

CONTESTANT NAME _____

**2008 UNDERGRADUATE RANGE MANAGEMENT EXAM
(a mini-URME)**

Society for Range Management, Wyoming Section Meeting

**Cheyenne, Wyoming
November 20, 2008**

Instructions

This examination consists of 62 multiple choice questions, which are worth 2 points each unless otherwise noted.

Length of Testing Period

60 Minutes

Grading

The entire examination is worth 150 points.

I. RANGE ECOLOGY (30 points)

1. Plants undergo water stress when the rate of ____ is exceeded by the rate of ____.
 - a. Percolation, evaporation
 - b. Absorption, transpiration**
 - c. Precipitation, transpiration
 - d. Evaporation, infiltration

2. The primary factor determining plant growth in arid and semi-arid environments is:
 - a. Availability of sunlight
 - b. Availability of atmospheric CO₂
 - c. Availability of water**
 - d. Availability of photosynthetic leaf area on the plant

3. Which of the following processes is responsible for the most water use in range plants?
 - a. Transpiration**
 - b. Photosynthesis
 - c. Respiration
 - d. Cell expansion

4. ____ components can be manipulated by management, but ____ components are not.
 - a. Fixed, set
 - b. Abiotic, biotic
 - c. Biotic, abiotic**
 - d. Composition, utilization

5. According to the ____ effect, precipitation generally increases with elevation.
 - a. Thermocline
 - b. Krumholtz
 - c. Rain shadow
 - d. Orographic**

6. How much usable solar radiation available to range plants is utilized in photosynthesis?
 - a. <1%**
 - b. 5-10%
 - c. 20-30%
 - d. 40-60%

7. Which of the following is an example of a primary producer?
 - a. Fungi
 - b. Insects
 - c. Plants**
 - d. Nematodes

8. An example of a biotic threshold is:
- Upland soil erosion after fire
 - Change in peak flows in a river after a dam construction
 - Weed dominance associated with heavy grazing**
 - Gully erosion
9. The expected pH of rain would be near:
- 2.5
 - 5.7**
 - 8.1
 - 10.5
10. What general modification of the photosynthetic system do C4 and CAM plants have that distinguishes them from C3 plants?
- PEP carboxylase**
 - Photosystem 1
 - Photosystem 2
 - More photoreceptors
11. Which of following factors LEAST determines the rate of photosynthesis by a plant?
- Area of leaf surface
 - Physiological efficiency
 - Intensity and quality of light
 - Soil texture**
12. The intermediate disturbance hypothesis predicts that:
- Biological diversity is greatest when there are high levels of environmental disturbance
 - Biological diversity is greatest when there are low levels of environmental disturbance
 - Biological diversity is greatest when there are moderate levels of environmental disturbance**
 - Biological diversity is similar at all levels of environmental disturbance
13. If an exponentially growing population had a constant growth rate of 5%, how many years would it take for that population to double?
- 5
 - 10
 - 14**
 - 25
14. The generalized grazing model of Milchunas et al. (1988) suggests that plant diversity in grassland communities in relation to grazing can be expressed along gradients of:
- Soil fertility and elevation
 - Evolutionary history of grazing and moisture**
 - Temperature and nitrogen availability
 - Root depth and light availability

15. Root:shoot ratios:

- a. Are higher for temperate forests compared to temperate grasslands.
- b. Increase from cool, mesic environments to warm, arid habitats**
- c. Are similar between native rangelands and annual cropping systems in mesic environments.

II. GRAZING MANAGEMENT (26 points)

16. Which of the following is NOT a common mechanism for increasing grazing resistance in grasses?

- a. High vegetative/reproductive stem ratio
- b. High proportion of culmless shoots
- c. Delay in apical meristem elevation
- d. Presence of secondary compounds**

17. What is the difference between herbaceous and browse plants?

- a. Herbaceous plants are palatable whereas browse plants are not
- b. Herbaceous plants typically are shrubs and trees whereas browse plants typically are forbs, grasses and grass-likes
- c. Herbaceous plants typically are forbs, grasses and grass-likes, whereas browse plants typically are shrubs and trees**
- d. Browse plants are palatable whereas herbaceous are not

18. Diet selection of rangeland ungulates is influenced by:

- a. Maternal social interaction
- b. Positive post-ingestive feedback
- c. Negative post-ingestive feedback
- d. All of the above**
- e. None of the above

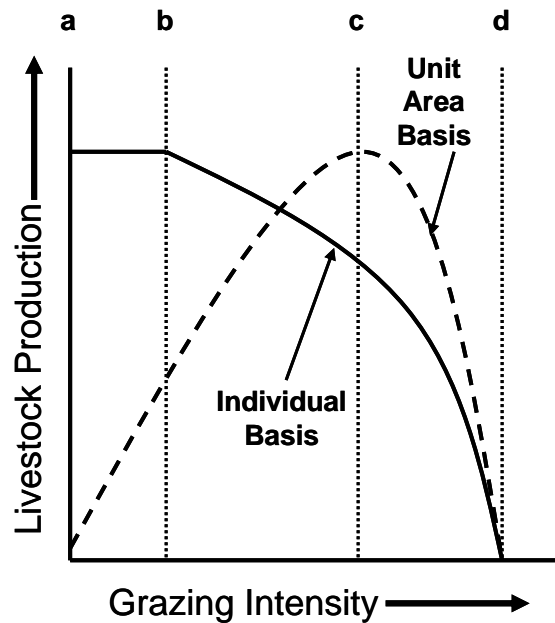
19. Which of the following is true about toxins?

- a. Different species of animal vary in their susceptibility to different toxins
- b. Individual animals within a species differ in their susceptibility to different toxins
- c. A palatable plant can be toxic at certain times of the year depending on environmental conditions
- d. All of the above**
- e. None of the above

20. The Seasonal-Suitability grazing system:

- a. Involves the seasonal rotation of three herds and four pastures
- b. Involves several pastures where one pasture receives a year of nonuse while the other pastures absorb the grazing load
- c. Involves the partitioning of rangeland into pastures based on vegetation types**
- d. Involves three or more pastures with grazing periods longer than two weeks and nonuse periods over sixty days

For questions 21-24, please use the following figure (modified from Briske and Heitschmidt 1991)



21. (4 pts) The lowest grazing intensity at which animals begin to compete for forage resources is at point:
- A
 - B**
 - C
 - D
22. (4 pts) Solar energy capture and conversion to animal biomass is most likely maximized at point:
- A
 - B
 - C**
 - D
23. (4 pts) From a purely ecological standpoint, grazing intensity at what level is likely to be sustainable in the long term?
- Grazing intensity of B or less**
 - Grazing intensity of C or less
 - Grazing intensity of D or less
24. (4 pts) From a purely economical standpoint, grazing intensity at what level is likely to be sustainable in the long term?
- Grazing intensity equal to B
 - Grazing intensity equal to C
 - Grazing intensity equal to D
 - Grazing intensity at the level where individual and area gain curves intersect**

IIa. GRAZING MANAGEMENT PROBLEM (5 points)

SEE END OF TEST

III. RANGE IMPROVEMENT (24 points)

25. (4 pts) Seed lot A is labeled as 94% pure live seed with a 96% germination rate and costs \$4.75/kg bulk seed. Seed lot B is labeled as 90% pure live seed with a 92% germination rate and costs \$5.50/kg bulk seed. Which seed lot is a better economic value?
- Seed Lot A**
 - Seed Lot B
 - There is no difference in economic value between to two seed lots
26. The low-energy grubber replaces tractor horsepower requirements through the use of:
- Multiple blades
 - Hydraulics**
 - Reverse motion
 - Larger tires
27. Which economic evaluation model requires the assumption of a discount rate before completing the calculations?
- Internal rate of return
 - Benefit-cost ratio
 - Net present value**
 - Internal rate of return
28. Fire in an ecosystem is more likely to occur and have a greater intensity if:
- The relative humidity is low and air temperature is low
 - The relative humidity is low and air temperature is high**
 - The relative humidity is high and air temperature is low
 - The relative humidity is high and air temperature is high
29. A surfactant is added to foliar applied herbicide mixes to:
- Increase killing power of the herbicide
 - Uniformly moisten leaves with spray droplets**
 - Reduce the amount of water required
 - Prepare the soil surface for penetration
30. Which of the following statements regarding wind and fire is correct for mountainous areas?
- Winds tend to move fire downslope during both the day and night
 - Winds tend to move fire upslope during both the day and night
 - Winds tend to move fire upslope during the day and downslope at night**
 - Winds tend to move fire downslope during the day and upslope at night

31. Which of the following practices have been used to manipulate water yield on rangelands?
- Pitting
 - Waterspreading
 - Ripping
 - All of the above**
 - None of the above
32. Which of the following statements is most correct regarding fine and heavy fuels for rangeland fires?
- Heavy fuels burn more rapidly and have a narrower fire front than fine fuels
 - Fine fuels have a wider fire front and burn more rapidly than heavy fuels**
 - Heavy fuels have a wider fire front and burn slower than fine fuels
 - All of the above
 - None of the above
33. Interseeding a legume into native rangelands can:
- increase soil nitrogen
 - increase forage production
 - increase soil carbon sequestration potential
 - all of the above**
 - none of the above
34. Consider the following two fuel types, both have equal weight and have been exposed to a lengthy drying period: Type A is a loose pile of twigs and small boles whereas Type B is a tightly packed pile of large boles. Which of the following statements is most correct?
- Type A will burn at a higher intensity and burn longer than Type B
 - Type B will burn at a higher intensity and burn longer than Type A
 - Type A will burn at a lower intensity and burn faster than Type B
 - Type B will burn at a lower intensity and burn faster than Type A
 - Type A will burn at a higher intensity and burn faster than Type B**
35. Which of the following rankings is most correct regarding the potential productivity increase (%) following a range management improvement practice?
- Fire > fertilization > revegetation
 - Water management < fertilization < control of unwanted plants
 - Manipulation of grazing < control of unwanted plants < revegetation**
 - All of the above
 - None of the above

IIIa. RANGE IMPROVEMENT PROBLEM (5 points)

SEE END OF TEST

IV. RANGE REGIONS (16 points)

36. Above 500 mm of precipitation per year, the single most important factor for determining the type and productivity in an area is:
- Water
 - Existing biota
 - Soil characteristics**
 - Humidity
37. Which of the following statements is most correct regarding temperature and precipitation gradients in the Great Plains?
- Temperature increases from east to west and precipitation decreases from south to north
 - Precipitation increases from west to east and temperature increases from north to south**
 - Temperature decreases from west to east and precipitation increases from north to south
 - Precipitation decreases from west to east and temperature decreases from north to south
38. The predominant shrub species in the Sagebrush grassland region of the Great Basin is:
- Artemisia nova*
 - Artemisia tridentata***
 - Larrea tridentata*
 - Artemisia frigida*
39. Which of the following statements is most correct regarding proportions of C4 and C3 species in the Great Plains?
- C4 species increase from the southeast to the northwest
 - C3 species increase from the south to the north
 - C3 species increase from the northeast to the southwest
 - C3 species decrease from the northwest to the southeast**
40. Which of the following woodland communities covers the largest land area in North America?
- Mountain shrubland
 - Western coniferous forest
 - Eastern deciduous forest**
 - Southern pine forest
41. Which of the following grasslands supports the highest diversity of grasses?
- tallgrass prairie
 - shortgrass prairie
 - southern mixed prairie
 - northern mixed prairie**

42. Plant-soil interactions in xeric grassland ecosystems are driven by _____ constraints and in mesic grassland ecosystems plant-soil interactions are driven by _____ constraints.

- a. Aboveground, belowground
- b. Aboveground, aboveground
- c. Belowground, aboveground**
- d. Belowground, belowground

43. Which of the following desert regions of North America is the smallest in land area?

- a. Great Basin
- b. Mojave**
- c. Sonoran
- d. Chihuahuan

V. RANGE INVENTORY AND ANALYSIS (20 points)

44. The presence or absence of an individual within a quadrat best describes:

- a. Density
- b. Frequency**
- c. Species composition
- d. Diversity

45. What is the standard error of the mean?

- a. Standard deviation divided by the square root of the number of samples**
- b. Standard deviation divided by the mean
- c. Coefficient of variation divided by the sample size
- d. Standard deviation multiplied by the mean

46. The mean is the average number, whereas the mode is the _____, and the median is the _____.

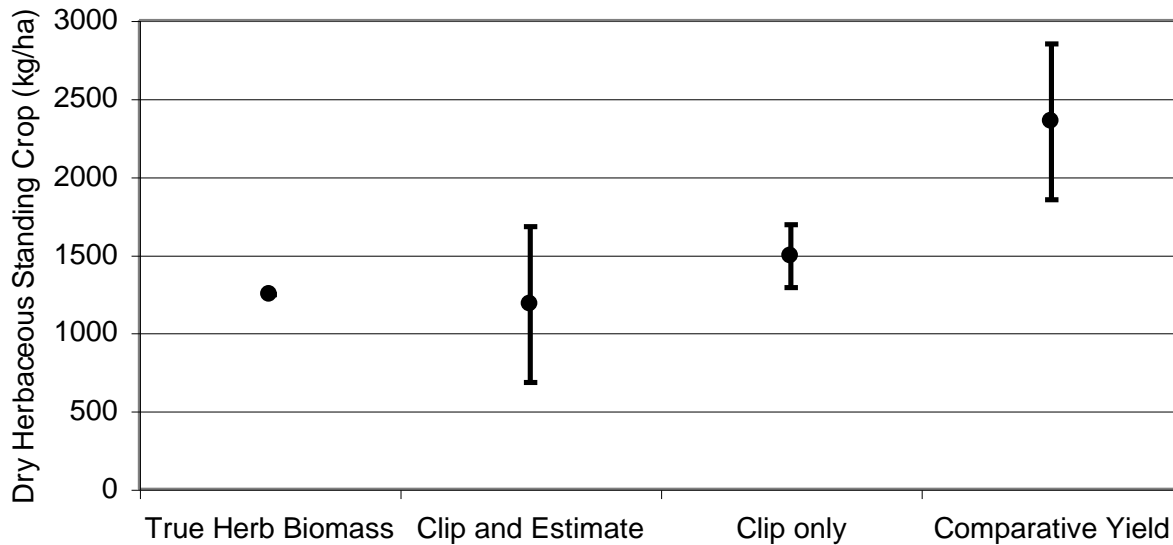
- a. Most common number, middle number**
- b. Middle number, most common number
- c. Least common number, middle number
- d. Middle number, least common number

47. Which of the following is the most common monitoring technique used to determine how susceptible a rangeland is to soil erosion?

- a. Density
- b. Forage production
- c. Frequency
- d. Cover**

For questions 48-50, please use the following figure.

The following figure reports estimates (means \pm 95% confidence intervals) of dry herbaceous standing crop (kg/ha) under aspen stands from a hypothetical study in northeastern Nevada. True herbaceous biomass (point with no confidence interval bars) was derived from findings of a previous study covering several years and is for comparison purposes only. Researchers estimated standing crop with clipping, by clipping and estimating (double sampling), and through a comparative yield technique.



48. (4 pts) Which technique was the most precise?

- Comparative yield
- Clip and estimate
- Clip only**

49. (4 pts) Which technique was the most accurate?

- Comparative yield
- Clip and estimate**
- Clip only

50. (4 pts) Does a statistical difference exist between the clip and estimate and the comparative yield techniques?

- No, because a p-value has not been reported
- Yes, because the standing crop value for comparative yield is more than twice that for the clip and estimate technique
- No, because the confidence intervals for both estimated values do not overlap
- Yes, because the confidence intervals for both estimated values do not overlap**

Va. RANGE INVENTORY AND ANALYSIS PROBLEM (10 points)

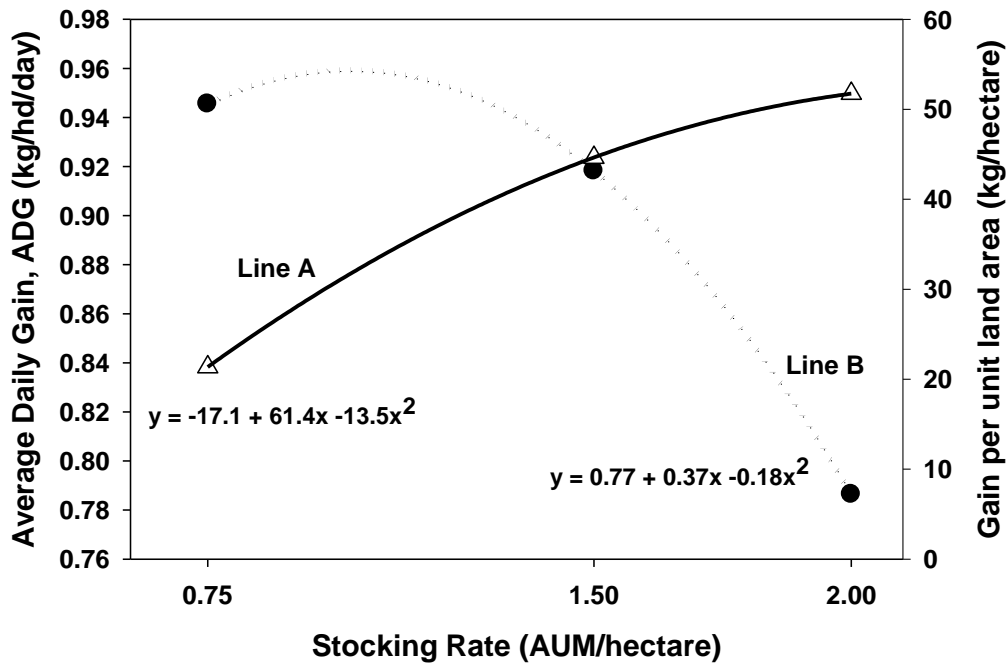
SEE END OF TEST

VI. MULTIPLE USE RELATIONSHIPS (14 points)

51. Which of the following is the most widespread contaminant of rangeland surface water?
- Sewage
 - Nitrogen
 - Pesticides
 - Sediment**
52. Which of the following soils has the highest clay content?
- Silt
 - Loam
 - Silt loam
 - Clay loam**
53. Which of the following describes the erosional process of detachment?
- Movement of detached particles
 - Movement of eroded particles to a new location
 - Destruction of aggregation**
 - All of the above
 - None of the above
54. Approximately 97% of the earth's surface water is located in the:
- Living organisms
 - Atmosphere
 - Rivers and lakes
 - Oceans**
55. A soil with a pH of 5 is _____ times as acidic as a soil with a pH of 8.
- 0.3
 - 3
 - 30
 - 1000**
56. Prairie dogs tend to promote a higher composition of _____ and tend to reduce _____ through their foraging activities.
- forbs, grasses**
 - grasses, shrubs
 - shrubs, grasses
 - grasses, forbs
57. Which of the following statements is most correct regarding stocking rate, infiltration rate and sediment production?
- Stocking rate and infiltration rate exhibit a positive relationship
 - Sediment production decreases with increasing stocking rate
 - The rate of increase in sediment production with increasing stocking rate is greater than the rate of decrease in infiltration rate**
 - All of the above
 - None of the above

GRAZING MANAGEMENT PROBLEM (5 points)

A long-term grazing management study is addressing the effects of stocking rate on animal performance in grasslands. Provided below is a figure showcasing the responses of average daily gain and gain per unit land area to different stocking rates.



58. (2 pts) Which of the following statements is most correct?

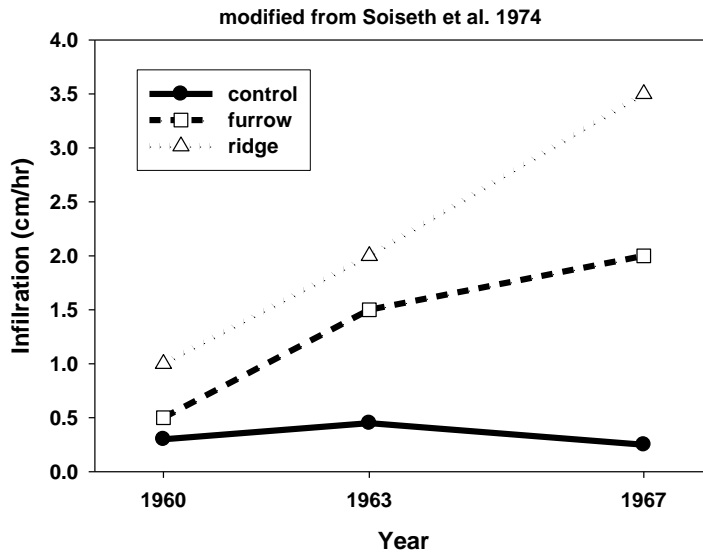
- Line A is the response of average daily gain to stocking rate
- Line B is the response of average daily gain to stocking rate**
- Line B is the response of gain per unit land area to stocking rate
- All of the above
- None of the above

59. (3 pts) If the stocking rate was 1 AUM/hectare, which of the following is correct?

- Average daily gain will be 0.96 kg/hd/day
- Gain per unit land area will be 30.8 kg/hectare
- Average daily gain will be 21.5% greater compared to that obtained with a stocking rate of 2 AUM/hectare
- All of the above**
- None of the above

RANGE IMPROVEMENTS PROBLEM (5 points)

Contour furrowing is an improvement practice that has been used on degraded rangelands to increase water infiltration rates (see Figure) and forage production (see Table).



Forage production (g/m^2) following contour furrowing in 1967 (from Wight et al. 1978)

TRT	1968	1969	1970	1971	1972	1974	1975	1976
Control	20	25	30	40	35	40	30	40
furrowed	24	60	65	100	95	65	80	145

60. (5 pts) Given the above information, how many more AUMs would be expected on 130 hectares of degraded northern mixed prairie following contour furrowing assuming harvest efficiency of the forage is 40% and that intake of the grazing animals is 2.2% of their body weight?
- 80
 - 120
 - 200
 - None of the above

Average forage production on control plots= 32.5 g/m^2 or 325 kg/ha

Average forage production on furrowed plots= 79.25 g/m^2 or 792.5 kg/ha

Thus, increase in forage production is 467.5 kg/ha

40% harvest efficiency yields ($467.5 \text{ kg/ha} \times 0.4$) an extra 187 kg/ha of available forage

With 130 hectares ($\times 187 \text{ kg/ha}$), there would be a total of $24,310 \text{ kg}$ of extra forage

Forage demand:

1 AU = 454 kg animal and this animal consumes 2.2% of its body weight = 10 kg/day

Then take $24,310 \text{ kg}$ of forage divided by 10 kg/day = extra 2431 AUDs

2431 AUD divided by 30.4 AUDs/AUM = **80 AUMs**

RANGE INVENTORY AND ANALYSIS PROBLEM – 10 points total

A research project is addressing the effects of altering precipitation distribution in the tallgrass prairie of Texas. Plots are receiving the following treatments: 1) 'ambient' precipitation distribution each month, 2) long-term 'normal' precipitation distribution for each month, or 3) 'even' precipitation distribution with each month receiving the same amount. Plots were watered in 1999 and 2000; 'ambient' plots received 50 cm in 1999 and 110 cm in 2000, 'normal' and 'even' plots received 87 cm in both years. Plots were harvested in July and December each year. Mean values for the biomass harvested (g/m^2) along with coefficients of variation (standard deviation/mean, %) in parentheses are presented in the table below.

TRT	1999		2000	
	July	Dec	July	Dec
'ambient'	401 (9.3)	130 (29.5)	524 (14.5)	126 (26.4)
'normal'	447 (22.9)	171 (42.8)	480 (19.7)	187 (44.9)
'even'	449 (19.5)	175 (45.5)	483 (18.4)	188 (44.3)

61. (5 pts) July biomass production:

- was about 9-10% greater for the 'ambient' treatment compared to the 'normal' treatment in 1999 and 2000.
- represented about 72% of the annual production for both the 'normal' and 'even' treatments in both 1999 and 2000.**
- was 14.7% greater across treatments in 1999 compared to 2000.
- all of the above
- none of the above

62. (5 pts) Biomass production efficiency (kg/ha/mm precipitation) was

- 4.8 for 'ambient' in 1999
- 9.4 for 'even' in 1999
- 13.0 for 'ambient' in 2000
- 7.7 for 'normal' in 2000**