left corner extending towards the 0-foot mark on the tape. The observer will determine a cover class for preferred grasses, other grasses, forbs, shrubs, litter, and bare ground. Data will be analyzed to determine which community type the property is: grassland community or shinnery-oak dune.

Procedure with the Students. On the field day, every student will be provided with a Line-Point Intercept data record sheet. Each group of students will be given a demonstration on how to execute the aforementioned procedure. Each group of students will complete the data sheet for a single site, allowing every student the chance to gather at least one observation independently. Documented observations will be verified by a CEHMM biologist. During the field activity, students will be shown specimens representing the different canopy cover classes and the preferred grasses.

A total of four sites will be surveyed during the field day with the students. See *Line-Point Intercept* for site coordinates.

Data Record Sheet

Daubenmire/Visual Obstruction Data Sheet

Date: _____ **Observer:** _____

Property: _____

Location (UTM): _____ E _____ N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Average	#####	#####	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Visual Obst

[illegible]

Robel Pole Survey Method

Field Module

Robel Pole

Purpose. The purpose of the Robel Pole survey method is to determine visual obstructions. Visual obstruction is a critical vegetation characteristic for the prairie chicken because it provides cover from predators for nesting, brooding, and lekking.

Procedure. Observations will be made along the same transect as the Line-Point Intercept survey. Observations and recordings will start at the 0-foot mark and be made every ten feet, ending at the 150-foot mark, for a total of 15 readings. A 1" PVC pipe with 10 decimeter bands will be placed on the left side of the tape at each interval that a reading is taken. Observations will be made perpendicular to the tape, on the left side, at eye level from a one-meter stake placed four meters from the pole. A four-meter string should be attached to the pole and stake to ensure the distance of each reading is the same. Recordings of the vegetative classes used for canopy cover, and their height in decimeters will be made to the closest half decimeter, rounding down. Record the highest point that the vegetation completely covers the pole.

Procedure with the Students. On the field day, every student will be provided with a Line-Point Intercept data record sheet. Each group of students will be given a demonstration on how to execute the aforementioned procedure. Each group of students will complete the data sheet for a single site, allowing every student the chance to gather at least one observation independently. Documented observations will be verified by a CEHMM biologist. During the field activity, students will be shown specimens representing the different canopy cover classes and the preferred grasses.

A total of four sites will be surveyed during the field day with the students. See *Line-Point Intercept* for site coordinates.

Data Record Sheet

Daubenmire/Visual Obstruction Data Sheet

Date: _____ Observer: _____

Property: _____

Location (UTM): _____ E _____ N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
Average	#####	#####	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Visual Obst

[illegible]

Line-Point Intercept Survey Method

Field Module

Line-Point Intercept

Purpose. The purpose of the Line-Point Intercept survey method is to determine canopy cover. Canopy cover is the amount of vegetation classes in an area. It is a key factor in determining whether habitat is suitable for the prairie chicken.

Procedure. Data will be collected along a 150 foot transect line. Observations will be made by dropping a pin flag on the left side of the transect tape (starting at the 0-foot mark) every three feet, ending at the 150-foot mark, for a total of 50 readings. The flag should be dropped perpendicular to the ground and remain straight as observations are made. The observer should walk on the right side of the tape and be sure not to trample any vegetation along the transect. A recording shall be made for each class of canopy that touches the pin starting from the topmost vegetation that intersects the pin. Only the first six intersections shall be recorded. Any other observations shall be omitted. Bare ground is only recorded when no other canopy class is observed.

Classes of canopy cover shall be preferred grass (PG), tufted grass (TG), sod grass (SD), forb (FO), shrub (SH), sand sagebrush (SS), shinnery oak (SO), mesquite (MS), woody litter (WL), herbaceous litter (HL), organic litter (OL), artificial litter (AL), and bare ground (BG).

Preferred grasses are Big Bluestem, Little Bluestem, Sideoats Grama, Indiangrass, and Switchgrass. All other grasses are TG or SG. Yucca and cacti are SH.

Procedure with the Students. On the field day, every student will be provided with a Line-Point Intercept data record sheet. Each group of students will be given a demonstration on how to execute the aforementioned procedure. Each group of students will complete the data sheet for a single site, allowing every student the chance to gather at least one observation independently. Documented observations will be verified by a CEHMM biologist. During the field activity, students will be shown specimens representing the different canopy cover classes and the preferred grasses.

A total of four sites will be surveyed during the field day with the students.

Site 1 coordinates : 33.63842, -103.35473

Site 2 coordinates : 33.64196, -103.35047

Site 3 coordinates : 33.642, -103.34537

Site 4 coordinates : 33.63926, -103.3434

Data Record Sheet

Line Point Intercept Data Form									
Collection Date:									
CI/CP									
Project Name:									
Transect:									
Collector(s):									
Compass Bearing:									
Start UTM:									
End UTM:									
Notes:									

Mark (ft.)	Interceptions						
	1	2	3	4	5	6	BG
0							
3							
6							
9							
12							
15							
18							
21							
24							
27							
30							
33							
36							
39							
42							
45							
48							
51							
54							
57							
60							
63							
66							
69							
72							
75							

Mark (ft.)	Interceptions						
	1	2	3	4	5	6	BG
78							
81							
84							
87							
90							
93							
96							
99							
102							
105							
108							
111							
114							
117							
120							
123							
126							
129							
132							
135							
138							
141							
144							
147							
150							

Total Hits: 0

Results:

	PG	TG	SG	FO	SH	SS	SO	MS	WL	HL	OL	AL	Canopy Total	Litter Total	Bare Ground
Number of Hits:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Canopy Cover:	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	#####	0.000

Preferred grasses (PG) are Big Bluestem, Sand Bluestem, Little Bluestem, Sideoats Grama, Indiangrass, and Switchgrass.
All other grasses are TG or SG. Yucca and cacti are SH. Record BG only when no other hits are recorded.

Grazing Exclosure Survey Method

Field Module

Grazing Exclosures/Clip and Weigh Method

Purpose.

Procedure. A small cage will be constructed at randomized sites. The cage will be constructed using a 16' x 50" cattle panel rolled into a circle with no more than 2 squares of the panel overlapping and clamped together using hog rings. The cage will be secured by three, 6' t-posts. Forage weight within the grazing exclosure collected will be determined by dropping a one square meter hoop. A photo of the hoop and vegetation will be taken. All grass vegetation rooted within the hoop will be clipped, bagged, and weighed. The weight of the bag will be subtracted from the total weight of the filled bag, resulting in the forage weight within the exclosure. After forage weight is collected, all grass vegetation within the grazing exclosure will be clipped. Forage weight outside the grazing exclosure will be collected after cattle have grazed and a growing season has passed. A one square meter hoop will be placed 20-25 paces in any direction from the exclosure. A photo of the hoop and vegetation will be collected. All grass vegetation rooted within the hoop will be clipped, bagged, and weighed. The weight of the bag will be subtracted from the total weight of the filled bag, resulting in forage weight outside the exclosure. Forage weight inside and outside of the exclosure will be compared to determine the forage utilization percentage.

Procedure with the Students. The four grazing exclosures will be placed prior to the field day. For safety reasons, students will not be allowed to climb into/out of the grazing exclosure or clip the vegetation. On the field day, every student will be given a demonstration on how to execute the aforementioned procedure.

A total of four sites will be surveyed during the field day with the students. See *Line-Point Intercept* for site coordinates.

Data Record Sheet

CEHMM CCA/CAA Forage Utilization Monitoring Data Sheet	
Participating Cooperator:	
CI/CP#:	
Date:	
Collector/s:	

Pasture Name	Monitoring Site #	Total Weight Inside Cage	Total Weight Outside Cage	Percent Utilization
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!
				#DIV/0!</

Pitfall Traps Survey Method

Field Module

Pitfall Traps

Purpose. Pitfall traps are simple traps, often made out of plastic cups, used to capture ground-dwelling insects and other small invertebrates. The main purpose is to sample and monitor biodiversity within an area.

Procedure. Two 6x6 arrays will be randomly placed at separate site locations, for a total of 72 pitfall traps. Pitfall traps were constructed with 16 oz., 92 mm wide, and 117 mm deep plastic cups.

Procedure with the Students. Pitfall traps will be placed by a CEHMM biologist 24 hours prior to the field day. Each group of students will be lead into the field by a CEHMM biologist and will collect 18 traps. Students will return to the office and use tweezers to place invertebrates individually into glass vials containing 95% denatured ethyl alcohol. Vials will be filled with ethyl alcohol by a CEHMM biologist prior to the field day. Students will use an invertebrate guide and a dissecting microscope to identify specimens to the Family level. Each group of students will receive a data sheet to record the identified family and count. A CEHMM biologist will confirm all identifications. Specimens will be labeled and stored for future access and potential research opportunities.

Site 1 coordinates: 33.642038, -103.350461

Site 2 coordinates: 33.642040, -103.45120

Data Record Sheet

Pitfall Traps Data Sheet

[illegible]

Visual Observation Survey Method

Field Module

Visual Observation Survey

Purpose. Visual Observation Surveys are used to observe and record what can be seen in a given environment. This survey method is used to record bird species, numbers, and behaviors, and estimate population sizes.

Procedure. Visual Observation Surveys will be conducted along a 450-meter transect line (from Point A to Point B) for a duration of one hour.

Procedure with the Students. Each group of students will perform the survey during their allotted station time. Each student will receive a pair of binoculars to use during the survey. Each student will be given a data sheet to record the species and count observed. Each student will receive a bird identification guide to aid with IDing specimens. All students record sheets will be compiled to get a complete list of observed species and the count for each. A CEHMM biologist will be in attendance with each group of students to answer any questions and help identify.

Transect line coordinates:

Point A: 33.640754, -103.345181

Point B: 33.642664, -103.340887

Data Record Sheet

Visual Observation Survey Data Sheet

[illegible]

Game Camera Monitoring Survey Method

Field Module

Game Camera Monitoring

Purpose. Game cameras, also known as trail cameras or camera traps, are motion-activated devices used to capture images of wildlife in a natural habitat. Their primary purpose is to record wildlife species, numbers, and behaviors, and to estimate population sizes.

Procedure. Four game cameras will be deployed at 4 random site locations for one week. Cameras will be programmed to be motion-activated during daytime and nighttime hours.

Procedure with the Students. Game camera SD cards will be collected prior to the field day with the students. Each group of students will work together in CEHMM's conference room to identify and count all captured specimens. Each group will have an hour to identify as many as possible. A CEHMM biologist will be present with the students to answer any questions and verify correct identification. Any remaining images will be identified and counted by CEHMM employees.

Site 1 coordinates: 33.642682, -103.340676

Site 2 coordinates: 33.639471, -103.248627

Site 3 coordinates: 33.638256, -103.354529

Site 4 coordinates: 33.639182, -103.343118

Data Record Sheet

Game Camera Monitoring Data Sheet

[illegible]

Appendix B

Data and Data Analyses

Contents

Monitoring Grazing Protocols

Monitoring Invertebrate Diversity

Monitoring Bird Diversity

Monitoring Wildlife Diversity

Pre/Post Assessment

Monitoring Grazing Protocols

Daubenmire Cover Class/Ground Cover

Data. The following record sheets display data collected using the Daubenmire Cover Class survey method at sites 1-4.

Property: CEHMM Property Site 1

Location (UTM): 33.63842 E, -103.35473 N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1		3	2		2	2
2		2	1	1	4	2
3			1		5	1
4		1	1		3	4
5		2	2		3	1
6			3		2	4
7		1	2		1	4
8		1	1		3	4
9		1	1		4	2
10		4	1		1	2
11		1	2			5
12		1	2		4	
13		1	1		3	3
14		1	2			5
15		3	1		4	
Average	#DIV/0!	1.692308	1.533333	1	3	3

Property: CEHMM Property Site 2

Location (UTM): 33.64196 E, -103.35047 N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1		2	1		3	2
2		1			5	
3		4	1		2	1
4				1	5	2
5			1	1	3	1
6		3	1		3	1
7		2		1	2	3
8		1	1		5	
9		3	1		1	4
10		5	1		2	1
11		1	3		2	2
12		1	2		2	4
13			1		4	3
14			2		2	5
15		1	1		1	5
Average	#DIV/0!	2.181818	1.333333	1	2.8	2.615385

Property: CEHMM Property Site 3

Location (UTM): 33.642 E, -103.34537 N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1	1	2	2		3	2
2	4				1	2
3		3	2		2	1
4		3	1		3	1
5		1	1		2	5
6		3	1		2	2
7		1	1		1	5
8		3	3		1	
9	1	3	1		3	
10		1		1	3	3
11		2	1		1	3
12		1	1	3	3	
13		1		3	3	
14		3		1	3	
15		4	1		3	
Average	2	2.214286	1.363636	2	2.266667	2.666667

Property: CEHMM Property Site 4

Location (UTM): 33.63926 E, -103.3434 N

Cover Data (Daubenmire)						
Point	Preferred Grass	Other Grass	Forb	Shrub	Litter	Bare Ground
1		2		2	4	
2		2		3	3	1
3	1	5			1	
4		2		2	3	2
5		4	1		2	1
6	2			2	4	
7	3	3			2	2
8		5			2	1
9		5	1		1	
10		5	1		1	1
11		2			2	4
12		3	2		2	3
13	3			2	2	2
14	1	4		1	2	
15		2		2	3	3
Average	2	3.384615	1.25	2	2.266667	2

Data Analysis. A step-by-step process on how data for Daubenmire Cover Class is analyzed to determine ground cover percentages and community type.

1. The average number of hits for each cover type (preferred grass, other grass, forb, shrub, litter, bare ground) is calculated for each site (see above *Data Sheets*).
2. Insert the rounded averages into a table (see below).

Site	Pref. grass	Other Grass	Forb	Shrub	Litter	Bare
1	0	1.7	1.5	1	3	3
2	0	2.2	1.3	1	3	2.6
3	2	2.2	1.4	2	2.3	2.7
4	2	3.4	1.3	2	2.3	2
AVE	1	2.375	1.38	1.50	2.65	2.58

3. Total the averages for a value of 11.485.
4. The Daubenmire Cover Class survey method categorizes ground cover classes into four categories: 1) grasses and forbs, 2) shrubs and trees, 3) bare ground, and 4) litter (see below). To determine the percentage of ground cover for each category based on the data gathered at the CEHMM property, follow these steps:
 - a. For grasses and forbs: total the averages for preferred grass, other grass, and forbs for a value of 4.755. Divide 4.755 by the totaled value of all averages (11.485) to determine the ground cover percentage of grasses and forbs. Grasses and forbs ground cover = 41%.
 - b. For shrubs and trees: Divide the average for the four sites (1.5) by the totaled value of all averages (11.485) to determine the ground cover percentage of shrubs and trees. Shrubs and trees ground cover = 13%.
 - c. For bare ground: Divide the average bare ground value for the four sites (2.58) by the totaled value of all averages (11.485) to determine the ground cover percentage of bare ground. Bare ground cover = 22%.
 - d. For litter: Divide the average litter value for the four sites (2.65) by the totaled value of all averages (11.485) to determine the ground cover percentage of litter. Litter ground cover = 23%.

Ground Cover (%)		
	Grassland Community	Shinnery Oak-Dune
Grasses and Forbs	15-52	16-40
Shrubs and Trees	3-12	3-17
Bare Ground	14-60	5-20
Litter	8-44	25-70

5. **Results** – According to the Daubenmire Cover Class table (see above), the percentage of ground cover for each class classifies the habitat as either a grassland community or shinnery-oak dunes. The CEHMM property is classified as a grassland community based on the percentages of ground cover, which are as follows: grasses and forbs at 41%, trees and shrubs at 13%, bare ground at 22%, and litter at 23%.

Robel Pole/Visual Obstructions

Data. The following table displays data recorded at sites 1-4 using the Robel Pole survey method.

Site 1	Site 2	Site 3	Site 4
VOR	VOR	VOR	VOR
4	3	4	3
3	2	1	3
7	3	2	3
4	2	2	2
6	3	2	2
7	3	2	6
5	4	3	2
5	4	1	2
7	4	3	4
6	3	2	3
2	3	1	2
5	2	4	3
2	1	1	3
4	2	2	2
4	4	1	3
4.733333	2.866667	2.066667	2.866667

Data Analysis. A step-by-step process on how data recorded during the Robel Pole survey method is analyzed to determine visual obstructions and if the enrolled property is meeting CEHMM's CCA/A protocol.

1. Calculate the average for each site: Site 1 = 4.7, Site 2 = 2.9, Site 3 = 2.1, and Site 4 = 2.9.
2. Total all of the sites averages for a value of 12.6.
3. Divide the totaled averages by the number of sites to determine the CEHMM property's average visual obstructions. $12.6/4 = 3.15$.
4. **Results** – CEHMM's CCA/A grazing protocols require the property's average visual obstruction to be greater than 1 and at least 10% of the site's averages to be greater than 3.25. One site, site 1, had an average of greater than 3.25; 25% of the sites exceeded 3.25. The average of all the sites was greater than 1. Therefore, CEHMM property would be considered as passing the protocol for visual obstructions.

Data. The following data sheets display the data collected during the Line-point intercept survey method at sites 1-4.

Line-Point Intercept Data - Site 1

Mark (ft.)	Interceptions						Mark (ft.)
	1	2	3	4	5	6	
0	FO	HL					BG
3	TG	HL					
6	FO	FO	TG				
9	TG	TG	HL				
12	HL						
15	HL						
18	HL						
21	SO	HL					
24	TG	TG	HL				
27	FO	FO	TG	TG	TG	TG	
30	FO	FO	TG	TG	HL		
33	HL						
36	FO	HL					
39	HL						
42	TG	HL					
45	FO	FO	TG	HL			
48	TG	HL					
51	FO	FO	FO	FO	TG	HL	
54	FO	FO	FO	HL			
57	TG	TG	TG	TG			
60	FO	FO	HL				
63	FO	FO	FO	FO	FO	FO	BG
66	TG	FO	FO	HL			
69	TG	FO	FO				
72	TG	TG	HL				
75							BG

Results:

	FD	IS	CS	LO	SH	SS	SO	NS	WL	HL	OL	AL	Canopy total	Water total	Site Ground
Number of Hits:	11	35	0	29	0	0	1	0	0	38	0	0	76	38	2
% Canopy Cover	0.071	0.227	0.000	0.188	0.000	0.000	0.006	0.000	0.000	0.247	0.000	0.000	0.494	0.247	0.040

Line-Point Intercept Data - Site 3

Mark (ft.)	Interceptions					
	1	2	3	4	5	6
0	HL					BG
3	WL	HL				
6	TG	HL				
9	TG	TG	HL			
12	FO	FO	FO	HL		
15	TG	TG				
18	TG	HL				
21	PG	PG	PG	PG	PG	PG
24	FO	FO	HL			
27	TG	HL				
30	FO	FO				
33	TG	TG	HL			
36	TG	TG	TG	TG	TG	TG
39	TG	TG				
42	TG	TG	TG	HL		
45	TG	TG	TG	HL		
48	TG	HL				
51	HL					
54	FO	HL				
57	PG	PG	PG	PG	PG	PG
60	FO	HL				
63	PG	HL				
66	HL					
69	TG					
72	HL					
75	HL					

Mark (ft.)	Interceptions					
	1	2	3	4	5	6
78	TG	TG	TG	HL		BG
81	TG	TG	TG	TG	TG	
84	FO	FO	HL			
87	TG	HL				
90	TG	TG	FO	HL		
93	HL					
96	PG	HL				
99	TG	TG	FO	FO		
102	TG	TG	HL			
105	FO	SO	SO	HL		
108	HL					
111	SH	SH	SH	HL		
114	TG	TG	TG	TG	HL	
117	FO	FO	HL			
120	HL					
123	SS	SS	TG	HL		
126	TG	TG	TG	HL		
129	TG	TG	TG	TG	HL	
132	TG					
135	TG	TG	TG	TG	TG	TG
138	TG	TG	TG	HL		
141	TG	HL				
144						BG
147	SH	SH	SH	SH	SH	SH
150	HL					

Total Hits: 147

Results:

Number of Hits:	10	PG	TG	SG	FO	SH	SS	SO	MS	WL	HL	OL	AL	Canopy Total	Litter Total	Bare Ground
% Canopy Cover:	0.068	0.265	0.000	0.061	0.048	0.014	0.014	0.014	0.000	0.007	0.259	0.000	0.000	69	39	1
														0.469	0.265	0.020

Line-Point InterceptData - Site 4

Mark (ft.)	Interceptions						Mark (ft.)	Interceptions					
	1	2	3	4	5	6		1	2	3	4	5	6
0	HL						78	TG	TG	TG	TG	TG	TG
3	TG	TG					81	TG	TG	TG	TG	HL	
6	SS	SS	WL				84	SH	HL				
9	SO	SO	HL				87	HL					
12	TG	HL					90	HL	HL				
15	HL						93	HL					
18	SO	SO	SO	HL			96	TG					
21	TG	TG	HL				99	WL					
24	TG	TG	TG	HL			102						BG
27						BG	105	TG	TG	TG	HL		
30	TG	TG	TG	TG	TG	TG	108	HL					
33	WL	HL					111	HL					
36	TG	TG	HL				114						BG
39	SO	SO	HL				117	TG	TG	TG	TG	TG	TG
42	SO	SO	HL				120	HL					
45	FO	HL					123	SH	SH	TG	HL		
48	HL						126	TG	TG	TG			
51	TG	HL					129	HL					
54	HL						132	PG	TG	HL			
57	TG	HL					135	PG	PG	HL			
60	TG	HL					138	SH	TG	HL			
63	TG	FO					141	HL					
66	TG	TG	TG	TG	TG	TG	144	TG	TG	TG	HL		
69	FO	FO	HL				147	HL					
72	PG	HL	HL				150	TG	WL				
75	HL												

Total Hits: 122

Results:

Number of Hits:	1	PG	TG	SG	FO	SH	SS	SO	MS	WL	HL	OL	AL	Canopy Total	Litter Total	Bare Ground
% Canopy Cover:	37	0.008	0.303	0.000	0.016	0.008	0.016	0.074	0.000	0.033	0.320	0.000	0.000	52	43	3

Data Analysis. A step-by-step process on how data recorded during the Line-Point Intercept survey method is analyzed to determine canopy cover and if the enrolled property is meeting CEHMM's CCA/A protocol.

1. For each site, calculate the total number of hits for all canopy cover classes.
2. For each site, total the number of hits for each canopy cover class.
3. For each site, calculate the percentage of each canopy cover class. Canopy cover class/total number of hits for all classes = canopy cover class percentage.
4. For each site, calculate the Canopy Total. Canopy Total = total number of hits for every canopy cover class excluding bare ground and litter. Calculate the Canopy Cover percentage. Canopy Cover percent = Canopy Total/total number of hits for all classes.
5. For each site, calculate the Litter Total. Litter Total = total number of hits for WL, HL, OL, and AL. Calculate the Litter percentage. Litter percentage = Litter Total/total number of hits for all classes.
6. For each site, count the number of Bare Ground hits. Calculate the Bare Ground percentage. Bare Ground percentage = number of bare ground hits/total number of hits for all classes.
7. Calculate the average for the four sites for each class of canopy cover.
8. Total the averages for PG, TG, SG, FO, SH, SS, SO, and MS to determine the Canopy Cover Average across the four sites. Total the averages for WL, HL, OL, and AL to determine the Litter Average across the four sites. Total the averages for Bare Ground to determine the Bare Ground Average across the four sites.
9. **Results** – The Canopy Cover Average for all four sites was 69%. The Litter Average for all four sites was 31%. The Bare Ground Average for all four sites was 3%. According to CEHMM's CCA/A protocols, the Bare Ground and Litter Averages must be less than 42% combined. CEHMM's property had a 34% combined average between the two, therefore, the CEHMM property is meeting the protocol requirements.

Grazing Enclosures

Data.

CEHMM CCA/CCAA Forage Utilization Monitoring Data Sheet			
Participating Cooperator:	CEHMM Office		
CI/CP#:			
Date:	12/8/2025		
Collector/s:	Caleb Doss and Kaiden Eastman		
Monitoring Site #	Total Weight Inside Cage	Total Weight Outside Cage	Percent Utilization
1	132	90	31.8
2	152	94	38.2
3	152	84	44.7
4	145	88	39.3
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
			#DIV/0!
	</		

Data Analysis. A step-by-step process on how data recorded during the Grazing Enclosures survey method is analyzed to determine forage utilization and if the enrolled property is meeting CEHMM's CCA/A protocol.

1. Calculate Percent Utilization for each site. $\text{Percent Utilization} = [(\text{Weight Inside Cage} - \text{Weight Outside Cage}) / \text{Total Weight Inside Cage}] * 100$
2. Percent Utilization for each site:
 - a. Site 1 = 31.8%
 - b. Site 2 = 38.2%
 - c. Site 3 = 44.7%
 - d. Site 4 = 39.3%
3. Calculate the Overall Utilization for all four sites combined. Total the four sites weight inside the cage. Total the four sites weight outside the cage. Use these values to calculate the above formula for Percent Utilization.
 - a. Overall Utilization = 38.7%
4. CEHMM's CCA/A protocols require Overall Utilization to be below 45%; therefore, CEHMM's property meets the forage utilization protocol.

Monitoring Invertebrate Diversity

The following table displays the 23 invertebrate families identified and the number of specimens found within each.

Family	Total
Formicidae	13
Acrididae	2
Romaleidae	6
Tenebrionidae	2
Carabidae	7
Hydrophilidae	1
Buthidae	1
Ctenomorphidae	1
Silvanidae	6
Lycosidae	4
Sicariidae	2
Thomisidae	2
Actinopodidae	1
Curculionidae	7
Pholcidae	1
Ichneumonidae	2
Aleyrodidae	1
Miridae	1
Theridiidae	1
Salticidae	1
Elateridae	1
Rhinotermitidae	1
Stenopelmatidae	2
Unidentifiable	4
	Total = 70 specimens

Monitoring Bird Diversity

The table below presents all recognized bird species along with the tally compiled from each student's record sheet.

Species	Count
Eurasian Collared Dove	22
Bullock's Oriole	3
Black-Chinned Hummingbird	2
American Kestrel	10
Red-winged Blackbird	2
Dark Eyed Junco	7
Western Wood Pewee	1
Great Tailed Grackle	18
White Crowned Sparrow	49
Say's Phoebe	6
American Robin	10
House Finch	5
Barn Swallow	33
European Starling	12
Western Kingbird	29
Mourning Dove	5
Greater Roadrunner	1
Great Horned Owl	2
Red-Tailed Hawk	2

Monitoring Wildlife Diversity

The following table displays the specimens identified via game camera monitoring.

Specimens (category or species)	Total
Bird	225
<i>Canis latrans</i> (Coyote)	1
<i>Odocoileus hemionus</i> (Mule deer)	10
	Total Wildlife = 236

Pre/Post Assessment

The following table displays the pre-/post-assessment scores for 17 students, the average pre-assessment score, and the average post-assessment score.

Student #	Pre-Assessment Score (%)	Post-Assessment Score (%)
1	35	100
2	60	95
3	55	75
4	55	100
5	70	100
6	40	75
7	55	70
8	55	100
9	40	75
10	45	100
11	40	100
12	35	95
13	50	90
14	80	90
15	30	100
16	70	85
17	55	85
	Avg. = 51	Avg. = 90