Name: _____ Date: _____

Period: _____ **AP Environmental Science**

Range Condition Simulation

Background Information

Rangelands are grasslands, shrublands, woodlands, wetlands, and deserts that are grazed by domestic livestock or wild animals. Types of rangelands include: tallgrass and shortgrass prairies, desert grasslands and shrublands, woodlands, savannas, chaparrals, steppes, and tundras. Rangelands have been estimated to comprise almost one-half of all the lands in the world. They are extremely important to society for the goods and services they produce, as well as the ecological services they provide. They are also extremely vulnerable to desertification brought on by disturbances such as overgrazing or drought.

It is vital to monitor the health of rangelands; this is done through ecological sampling. The goal of ecological sampling of rangeland is often vegetation management and/or restoration projects that aim to recreate the plant cover, distribution, and species composition of the site prior to disturbance, such as: overgrazing, drought, or increasing dominance of invasive or non-native species. Rangeland restoration projects have successfully re-vegetated disturbed sites by reseeding and planting native species in a process called assisted succession, that uses techniques borrowed from agricultural practices (Robert & Anderson, 2004). Accurate data on the composition of plant communities is desirable for the planning and evaluation of these types monitoring and restoration projects.

It is impractical to take a complete census (count) of even a relatively small site; descriptive statistics such as cover, density, frequency, and relative abundance of plant species can be accurately estimated from as little as 1% of the community. Transects and quadrats are two methods of ecological sampling that allow us to quantify the relative abundance of organisms in an area. Gathering baseline data and tracking changes over time allows researchers to collect data on changes in abundance. Transect sampling is the act of collecting data along a single line, while and quadrat sampling involves gathering data within a grid. These sampling methods provide accurate data and take less time than counting every specimen in a certain area. Thus, allowing researchers to estimate and compare species abundance and diversity in rangeland plant communities.

To assess overall rangeland health researchers use relative density values to determine range condition. The best-known procedure to assess range condition is the Quantitative Climax Method used the Natural Resources Conservation Service. This method compares species or species groups in the existing vegetation with that expected in the climax vegetation, to give a percentage reflecting the similarity between the two. A value close to 100% indicates that species composition of the existing vegetation closely reflects the composition of the climax vegetation, whereas lower values indicate a greater level of departure from perceived climax conditions. Although range condition is evaluated on a continuous scale from 0% to 100%, arbitrary classes are generally reported to illustrate range condition (Table 1).

Purpose
To collect relative density data and use it to calculate range condition in a simulated situation.

Procedure

1. A sample 'range' will be placed on your table before you. The 'plants' are labeled and color-coded for easy identification.
2. Use the quadrat method to obtain the numbers and relative densities (Figure 1) of the 'plants' and record these in the data table labeled Quadrat Method.
3. Now use the transect method to obtain the numbers and relative densities (Figure 1) of the 'plants' and record these in the data table labeled Transect Method. Now count the entire set of 'plants' in your habitat and record the numbers and relative densities this way.
4. Use the range condition guide below to calculate the range condition using all three sets of data. → ***Determine %Used*** by using the smaller of the two numbers: % Allowed or Relative Density, simply select the smaller of the two numbers & write it in the % Used column.
5. Return your 'plants' to the bag.
6. Answer the analysis and conclusion questions.

Table 1. Range condition classes used in the Quantitative Climax Method

Range Condition Class	Percent of Climax
Excellent	76 -100
Good	50 - 75
Fair	26 - 50
Poor	0 - 25

Figure 1.

$$Relative\ Density = \frac{\#\ \text{of Species}}{\text{Total Individuals of All Species}}(100)$$

Table 2.

Range Condition Guide

Plant	Percent Allowed in Climax Community
Little Bluestem	30%
Indiangrass	20%
Sideoats Grama	20%
Silver Bluestem	5%
Meadow Dropseed	5%
Englemann Daisy	5%
Maximilian Sunflower	5%
Annual Forbs	3%
Live Oak	5%
Pecan	2%

Data – Quadrat Method

Plant	Number	Relative Density
Little Bluestem		
Indiangrass		
Sideoats Grama		
Silver Bluestem		
Meadow Dropseed		
Englemann Daisy		
Maximilian Sunflower		
Annual Forbs		
Live Oak		
Pecan		
Total		

Data – Transect Method

Plant	Number	Relative Density
Little Bluestem		
Indiangrass		
Sideoats Grama		
Silver Bluestem		
Meadow Dropseed		
Englemann Daisy		
Maximilian Sunflower		
Annual Forbs		
Live Oak		
Pecan		
Total		

Data – Actual Count

Plant	Actual Count	Relative Density
Little Bluestem		
Indiangrass		
Sideoats Grama		
Silver Bluestem		
Meadow Dropseed		
Englemann Daisy		
Maximilian Sunflower		
Annual Forbs		
Live Oak		
Pecan		
Total		

Calculations – Quadrat Method

Plant	% Allowed	Relative Density	% Used
Little Bluestem			
Indiangrass			
Sideoats Grama			
Silver Bluestem			
Meadow Dropseed			
Englemann Daisy			
Maximilian Sunflower			
Annual Forbs			
Live Oak			
Pecan			
Total			
			↑ Range Condition

Calculations – Transect Method

Plant	% Allowed	Relative Density	% Used
Little Bluestem			
Indiangrass			
Sideoats Grama			
Silver Bluestem			
Meadow Dropseed			
Englemann Daisy			
Maximilian Sunflower			
Annual Forbs			
Live Oak			
Pecan			
Total			
			↑ Range Condition

Calculations – Actual Count

Plant	% Allowed	Relative Density	% Used
Little Bluestem			
Indiangrass			
Sideoats Grama			
Silver Bluestem			
Meadow Dropseed			
Englemann Daisy			
Maximilian Sunflower			
Annual Forbs			
Live Oak			
Pecan			
Total			
			↑ Range Condition

Analysis & Conclusion Questions

1. What was the Range Condition in each scenario? (Quadrat, Transect, Actual)

2. Which sampling method seemed most accurate, according to your data? (Quadrat or Transect compared to Actual)

3. In what types of biomes are rangelands found? Why are rangelands important?

4. What do vegetation management and/or restoration projects aim to restore?

5. If any of your conditions were fair or poor, describe some specific actions a range manager could take to improve the condition of this range.

6. Identify and describe the two types of ecological sampling that you practiced today.

7. What is relative density and what does it tell us?

8. What is range condition and what does it tell us?

References

Robert D., C., & Anderson, V. J. (2004). Increasing Native Diversity of Cheatgrass-Dominated Rangeland through Assisted Succession. Journal of Range Management, (2). 203.

Extra Credit: Use Google Scholar to find the article referenced above. Read the article and write a one-page summary. Staple it to this lab. **40 points**