

CONTESTANT NAME _____

**2010 UNDERGRADUATE RANGE MANAGEMENT EXAM
(a mini-URME)**

Society for Range Management, Wyoming Section Meeting

**Laramie, Wyoming
November 9, 2010**

Instructions

This examination consists of 51 multiple choice questions. Choose the best answer for each question and fill in the appropriate circle on the scantron answer sheet provided.

Length of Testing Period

60 Minutes

Grading

The entire examination is worth 150 points.

I. RANGE ECOLOGY (30 points)

1. Concepts included in the state-and-transition model of succession that were NOT a part of the Clementsian concept of succession include:
 - a. Multiple steady states
 - b. Abiotic and biotic thresholds
 - c. Differential probabilities of transitions from one state to another
 - d. All of the above
 - e. None of the above

2. Plants that minimize the cost of photorespiration by incorporating CO₂ into four-carbon compounds in mesophyll cells are:
 - a. C₃ plants
 - b. C₄ plants
 - c. CAM plants
 - d. None of the above

3. Which of the following statements most correctly matches the term with its definition?
 - a. Herbage: biomass of all herbaceous vegetation at one point in time
 - b. Standing crop: rate of above-ground biomass accumulation
 - c. Primary productivity: weight of organisms at a given time
 - d. Browse: herbage available and acceptable to grazing animals

4. Mycorrhizal fungi are likely to aid in uptake of nutrients by the following groups of plants:
 - a. Shrubs
 - b. Trees
 - c. Both a and b

5. How do foliar cover and ground cover contribute to evaluating hydrological processes?
 - a. Foliar cover influences the amount of precipitation that is intercepted
 - b. Ground cover influences infiltration
 - c. Foliar cover influences infiltration
 - d. Both a and b
 - e. Both b and c

6. Which of the following would be a representative $\delta^{13}\text{C}$ value for a C₄ plant species?
 - a. -13‰
 - b. 0‰
 - c. -27‰
 - d. none of the above

7. Which of the following stable isotopes can be used to determine patterns of water acquisition by plants?
 - a. ¹⁵N
 - b. ¹⁸O
 - c. ¹³C
 - d. None of the above

For questions 8-10, please use the following figure (Peterson et al. 2009 REM)

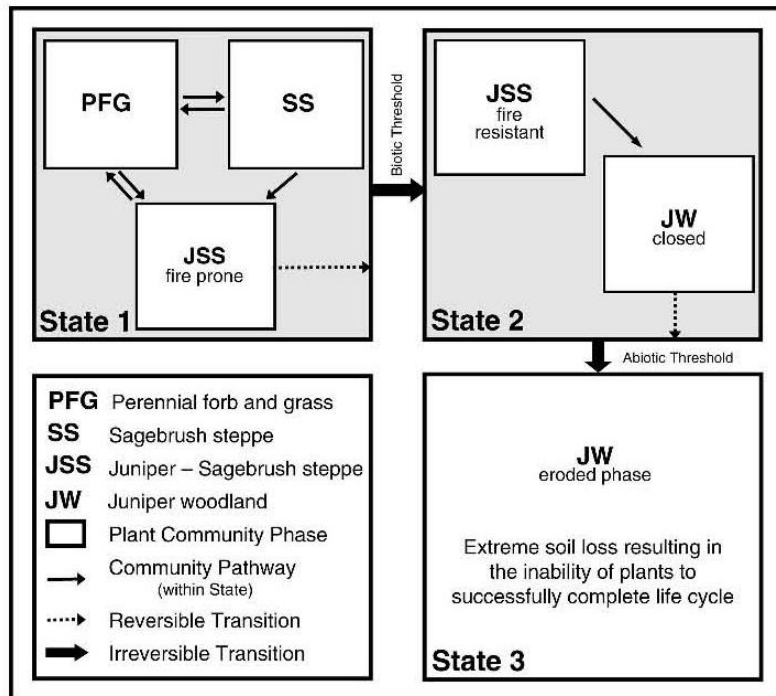


Figure 5. Proposed model of western juniper invasion, incorporating state-and-transition concepts for assessing plant community dynamics.

8. (4 pts) Which of the following statements is most correct regarding this figure?
 - a. The PFG plant community phase is the most desirable for livestock production
 - b. The JW closed plant community phase is the most desirable for wildlife habitat
 - c. The SS plant community phase is the most desirable for carbon sequestration
 - d. All of the above
 - e. None of the above

9. (4 pts) Which of the following statements is most correct regarding this figure?
 - a. Management intervention is needed to transition the JSS fire resistant plant community phase to the JSS fire prone plant community phase
 - b. Management intervention is needed to transition the JW closed plant community phase to the SS plant community phase
 - c. Management intervention is needed to prevent the transition from JSS fire prone plant community phase to the JSS fire resistant plant community phase
 - d. All of the above
 - e. None of the above

10. (4 pts) Which of the following statements is most correct regarding this figure?
 - a. State 1 has the potential to produce more ecosystem services than State 3
 - b. State 2 has the potential to produce more ecosystem services than State 3
 - c. State 1 has the potential to produce more ecosystem services than State 2
 - d. Both a and b

11. The process by which deep-rooted plants take in water from lower soil layers and exude that water into upper, drier soil layers is called:
- Hydraulic lift
 - Xylem gravitational leakage
 - Cohesion-tension
 - Preferential root transpiration
12. Which of the following statements concerning root turnover is correct?
- Average turnover rates are higher for coarse than fine roots
 - Root turnover decreases from the tropical to high-latitude systems
 - Root turnover rates decrease with increases in mean annual temperature
 - The highest average turnover rates occur in tree root systems

II. GRAZING MANAGEMENT (28 points)

13. As plants increase in age, the percentage of lignin and cellulose _____ and digestibility _____.
- increases, increases
 - increases, decreases
 - decreases, decreases
 - decreases, increases

For questions 14-15, please use the following scenarios:

- 40 cow-calf pairs for 6 months on 400 ha
- 20 cow-calf pairs for 9 months on 300 ha
- 1200 cow-calf pairs for 2 months on 4000 ha
- 4 cow-calf pairs for 12 months on 60 ha

14. (4 pts) Which scenarios have the same stocking rates?
- 1 and 2
 - 3 and 4
 - 2 and 4
 - All of the scenarios have the same stocking rate
 - None of the scenarios have the same stocking rate
15. (4 pts) Which scenarios have the same stocking density?
- 1 and 2
 - 3 and 4
 - 2 and 4
 - All of the scenarios have the same stocking density
 - None of the scenarios have the same stocking density
16. _____ is the primary volatile fatty acid produced during fermentation of high fiber diets.
- Acetate
 - Butyrate
 - Lactate
 - Propionate

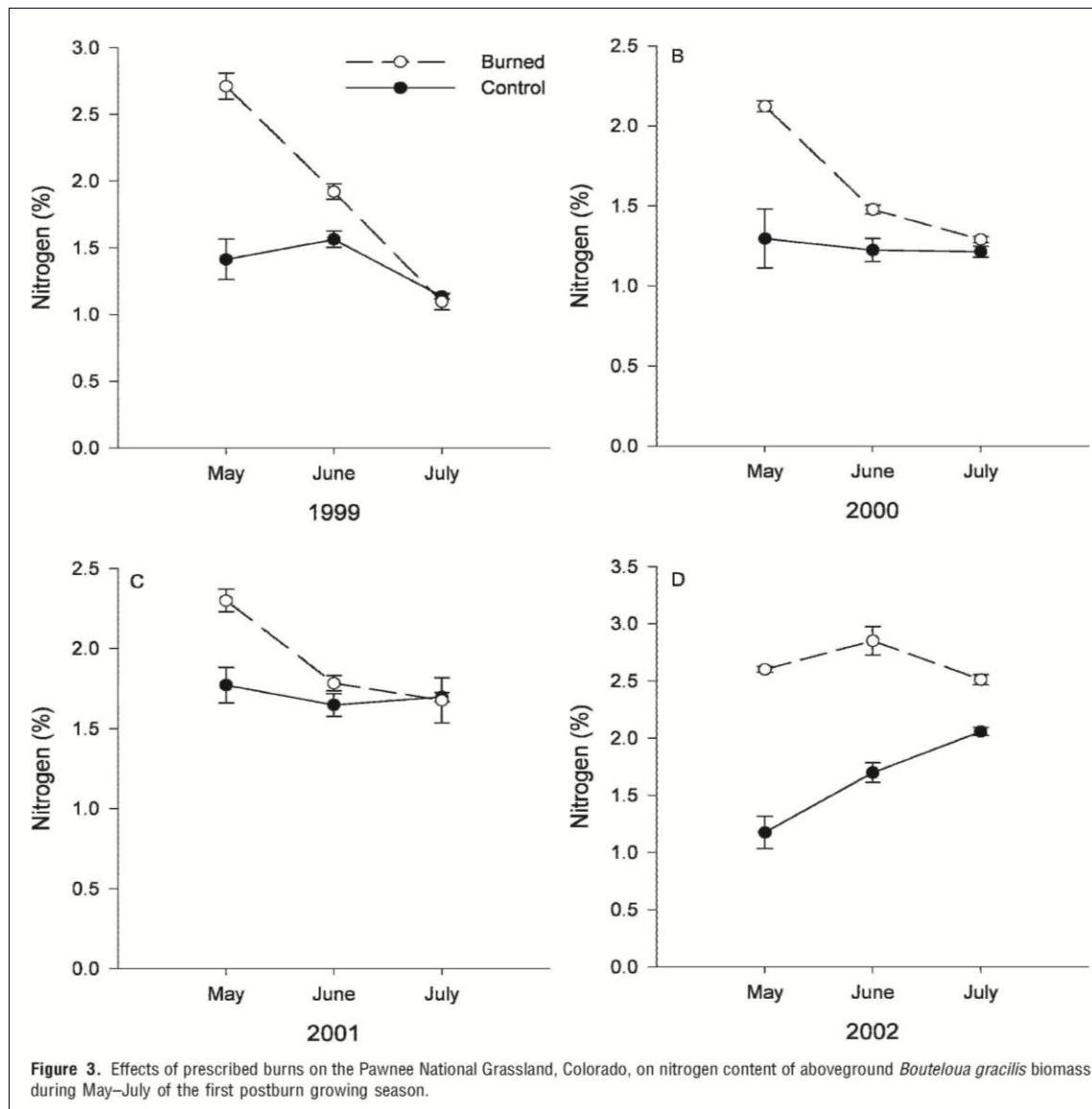
17. **(4 pts)** If a yearling consumes 341 kg/month on rangeland that produces 2000 kg/ha/yr, how many yearlings can be stocked on a 8000 ha ranch for a 6 month grazing season with the following assumptions: 1) assume 50% use of the produced forage and half of this is consumed by the yearlings, 2) all of the forage is produced during the 6 months of grazing, and 3) no adjustments are needed for slope or water?
- 1,955
 - 3,910
 - 11,730
 - 23,460
18. **(4 pts)** Using the above information in question #17, what are the number of cow-calf pairs (each consuming 590 kg/month) needed if there is a 30% reduction in grazing capacity for slope?
- 339
 - 678
 - 791
 - 1,582
19. Which of the following statements concerning retention time in the rumen is correct?
- Retention time in the rumen decreases with increases in plant morphological development
 - Retention time in the rumen depends mainly on the degradation rate of the degradable fraction of the forage
 - Retention time in the rumen decreases with increased particle size of the forage
 - Retention time in the rumen increases with a decrease in the amount of cell walls in the forage
20. Which of the following grazing system – developer combinations is correct?
- Deferred-rotation, Gus Hormay
 - Rest-rotation, Arthur Sampson
 - Best pasture – John Vallentine
 - None the above
21. **(4 pts)** A producer is contemplating a switch from a yearling stocker (AU=0.7) to a ewe-lamb (AU=0.2) grazing operation. Implementation of this switch will involve changing from a 5 month grazing to a year-round grazing season, but the producer wants to keep her same stocking rate. Last year, she grazed 260 yearlings. How many ewe-lambs will be needed for this year?
- 76
 - 379
 - 910
 - 4550

IIa. GRAZING MANAGEMENT PROBLEM (5 points) – See END OF TEST

III. RANGE IMPROVEMENT (22 points)

22. Targeted grazing by cattle, sheep and goats can be used to reach vegetation objectives in which of the following ways?
- Cattle can be used to stimulate leader growth on important winter browse plants through grazing grasses in spring, which releases competition between shrubs and herbaceous plants
 - Sheep can be used to control plants that are poisonous to cattle such as larkspur
 - Goats are particularly effective at suppressing sprouting browse plants
 - All of the above
 - None the above
23. Discounting:
- is the process of paying initial costs plus subsequent interest costs over a repayment period
 - is the process of determining the present value of future returns
 - is the average percent of the initial investment that must be added to the project cost to account for the probability of project failure
 - none of the above
24. Which of the following statements is correct regarding the calculation of a benefit-cost ratio?
- Present value of project benefits is divided by future value of project costs
 - Present value of project benefits is divided by the present value of project costs
 - Future value of project benefits is divided by the present value of project costs
 - None of the above

For questions 25 and 26, please use the following figure (Augustine and Milchunas 2009 REM)



25. (4 pts) Nitrogen (%):

- Was similar between burned and control areas in May of each year
- Differed between burned and control areas in July each year
- Exhibited declines for both burned and control areas each year
- All of the above
- None of the above

26. (4 pts) Burning:

- Increased nitrogen content in blue grama every year in May
- Increased nitrogen content in blue grama every year in June
- Generally did not affect nitrogen content in blue grama in July
- All of the above
- None of the above

For questions 27 and 28, please use the following figure (Romme et al. 2009 REM)

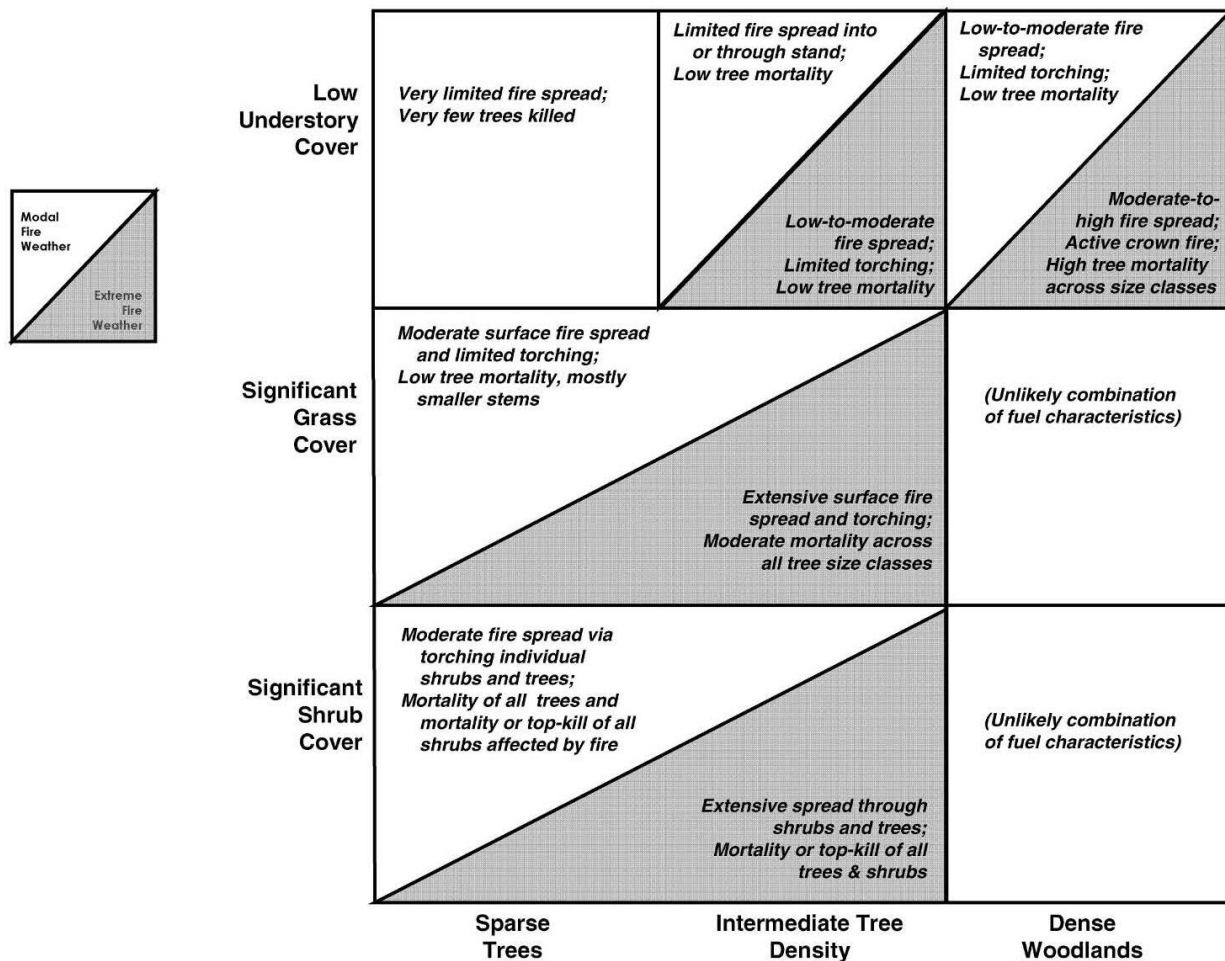


Figure 3. Probable fire behavior following a single ignition event in piñon and juniper vegetation with respect to variability in tree density (horizontal axis) and understory fuel characteristics (vertical axis). Split cells reflect variable fire behavior, spread dynamics, and tree mortality under modal (80th percentile fire weather) in the unshaded upper left vs. extreme (95th percentile) fire weather conditions in the shaded lower right.

27. (4 pts) Moving from modal to extreme fire weather conditions:

- Increases fire spread
- Has similar effects regardless of the tree density
- Results in substantial tree mortality across tree densities and understory fuels
- All of the above
- None of the above

28. (4 pts) As tree density increases:

- Fire spread is lower
- Mortality of trees decreases
- Torching of individual trees increases
- All of the above
- None of the above

IIIa. RANGE IMPROVEMENT PROBLEM (5 points) - SEE END OF TEST

IV. RANGE REGIONS (14 points)

For questions 29-34, please use the following lists:

Grazing Resistance

1. high
2. moderate
3. low

Precipitation

- A. summer-dominated
- B. spring-dominated
- C. winter-dominated

Vegetation

- T. C4 grass dominated
- U. C3 grass dominated
- V. mix of C3 and C4 grasses
- X. shrub-dominated
- Y. savanna appearance
- Z. tree-dominated

29. Which of the combinations is most correct for Palouse Prairie?

- a. 2 and C
- b. 2 and T
- c. 1 and U
- d. 1 and B

30. Which of the combinations is most correct for California Annual Grassland?

- a. 2 and C
- b. 1 and U
- c. 3 and V
- d. C and T

31. Which of the combinations is most correct for Shortgrass Prairie?

- a. 1 and T
- b. 1 and B
- c. 1 and Y
- d. A and U

32. Which of the combinations is most correct for Alpine Tundra?

- a. 2 and X
- b. 2 and C
- c. 3 and X
- d. 3 and V

33. Which of the combinations is most correct for Tallgrass Prairie?

- a. 1 and B
- b. 1 and T
- c. 1 and V
- d. 1 and Y

34. Which of the combinations is most correct for Northern Mixed Prairie?

- a. 1 and T
- b. 1 and V
- c. 2 and V
- d. 3 and V

35. Which of the following is the correct order regarding size of the hot deserts (largest to smallest)?
- Mojave, Chihuahuan, Sonoran
 - Chihuahuan, Sonoran, Mojave
 - Sonoran, Mojave, Chihuahuan
 - Mojave, Sonoran, Chihuahuan

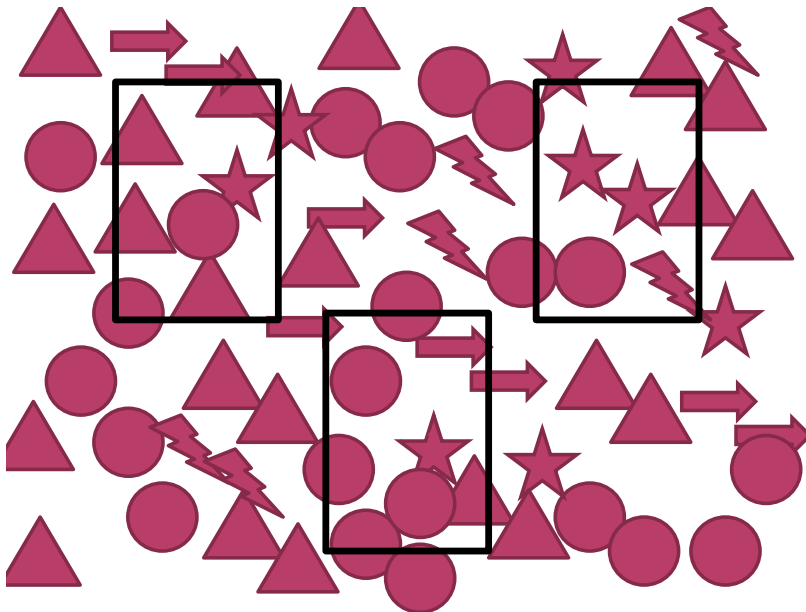
V. RANGE INVENTORY AND ANALYSIS (20 points)

The following table reports cover hits for 5 categories of ground cover at 2 sites.

Site	Bare soil	Basal vegetation	Biological soil crust	Litter	Rock
1	10	3	4	5	8
2	12	4	1	6	7

36. (4 pts) What is the percentage cover of litter at Site 2?
- 10.0%
 - 16.7%
 - 20.0%
 - 30.0%
37. (4 pts) What is the frequency of rock at Site 1?
- 2.7%
 - 8.0%
 - 26.7%
 - 40.0%
38. Which of the following would one expect when variability in plant communities increases?
- Quadrat size should increase
 - Number of quadrats examined should increase
 - Need for stratification increases
 - All of the above
 - None of the above
39. Residual measurements of vegetation are defined as:
- The proportion or degree of current year's production that has been consumed or destroyed by animals
 - The determination of herbage material or stubble height left after a grazing or use period, which is independent of annual production
 - The proportion of herbage production remaining following grazing bouts

Use the “vegetation community” and plots (0.5 m²) presented below, to estimate frequency and density for the circle and lightning bolt components. Your protocol states that if the “plant” is more than 50% IN the plot, it is considered in the plot.



40. (4 pts) The frequency of circle and lightning bolt components are respectively:

- 100%, 33.3%
- 3, 1
- 4 m², 0.67 m²
- 5, 1

41. (4 pts) The density of circle and lightning bolt components are respectively:

- 100%, 33.3%
- 3, 1
- 4 m², 0.67 m²
- 5, 1

Va. RANGE INVENTORY AND ANALYSIS PROBLEM (10 points) - SEE END OF TEST

VI. MULTIPLE USE RELATIONSHIPS (16 points)

42. Ecological management approaches to rangeland weed control include:

- Manipulation of soil nutrients to put weeds at a competitive disadvantage
- Designer disturbances and control efforts to reduce recolonization
- Using only native species for revegetation efforts
- A and B
- B and C

43. Livestock can be used as “ecosystem engineers” to:
- Manipulate vegetation structure for suitable bird habitat
 - Modify vegetation composition for suitable small mammal habitat
 - Alter vegetation cover for suitable arthropod habitat
 - All of the above
 - None of the above
44. Improper grazing of riparian areas can increase water temperature through reductions in shade from streamside vegetation. Which of the following are impacts that may result from this change?
- Changes in growth rate and population size of cyanobacteria and algae
 - Higher decomposition rates
 - Reduced fish growth
 - All of the above
 - None of the above

The bulk density of soil at your location is 1.25 g/cm^3 . You collected this soil in a container that was 5 cm in height and 6 cm in diameter, and the fresh (moist) weight of the soil without the container was 263 g.

45. **(4pts)** What was the dry weight of the soil without the container?
- 113 g
 - 177 g
 - 210 g
 - 329 g
46. Which of the following statements regarding ranching on the urban interface is correct?
- Management options such as prescribed burning can be restricted
 - Livestock odors may result in complaints by homeowners
 - Vandalism and trespassing generally increase
 - All of the above
 - None of the above
47. Several organizations and groups have purchased _____ on rangelands to protect intact, functioning ecosystems and biological diversity while providing open space.
- Conservation easements
 - Tax credits
 - Right-of-ways
 - All of the above
 - None of the above
48. Which of the following responses of riparian habitats to improper grazing is correct?
- Channel width is decreased
 - Streambank stability is increased
 - Infiltration is increased
 - All of the above
 - None of the above

GRAZING MANAGEMENT PROBLEM (5 points)

A rancher has a herd of 200 large frame cows (1.3 AUE), 8 mature bulls (1.7 AUE), 40 replacement heifers (0.9 AUE), and 4 horses (1.5 AUE). She grazes her cows, heifers, and horses for 7 months, and bulls for the breeding season (2 months). She owns 1200 ha of upland native range (0.9 AUM/ha) and 400 ha of tame pasture (0.8 ha/AUM). If required she can rent crested wheatgrass pasture from a neighbor (38 AUD/ha).

49. (5 pts) How many hectares of crested wheatgrass pasture should she rent to balance her forage demand with forage supply?
- a. 63 ha
 - b. 400 ha
 - c. 445 ha
 - d. 605 ha
 - e. 628 ha

RANGE IMPROVEMENTS PROBLEM (5 points)

A rancher is considering some range improvements through changes in management strategies to her property with the desired goal of enhancing some ecosystem services. Associated with these improvements are modifications to the grazing capacity of the ranch (see Table below). In addition, she has assembled estimates of incentive payments associated with the different ecosystem services (see Table below). Her current grazing capacity on the ranch is 425 AUY on the 3,400 ha ranch, and net profits averaged over the past five-year period were \$102,000. The assumption here is that changes in management that affect grazing capacity will be manifest in a linear manner for net profit at the ranch level. She has recently established a Limited Liability Company for operations and placed the land in a trust. In addition, a daughter and son-in-law are coming back to help with the labor and operation of the ranch.

Ecosystem service	Effect of changing management on grazing capacity to achieve ecosystem service	Value of ecosystem service (\$/ha)
Airshed quality	-4%	3.00
Biodiversity	-8%	6.00
Carbon sequestration	-6%	4.50
Water quality	-2%	4.00
Wildlife habitat	+3%	2.00

50. (5 pts) Which is the correct ordering (highest to lowest) of ecosystem services in terms of increased net profit to the rancher?
- Airshed quality, Biodiversity, Carbon sequestration, Water quality, Wildlife habitat
 - Biodiversity, Water quality, Wildlife habitat, Carbon sequestration, airshed quality
 - Wildlife habitat, Water quality, Airshed quality, Carbon sequestration, Biodiversity
 - Biodiversity, Carbon sequestration, Airshed quality, Water quality, Wildlife habitat

RANGE INVENTORY AND ANALYSIS PROBLEM – 10 points total

As part of your responsibilities as a rangeland ecologist for a natural resource agency you find it important to monitor the structure of shrubby cinquefoil (*Dasiphora fruticosa*) in high elevation parks on a mountain range in the Rocky Mountains. After designing a sampling protocol you drive to one of the randomly selected locations in your sample. You record the number of shrubs rooted within a 50-m² belt transect and find that there are 20 shrubby cinquefoil plants rooted within the belt. You randomly select 3 of the shrubs and measure the longest horizontal diameter (D1) and the perpendicular horizontal diameter (D2) for each shrub (see Table directly below). You wish to compute the crown area for the shrubs and use this equation for an oval area = $[(0.5 \times D1) \times (0.5 \times D2) \times \pi]$, where $\pi = 3.1415$.

Shrub	D1 = Longest horizontal diameter (cm)	D2 = Perpendicular horizontal diameter (cm)	Crown area cm ²
1	78	53	
2	66	48	
3	35	17	

51. (10 pts) What is the percentage canopy cover of shrubby cinquefoil in the 50 m² belt?
- 4.1%
 - 8.3%
 - 18.3%
 - Not enough information provided to answer the question