

CONTESTANT NAME _____

2005 UNDERGRADUATE RANGE MANAGEMENT EXAM

Society for Range Management, Wyoming Section Meeting

Casper, Wyoming

November 30 and December 1, 2005

Instructions

This examination consists of 123 questions; 3 are calculation problems and the remainder are multiple choice. Circle the one best answer for each multiple-choice question. Show all work on the calculation problems.

Length of Testing Period

120 Minutes

Grading

Multiple-choice questions are worth 2 or 4 points each for a total of 260 points. Problems are worth 10 or 20 points each for a total of 40 points. The entire examination is worth 300 points.

I. RANGE ECOLOGY (60 points)

1. Soil pH is most often injurious to plants because of its influence on:
 - a. protoplasm of the plant roots
 - b. soil microorganisms
 - c. water absorption
 - d. nutrient availability**

2. The study of individual organisms or individual species in relation to their environment is:
 - a. autecology**
 - b. synecology
 - c. structural ecology
 - d. macroecology

3. Photoperiodic response that results in flowering initiation in a plant species is an example of:
 - a. compensating factors
 - b. triggering factors**
 - c. factor elimination

4. Which of the following is NOT true about energy in ecological systems?
 - a. the sun is the ultimate source of all energy into the biosphere
 - b. energy is efficiently cycled through ecosystems**
 - c. the flow of energy through ecosystems drives the hydrologic and nutrient cycles
 - d. it obeys the laws of thermodynamics

5. A locally adapted variant to a species is:
 - a. a biotype
 - b. an ecotype**
 - c. a genotype
 - d. a phenotype

6. At which of the following growth stages of a grass plant is a single, close grazing of the plant normally the most detrimental to the vigor of the plant?
 - a. early growth following dormancy
 - b. at boot stage**
 - c. during winter dormancy
 - d. during drought dormancy

7. Succession that occurs primarily as a result of change in the habitat caused by organisms is called:
 - a. retrogressive succession
 - b. allogenic succession
 - c. reverse succession
 - d. autogenic succession**

8. In the nitrogen cycle, the order of the form of nitrogen from biological fixation of decomposition to atmospheric nitrogen is:
- a. ammonium - nitrite - nitrate - nitrous oxide**
 - b. ammonium - nitrous oxide - nitrate - nitrite
 - c. nitrous oxide - ammonium - nitrite - nitrate
 - d. nitrate - nitrite - ammonium - nitrous oxide
9. An inclusive term that includes not only the physical space occupied by an organism but also its functional role in the community is a(an):
- a. habitat
 - b. ecological niche**
 - c. ecological equivalent
 - d. allopatry
10. Cryptogamic communities are of importance in many arid regions of western North America because:
- a. they provide protection against wind erosion
 - b. they may fix atmospheric nitrogen
 - c. they increase infiltration of water and decrease sediment in the runoff
 - d. all of the above**
 - e. none of the above
11. The ___ develops into the first leaf of the grass plant.
- a. scutellum
 - b. coleoptile**
 - c. coleorhiza
 - d. plumule
12. The major group of organisms in soils which contribute oxidation processes in the N and S cycles are the:
- a. bacteria
 - b. actinomycetes
 - c. fungi
 - d. all of the above**
 - e. none of the above
13. Why are such great amounts of materials (biomass, energy, numbers, etc.) at one trophic level required to support the next trophic level?
- a. not all of the energy fixed at one trophic level is available to the next trophic level
 - b. much of the energy fixed at one trophic level is lost as low grade heat because it is changed in form as it goes from one trophic level to another
 - c. organisms at higher trophic levels cannot digest or assimilate a lot of the chemical energy fixed at a lower trophic level
 - d. all of the above**

14. The “greenhouse effect” which may cause global warming appears to be associated with:
- the release of heat from industrial processes
 - the depletion of atmospheric ozone (which enables the amount of ultraviolet radiation reaching the earth’s surface to increase)
 - an increase in the amount of cloud cover (which causes more heat energy to be trapped in the earth’s atmosphere)
 - an increase in atmospheric CO₂ concentration (which increases the capacity of the atmosphere to absorb longwave radiation)**
 - decreased cloud cover (which results in an increase in the amount of solar radiation reaching the earth’s surface)
15. A plant species that accumulates salt in cell sap and is adapted to grow in saline soils is called:
- a phreatophyte
 - a halophyte**
 - a hydrophyte
 - a xerophyte
16. Phosphorus is a limiting nutrient in most soils because:
- it tends to be volatilized as a gas by soil bacteria
 - it readily forms insoluble complexes with other elements**
 - most phosphorus is in gaseous form and cannot be utilized by plant
17. Which is the correct order of photosynthetic capability?
- perennial > annual and evergreen > deciduous
 - annual > perennial and deciduous > evergreen**
 - perennial > deciduous > annual and evergreen
 - annual > perennial and evergreen > deciduous
18. Organisms compete for resources via which mechanisms?
- exploitation competition
 - interference competition
 - allocation priority
 - a and b**
 - b and c
19. An agricultural drought is defined as:
- rainfall below values considered to be “normal”
 - when soil moisture availability to plants has dropped to such a level that it adversely affects production**
 - period when surface and ground water is inadequate to supply established uses
20. Competition occurs when:
- abundance of resources exceeds demands by organisms
 - when demands on resources by organisms are greater than resource supply**
 - resources are superabundant
 - one organism depletes a resource that is not required by another organism

21. "Islands of fertility":
- occur when the distribution of soil nutrients is strongly associated with the presence of shrubs
 - are localized beneath canopies of plants, while adjacent, interplant areas are comparatively devoid of soil nutrients
 - are the product of both physical and biological processes
 - all of the above**
 - none of the above
22. During drought periods:
- rangeland soils are net sources of carbon**
 - plants suspend all meristematic activity
 - plants cease production of new roots
 - all of the above
 - none of the above
23. Decomposition of roots:
- decreases with increasing soil depth**
 - increases with increasing soil depth
 - is uniform throughout the soil profile
24. Root life span:
- decreases with increasing root diameter
 - increases with increasing root diameter**
 - is similar regardless of root diameter
25. CO₂ enrichment can indirectly benefit plants by:
- greater biomass accumulation
 - increasing soil water availability through greater water use efficiency**
 - increased photosynthesis efficiency
 - all of the above
 - none of the above
26. Which of the following generally occur in most CO₂ enrichment studies?
- greater biomass accumulation
 - lower digestibility of plant material
 - greater response by C₃ than C₄ plant species
 - all of the above**
 - none of the above
27. As a result of increased concentrations of greenhouse gases in the atmosphere, which of the following are predicted to occur?
- global warming
 - more intense storms
 - altered precipitation patterns
 - all of the above**
 - none of the above

28. Which of the following greenhouse gases has the greatest warming potential per unit?
- carbon dioxide
 - methane
 - nitrous oxide**
 - water vapor
29. For rangelands:
- soil carbon storage increases with increasing precipitation**
 - soil carbon storage decreases with increasing precipitation
 - soil carbon storage is independent of precipitation
30. Which is the correct order regarding carbon storage in rangelands?
- roots > soil > aboveground biomass
 - aboveground biomass > soil > roots
 - soil > aboveground biomass > roots
 - soil > roots > aboveground biomass**

II. GRAZING MANAGEMENT (50 points)

31. In order to maintain a consistent cattle production schedule, brood cows should be bred within _____ days post calving.
- 40 to 60
 - 75 to 85**
 - 100 to 130
 - 200 to 220
32. (4 pts) If feed stuff weighing 100 g contains 2 g of nitrogen, what percent crude protein is the feedstuff?
- 2.0
 - 3.1
 - 12.5**
 - none of the above
33. Under deferred grazing systems in perennial grassland, the primary purpose of deferment until seed formation is to:
- assure the production of seed for grass reproduction**
 - allow normal early season growth and food storage by the plant
 - assure an adequate food supply for livestock
 - maintain a natural looking stand
34. Expressed as a percentage of body weight, what is the normal range of daily intake of dry forage which would be expected of cattle on rangeland?
- 0.1% to 0.5%
 - 1% to 3%**
 - 10% to 30%
 - 20% to 40%

35. Livestock distribution (uniformity of grazing) increases:
- as topography becomes steeper
 - as pasture size per number of cattle increases
 - if water and salt are located together
 - as stocking density increases**
36. Grazing a pasture during the same season every year is called:
- repeated seasonal grazing**
 - deferred grazing
 - continuous grazing
 - range resting
37. Many times, clipping studies do not simulate grazing because:
- livestock tend to remove plant parts and defoliate species nonselectively
 - grazing animals select what and where they eat**
 - different animals graze by pulling, breaking, or biting at uniform heights
38. A nutrient deficiency will:
- increase the rate of digestion and passage of ingesta
 - reduce consumption and production**
 - increase consumption and production
 - slow digestion and increase passage of ingesta
39. **(4 pts)** You are evaluating a four-pasture rotational grazing system (single occupation) and are asked to calculate the stocking rate. All pastures contain 120 hectares, and the system is grazed for 3 months with 160 animal units. The stocking rate is:
- 0.25 AUM/ha
 - 1.0 AUM/ha**
 - 2.3 AUM/ha
 - 3.8 AUM/ha
40. **(4 pts)** Using the same information given in question #39 (above), the stocking density for this system is:
- 0.3 AU/ha
 - 0.7 AU/ha
 - 1.0 AU/ha
 - 1.3 AU/ha**
41. A system that has 9 pastures and a 135-day cycle is grazed ____ and rested ____:
- 9 days:126 days
 - 15 days:120 days**
 - 18 days:117 days
 - 30 days:105 days

42. Which of the following are higher for tallgrass than shortgrass plant species?
- C/N ratios
 - lignin/N ratios
 - % lignin
 - d. all of the above**
 - none of the above
43. Which of the following are ways to increase uniformity of use on rugged-terrain landscapes?
- select offspring from animals that preferentially use rugged terrain
 - select breeds that preferentially use rugged terrain
 - utilize attractants to move animals to the rugged terrain
 - d. all of the above**
 - none of the above
44. Grazing bouts typically occur:
- during the hottest part of the day
 - at night
 - c. in the early morning and late afternoon**
45. "Virtual fence" is an emerging technological tool that may be used to increase utilization of preferred areas and restrict use in environmentally-sensitive areas.
- a. true**
 - false
46. Grazing by small ruminants in arid environments may promote ecosystem stability by:
- controlling weeds
 - constraining brush encroachment
 - reducing the risk of fire
 - d. all of the above**
 - none of the above
47. Which of the following breeds of cattle is most likely to preferentially select level terrain that is close to a water source?
- a. Hereford**
 - Santa Gertrudis
 - Tarentaise
 - Brahman
48. Young, inexperienced animals can improve their foraging skills by associating with older, experienced animals.
- a. true**
 - false
49. During a grazing bout:
- a. rate of intake is greatest at the beginning**
 - rate of intake increases with increasing length of grazing bout
 - rate of intake remains similar throughout the grazing bout

50. Ruminants:

- a. generally develop preferences for feeds that provide a high satiety level rapidly
- b. control meal size and diet composition by anticipation of post-ingestive effects to avoid nutritional excesses or deficiencies
- c. select a diet of higher nutrient quality than that on offer
- d. all of the above**
- e. none of the above

51. Methane emissions from ruminants:

- a. generally peak with corresponding peaks in eating activity of animals
- b. are greater when animals are eating than ruminating
- c. decreases as rumen content declines
- d. all of the above**
- e. none of the above

52. Which of the following is most correct regarding grazing of crop residues?

- a. crop residues are most effectively utilized in maintenance rations**
- b. crop residues are low in fiber and lignin
- c. crop residues are high in protein and phosphorus
- d. all of the above
- e. none of the above

IIa. GRAZING MANAGEMENT PROBLEM (10 points)

SEE END OF TEST

III. RANGE IMPROVEMENT (50 points)

53. Heavy rates of phosphorous fertilizer application on grass-legume mixtures on mesic sites:

- a. stimulate the grasses while depressing the legumes
- b. stimulate the legumes so they become dominant over the grasses**
- c. do not affect the botanical composition of the mixture
- d. none of the above

54. Vegetation conversion for off-site water yield increases is primarily dependent on:

- a. evapotranspiration (ET) reduction and snowpack management**
- b. decreased bulk density
- c. increased soil moisture storage

55. The main purpose of surface mulch is to:

- a. protect emerging seedlings from defoliation
- b. smother annual weeds
- c. improve soil-seed contact
- d. conserve soil moisture**

56. **(4 pts)** An application rate of 4.5 kg a.e. per hectare of 2,4-D is required to control an invasive weed. The herbicide that you have purchased contains 0.9 kg a.e. per liter. How many liters of 2,4-D are needed to spray 10 hectares?
- 15
 - 45
 - 50**
 - 96
57. Fire is commonly used on rangelands to:
- remove shrubby species of low-forage value
 - remove herbaceous vegetation that accumulates where rank-growing species are common
 - control basal sprouting shrubs
 - a and b**
 - none of the above
58. **(4 pts)** A drag-type boom sprayer is used to spray broadleaf weeds in a tame pasture. The sprayer delivers a 5-meter-wide swath and can safely travel at 5 kilometers per hour over the pasture. At this speed, how many hectares per hour can be covered?
- 2.0
 - 2.5**
 - 20.0
 - 25.0
59. Which of the following upland sites has the greatest potential for improvement by either management or manipulation practices (assume all conditions are equal except for those mentioned)?
- good condition; shallow, rocky soil
 - poor condition; deep, loamy soil**
 - poor condition; shallow, rocky soil
 - good condition; deep, loamy soil
60. Watering facilities for cattle distribution purposes should be:
- developed wherever water can be found
 - spaced so that cattle have to walk no further than 0.4 km in any direction
 - no further than 3.2 km apart on level terrain**
 - located next to salt
61. **(4 pts)** You are seeding a species that has a seed count of 800,000 per bulk kg and is tested at 80% germination and 75% purity. How many kg of bulk seed would you need to plant per hectare using the standard rule of 200 pure live seeds (PLS) per square meter for upland range sites?
- 3.6
 - 3.8
 - 4.0
 - none of the above**

62. Which of the following is characteristic of an intensive range improvement?
- low cost
 - high risk**
 - low production potential
 - easily accomplished
 - applicable in all situations
63. Soil-applied herbicides are translocated in the:
- phloem
 - xylem**
 - cambium
 - epidermis
64. When planted at the same depth, how does a cool-season grass have an advantage over a warm-season grass?
- subcoleoptile internode does not elongate**
 - primary root system is smaller
 - relative growth rate is lower
 - possesses the C₃ photosynthetic pathway
65. When conducting a prescribed burn to kill undesirable plant species, what plant factor will reduce the effectiveness of the burn?
- growing points near the soil surface
 - stolon production
 - sprouting ability**
 - low carbohydrate reserves
66. What does contour furrowing do to change the physical environment that gives an increased response in aboveground biomass production?
- decreases infiltration, increases runoff, and decreases leaching of cations
 - increases infiltration, decreases runoff, and increases leaching of cations**
 - increases infiltration, increases runoff, and decreases leaching of cations
 - decreases infiltration, decreases runoff, and increases leaching of cations
67. A _____ is more likely created when a head fire meets a backfire.
- fire whirl**
 - front fire
 - fire break
 - all of the above
 - none of the above
68. C₄ grasses are most negatively impacted if they are burned in what season?
- Winter
 - Spring
 - Summer**
 - Fall

69. Fire whirls are most likely in heavy fuels on the:
- lee side of obstructions, when the atmosphere is stable
 - windward side of obstructions, when the atmosphere is unstable
 - windward side of obstructions, when the atmosphere is stable
 - lee side of obstructions, when the atmosphere is unstable**
70. Indicators of a stable atmosphere include:
- intermediate winds, layered clouds, haze
 - gusty winds, vertical clouds, haze
 - steady winds, layered clouds, good visibility**
 - gusty winds, vertical clouds, good visibility
71. Mixing height is the:
- region where flames extinguish and smoke appears
 - distance from the ground to the base of an inversion**
 - region where woody canopies and herbaceous plants intersect
 - height to which ash is lifted by convection
72. Smoke dispersion is generally best with _____ atmospheric conditions.
- very stable
 - neutral to stable
 - neutral to unstable
 - very unstable**
73. Reducing the density of shrubs in shrublands with herbicides can:
- increase production of understory grasses
 - increase potential sites for invasion by non-desirable plants
 - increase plant diversity
 - all of the above**
 - none of the above
74. 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

IIIa. RANGE IMPROVEMENT PROBLEM (10 points)

SEE END OF TEST

IV. RANGE REGIONS (30 points)

75. The genera of a common woody perennial invader of desert grasslands is:
- Atriplex*
 - Prosopis***
 - Celtis*
 - Opuntia*
76. The most ubiquitous grass in shortgrass and mixed prairies is:
- Pascopyrum smithii*
 - Hesperostipa comata*
 - Buchloe dactyloides*
 - Bouteloua gracilis***
 - Bouteloua curtipendula*
77. Characteristic shrub species in the cold desert of North America include:
- Artemisia nova* and *Atriplex confertifolia***
 - Larrea tridentata* and *Flourensia cernua*
 - Cowania mexicana* and *Purshia tridentata*
 - Acacia greggii* and *Juniperus scopulorum*
78. Representative shrub species in the chapparal vegetation type in California include:
- Adenostoma fasciculatum* and *Arctostaphylos pungens***
 - Prunus virginiana* and *Quercus gambelii*
 - Quercus stellata* and *Cowania mexicana*
 - Cercocarpus montanus* and *Ceanothus fendleri*
79. The dominant grasses of the Boreal Forest are:
- Calamagrostis canadensis* and *Elymus innovatus***
 - Festuca scabrella* and *Danthonia intermedia*
 - Agropyron trachycaulum* and *Elymus canadensis*
 - Calamagrostis rubescens* and *Festuca scabrella*
80. Which of the following factors is dominant in maintaining the coniferous forest of the southeastern United States?
- seasonality of precipitation
 - humidity
 - fire**
 - periodic freezes
81. The two shrubland regions with characteristic open canopies are:
- pinon-juniper and cold desert shrub
 - hot desert shrub and cold desert shrub**
 - mountain brush and pinon-juniper
 - mountain brush and cold desert shrub
 - hot desert shrub and pinon-juniper

82. Which is most correct about tree leaves growing under shade conditions in eastern deciduous forest?
- thin leaves, high concentrations of RUBISCO, high photosynthesis rate, low respiration rate
 - thick leaves, high concentrations of RUBISCO, high photosynthesis rate, high respiration rate
 - thin leaves, low concentrations of RUBISCO, low photosynthesis rate, low respiration rate**
 - thick leaves, low concentrations of RUBISCO, low photosynthesis rate, low respiration rate
83. Which of the following are growth strategies for herbs and shrubs growing under eastern deciduous canopies?
- spring ephemeral
 - evergreen
 - shade tolerant
 - all of the above**
 - none of the above
84. Which of the following characteristics are true concerning evergreen shrubs growing in Boreal forest?
- photosynthetic period is about a month longer than deciduous shrubs**
 - their phenological growth is very slow
 - they account for a major portion of the above ground biomass
 - all of the above
 - none of the above
85. Generally, as the ratio of fine to coarse fuels increases the following occurs:
- Fire intensity decreases
 - Fire longevity increases
 - Length of time to reduce fuel moisture increases
 - All of the above
 - None of the above**
86. Prescribed fire in the Fescue Prairie is used to accomplish:
- increase production of *Fescue* spp.
 - increase water run-off
 - control woody species**
 - all of the above
 - none of the above
87. Mediterranean climate can be described as having:
- cool, wet winters and warm, wet summers
 - cool, wet winters and warm, dry summers**
 - cool, dry winters and warm, dry summers
 - cool, dry winters and warm, wet summers

88. The salt desert is best described as:
- a. **receiving equal amounts of total precipitation in winter snows and in spring/fall rains**
 - b. having the lowest precipitation of all range types
 - c. occurring at high elevations
 - d. all of the above
 - e. none of the above
89. Which of the following range types occurs at the highest altitude?
- a. Oak woodland
 - b. Pinon-juniper
 - c. Mountain browse
 - d. **alpine tundra**

V. RANGE INVENTORY AND ANALYSIS (40 points)

90. Which of the following plant characteristics is least subject to annual fluctuations?
- a. **basal cover**
 - b. frequency
 - c. areal cover
 - d. biomass
 - e. density
91. The scale of an aerial photograph is determined by:
- a. **flying height and camera focal length**
 - b. flying height and topography
 - c. flying speed and topography
 - d. flying height and flying speed
 - e. flying speed and camera focal length
92. Which of the following statements is NOT always true?
- a. **systematic sampling in a regular population is random**
 - b. random sampling in a regular population is random
 - c. systematic sampling in a random population is random
 - d. random sampling in a random population is random
 - e. a, b and c
93. (4 pts) A range utilization study of a pasture indicates that 50% of the key species on the key areas has been utilized to date. The management goal for proper use is 60%. The pasture has been stocked with 200 animal units for the past 4 months at the time of the survey. What is the estimated grazing capacity of this pasture in AUM's?
- a. 133
 - b. 300
 - c. 533
 - d. **960**
 - e. 1200

94. An assessment of the direction of change of range condition based on measurements at two points in time is called:
- resource value rating
 - apparent trend
 - actual trend**
 - ecological rating
95. Which of the following samples yields the most precise estimate of a population mean? (means +/- Standard Error of the Mean)
- 100 +/- 10
 - 300 +/- 10
 - 10 +/- 10
 - 900 +/-20**
96. (4 pts) The net cost per cow unit is \$430.50. If the calves weaned per cow exposed to a bull is 90%, what is the breakeven cost (\$/kg) on weaned calves weighing 230 kg?
- \$1.68
 - \$1.87
 - \$2.08**
 - \$2.13
97. (4 pts) Using the photo scale of 1:50,000, what is the area of a rectangular pasture with sides of 2 cm and 3 cm?
- 24 ha
 - 60 ha
 - 150 ha**
 - 600 ha
98. The Palmer Drought Severity Index is used to monitor drought conditions.
- true**
 - false
99. Which of the following tools has been widely used recently to gage the impacts of grazing use in riparian areas?
- range condition assessment
 - plant cover
 - stubble height**
 - paired grazed and non-grazed plots
100. A product of the Advanced Very High Resolution Radiometer (AVHRR) is the Normalized Difference Vegetation Index (NDVI). What is the utility of NDVI?
- ability to predict live biomass in rangeland**
 - ability to assess rangeland health
 - ability to assess changes in plant communities
 - all of the above
 - none of the above

101. Increasingly, researchers are combining close-range vertical photography and computer digital analysis to measure changes in plant cover. Which of the following is an advantage of this method over traditional methods?
- less expensive
 - involves minimal field time
 - photos can be archived
 - d. all of the above**
 - none of the above
102. Which of the following nitrogen isotopes is commonly used in labeling studies to examine nitrogen cycling?
- ^{13}N
 - ^{14}N
 - c. ^{15}N**
103. Water use by plants can be assessed using which of the following natural isotope ratios?
- $\delta^2\text{H}$
 - $\delta^{13}\text{C}$
 - $\delta^{18}\text{O}$
 - a and b
 - e. a and c**
104. **(4 pts)** Clipping of grazed plots (25 cm X 20 cm) results in the estimate of 15 grams of remaining residue per plot. What is this value expressed as kg/ha?
- 3
 - 30
 - 300
 - d. 3000**
105. Assessments of plant diversity incorporate:
- plant species richness and abundance
 - plant species evenness and abundance
 - c. plant species richness and evenness**

Va. RANGE INVENTORY AND ANALYSIS PROBLEM (20 points)

SEE END OF TEST

VI. MULTIPLE USE RELATIONSHIPS (30 points)

106. Multispecies grazing:
- a. is best employed where there is a broad diversity of vegetation and habitats**
 - nearly always causes competition among those animals
 - is the most common cause of overgrazing
 - all of the above

107. Elk are highly successful competitors with mule deer because:
- they are heavier and taller, and can access greater forage resources
 - they have a more efficient digestive system for handling fibrous feeds
 - they have a greater plasticity in diet selection
 - d. all of the above**
108. The equivalent water depth of a snow pack can be estimated using a snow pillow. To convert a snowpack to equivalent water depth the appropriate calculation is:
- density of snow divided by weight of snow
 - density of snow multiplied by volume of snow
 - c. volume of snow divided by surface area of the snow pillow**
 - weight of snow divided by surface area of the snow pillow
109. Semiarid rangeland watersheds differ from forested ones in that:
- more water and less sediment per unit area are generated from rangeland watersheds
 - more water and more sediment per unit area are generated from rangeland watersheds
 - c. less water and more sediment per unit area are generated from rangeland watersheds**
 - none of the above
110. As grazing pressure is increased from moderate to heavy, the general hydrologic impact would be:
- a. increased bulk density, decreased infiltration rate, & increased sediment yield**
 - increased runoff, increased infiltration rate, and increased sediment yield
 - decreased vegetative cover, decrease infiltration rate, and decreased sediment yield
111. The most important single element determining the rate of soil blowing by wind erosion is:
- a. vegetation**
 - atmospheric humidity
 - soil organic matter
 - soil structure
112. You have a grassland range and want to use it with both wild and domestic ungulates, which of the following species would be **least** useful:
- cattle, bighorn sheep, and horses
 - b. bison, elk, and horses**
 - mule deer, angora goat, and pronghorn antelope
113. Riparian areas are a function of:
- geomorphology
 - topography
 - catchment size
 - d. all of the above**
 - none of the above

114. Discharge levels from streams can be affected by:
- Rainfall intensity
 - topography
 - soil type
 - d. all of the above**
 - none of the above
115. The amount of surface runoff in a basin determines the volume of water in a perennial stream.
- true
 - b. false**
116. What physical force(s) determine the amount and size of sediment a stream will carry?
- elevation
 - discharge
 - slope
 - a and b
 - e. b and c**
117. A stream channel will undergo a series of changes to adjust to new conditions if:
- sediment load changes
 - temperature changes
 - stream discharge increases
 - a and b
 - e. a and c**
118. Elk use patterns are related to topography and protective cover:
- a. True**
 - False
119. From the perspective of a land manager, which of the following recreational activities is not advantageous to a livestock operation?
- fee hunting
 - b. camping near stock ponds**
 - horseback riding
 - all of the above
 - none of the above
120. Tree density in forests influences:
- water infiltration
 - runoff
 - browse production
 - d. all of the above**
 - none of the above

GRAZING MANAGEMENT PROBLEM (10 points)

The Bar H Bar Ranch, located in the northern mixed-grass prairie ecosystem, has decided to dramatically alter their livestock operation by switching from a traditional, year-round, cow-calf operation to a seasonal grazing operation. The owners have hired you as a range consultant to determine proper kind and numbers of cattle needed for the upcoming year. Here is the information the owners have provided you:

Land holdings: 1,945 hectares

Previous grazing management: 120 head of cows-calf pairs (1.3 AU) grazed pastures from April 1-January 1, fed hay and supplement during other months

Desired grazing management: 2/3 of grazing animals should be yearling heifers (0.65 AU), remaining 1/3 of grazing animals are cow-calf pairs (1.3 AU). Yearling heifers will graze pastures from June 1 to August 15, while cow-calf pairs will graze from May 15 to November 1.

Please determine how many yearling heifers and cow-calf pairs are needed to graze the Bar H Bar Ranch according to desired management by the owners.

Solution:

Previous grazing:

$$120 \text{ cow-calf pairs} \times 1.3 \text{ AU/pair} \times 9\text{M} = 1404 \text{ AUM}$$

Desired grazing:

$$1404 \text{ AUM} = [(1.3 \text{ AU/pair} \times 5.5 \text{ M})x] + [(0.65 \text{ AU/yearling} \times 2.5 \text{ M})2x]$$

$$1404 \text{ AUM} = 7.15\text{AUM}x + 3.25\text{AUM}x$$

$$1404 = 10.4x$$

$$135 = x$$

thus, **135** cow-calf pairs and **270** yearling heifers

RANGE IMPROVEMENTS PROBLEM (10 points)

You have been asked to consult the city of Casper, Wyoming in applying well composted “Original Steer Manure” to a nearby rangeland area. Testing of a sample of oven-dried manure reveals a grade of 0.12 – 0.92 – 0.58 (%N - %P₂O₅ - %K₂O, with P₂O₅ containing 44% P and K₂O containing 83% K). Regulatory requirements for application of this manure are a maximum of 80 kg/ha of actual N and/or 95 kg/ha of actual P, and/or 75 kg/ha of actual K. If the manure is 52% moisture, how much manure can you legally apply to a 259 ha field? Answer in metric tons.

Solution

$80 / 0.0012 = 66,666$ kg/ha can be applied to meet N restriction

$0.92 \times 0.44 = 0.4048$

$95 / 0.004048 = 23,468$ kg can be applied to meet P restriction

$0.58 \times 0.83 = 0.4814$

$75 / 0.004814 = 15,580$ kg can be applied to meet K restriction

K amount is limiting. Applying based on N or P will over apply K

$15,580 / 0.48$ (dry weight conversion) = 32,458 kg of raw manure can be applied per ha.

$32,458 \text{ kg} \times 259 \text{ ha} = 8,406,622 \text{ kg}$

Since 1000 kg equals a metric ton then $8,406,622 / 1000 = \mathbf{8406.6}$ metric tonnes can be applied the whole area

RANGE INVENTORY AND ANALYSIS PROBLEM – 20 points total

A. (10 pts)

You are asked to conduct a vegetation survey for an ecological site. The objective of the survey is to estimate the mean standing crop of forage within ± 20 kg/ha. You have data available from a previous survey that reported a mean standing crop of 240 g/m² and a standard deviation of 7.5 g/m². Given the formula for calculating estimated sample size,

$$n = \frac{t^2 S^2}{d^2}$$

and an estimated value of 2.0 for t, calculate the number of 1 m² quadrats you will need to clip to achieve the desired degree of accuracy in your estimated mean.

Solution:

t=2.0

S = 75 (kg/ha)

d = 20

$(2.0)^2 * (75)^2 = 22,500 / (20)^2 = 22,500 / 400 = \mathbf{56.25}$ 1 m² quadrats

B. (10 pts) Determine the Similarity Index given the following information in the table.

Client: Straight Arrow Ranch

MLRA: 67 – North Central High Plains

Ecological Site: Loamy 15-17 inch precipitation zone

Reference vegetation state: Rhizomatous Wheatgrasses/Needleandthread/Blue grama (HCPC)

Solution:

A	B	C	D	E	F
Species	Green wt. (g/m ²)	% dry weight	Annual production (kg/ha)	kg/ha in ecological site description	kg/ha allowable
<i>Bouteloua gracilis</i>	12	75	90	210	90
<i>Pascopyrum smithii</i>	45	60	270	380	270
<i>Koeleria macrantha</i>	25	60	150	40	40
<i>Poa secunda</i>	5	80	40	40	40
<i>Hesperostipa comata</i>	50	50	250	460	250
<i>Nassella viridula</i>	15	50	75	125	75
<i>Artemisia ludoviciana</i>	5	40	20	15	15
G. Total normal annual production in reference vegetation state				1680	
H. Total kg of allowable present					780
I. Similarity Index (H divided by G X 100)					46.4