CONTESTANT NAME_____

2009 UNDERGRADUATE RANGE MANAGEMENT EXAM (a mini-URME)

Society for Range Management, Wyoming Section Meeting

Cody, Wyoming
November 5, 2009

Instructions

This examination consists of 48 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. The carbon budget of terrestrial ecosystems is determined largely by the balance between:
   a. Net uptake of CO_2 via respiration and CO_2 loss to photosynthesis
   b. Net uptake of CO_2 via photosynthesis and CO_2 loss to respiration
   c. Drought and non-drought years
   d. Forage production from herbaceous and woody plants

2. Plants that minimize the cost of photorespiration by incorporating CO_2 into four-carbon compounds in mesophyll cells are:
   a. C_3 plants
   b. C_4 plants
   c. CAM plants
   d. None of the above

3. The region of rapidly dividing cells of a plant the further differentiate to produce seedheads and flowers is called:
   a. A culm
   b. A root
   c. A cotyledon
   d. An apical meristem

4. The higher water use efficiency of C_4 plants is most closely correlated with which of the following physiological factors:
   a. optimum temperatures
   b. CO_2 compensation point
   c. photorespiration
   d. respiration rate

5. The fate of nitrogen as it moves from the atmosphere through the soil and back to the atmosphere is best depicted by which of the following?
   a. Nitrogen fixation, nitrification, denitrification, ammonification
   b. Nitrogen fixation, ammonification, nitrification, denitrification
   c. Nitrogen fixation, ammonification, denitrification, nitrification
   d. Nitrogen fixation, nitrification, ammonification, denitrification

6. Which of the following is not a soil invertebrate?
   a. Worm
   b. Actinomycete
   c. Protozoa
   d. Arthropod

7. Carbohydrates that consist of celluloses, hemicelluloses, and lignin are called:
   a. structural
   b. non-structural
   c. fixed
   d. variable

For questions 8-9, please use the following figure (Briske et al. 2008 REM)

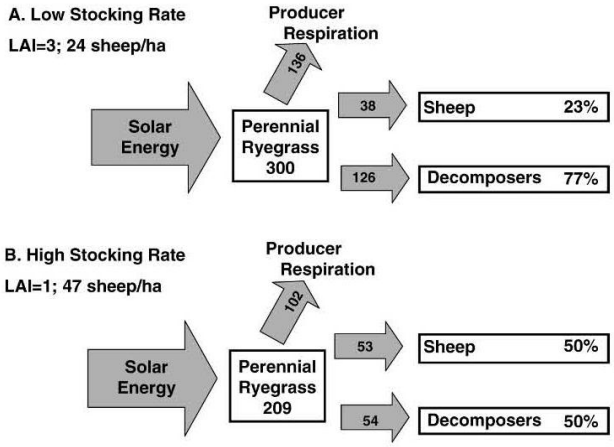

Figure 2. Illustration of the consequences of (**A**) low and (**B**) high stocking rate on energy partitioning (kg $C \cdot ha^{-1} \cdot d^{-1}$) between plant production and forage utilization by livestock in grazed ecosystems. Leaf area index (LAI) and forage utilization are interrelated so that neither can be optimized independently; rather, both must be simultaneously optimized to sustain plant and animal production. This fundamental requirement to balance plant growth and forage consumption by livestock partially explains why grazing research has found stocking rate to affect plant and animal response variables to a greater extent than grazing system on rangelands (redrawn from Parsons et al. 1983).

8. **(4 pts)** At the low stocking rate, which of the following statements is most correct?
   a. **Producer respiration represents 45% of the energy partitioning from the perennial ryegrass production.**
   b. Sheep represent 23% of the energy partitioning from the perennial ryegrass production.
   c. Decomposers represent 77% of the energy partitioning from the perennial ryegrass production.
   d. All of the above
   e. None of the above

9. **(4pts)** At the high compared to the low stocking rate, which of the following statements is most correct?
   a. **A higher percentage of the energy from the perennial ryegrass is partitioned to sheep.**
   b. Less total energy is transferred from the perennial ryegrass to sheep.
   c. A higher percentage of the energy from the perennial ryegrass is partitioned to decomposers.
   d. All of the above
   e. None of the above

10. The primary products of photosynthesis are:
    a. amino acids
    b. carbohydrates
    c. fats
    d. proteins

11. Etiolated growth is used to investigate carbohydrate reserves in plants because it is:
    a. independent of nutrient absorption
    b. independent of current photosynthesis
    c. independent of stored photosynthetic products

12. Of the following, which is the most sensitive physiological process to water stress?
    a. Stomatal closures
    b. Photosynthesis
    c. Respiration
    d. Cell expansion

13. Stability is a measure of persistence in the face of disturbance. Two components of stability are resistance and resilience. Resilience refers to:
    a. The ability of a community to avoid change in the face of disturbance
    b. The ability of a community to return to its former state after it has been displaced from that state
    c. The ability of a community to resist returning to its former state after it has been displaced from that state

II. GRAZING MANAGEMENT (26 points)

14. (**4pts**) A 520 ha ranch is grazed with 145 yearling steers (AUE=0.65) from May 15 to September 1. What is the stocking rate?
    a. 0.28 steers/ha
    b. 94.25 animal units
    c. 0.63 AUM/ha

15. (**4pts**) If a plant community within an ecological site produces 33 g/0.25m^2 and the desired use of the forage produced is 40%, and livestock consumption represents half of the desired use, how much forage is available for livestock consumption?
    a. 66 kg/ha
    b. 264 kg/ha
    c. 408 kg/ha
    d. 660 kg/ha

16. Acidosis in ruminants is caused by eating too many:
    a. Fats
    b. Sugars
    c. Proteins
    d. Carbohydrates

For questions 17-18, please use the following table (Owensby et al. 2008 REM).

Table 2. Steer gains (kg · head^{-1} and kg · ha^{-1}) for season-long stocking applied annually (SLS-R), intensive early stocking applied annually (IES-R), and season-long stocking (SLS-S), intensive early stocking (IES-S), and intensive early stocking plus late-season grazing (IES/LSG) rotated in a 3-yr sequence. Values for the IES+ System are an average of SLS-S, IES-S, and IES/LSG gains. Means (9-yr average) with a common letter within a column are not different ($P < 0.05$). The IES/LSG-J gains represent the IES portion of the IES/LSG treatment, and IES/LSG is the total gain for steers that were grazed season-long. Individual animal gains (kg · head^{-1}) for the System are not reported due to the change in stocking rate in midseason. Values in parentheses are standard errors (SE).

	Steer Gain		
Grazing Treatment	kg · day^{-1} (SE)	kg · head^{-1} (SE)	kg · ha^{-1} (SE)
SLS-R	0.95 d (0.04)	139 b (2.3)	86 d (3.6)
SLS-S	0.94 d (0.05)	138 b (1.5)	85 d (4.3)
IES/LSG	0.98 c (0.05)	144 a (3.6)	144 a (4.6)
IES-R	1.14 a (0.07)	87 c (3.2)	108 b (5.2)
IES-S	1.17 a (0.07)	90 c (1.1)	111 b (5.6)
IES/LSG-J	1.16 a (0.06)	88 c (2.9)	109 b (6.0)
IES+ System	1.03 b (0.05)	—	113 c (5.3)

17. (**4pts**) Which of the following statements is most correct for steer gains (kg/day)?
    a. Season-long stocking grazing treatments had higher steer gains than intensive early stocking treatments
    b. The two SLS grazing treatments differed with respect to steer gains
    c. All of the IES grazing treatments were similar with respect to steer gains
    d. All of the above
    e. None of the above

18. (**4pts**) Which of the following statements is most correct for steer gains (kg/ha)?
    a. Season-long stocking grazing treatments had higher steer gains than intensive early stocking treatments
    b. The two SLS grazing treatments differed with respect to steer gains
    c. All of the IES grazing treatments were similar with respect to steer gains
    d. All of the above
    e. None of the above

19. _____ are the visually apparent rings of utilization in area which diminish in with distance from water sources.
    a. Piospheres
    b. Circospheres
    c. Concurrent spheres

20. Which vitamin can be synthesized in the digestive tract by bacteria?
    a. A
    b. B
    c. E
    d. K

21. The greater the density of high quality food species, the ____ the grazing velocity therefore the ____ residence time and intake level attained relative to the other vegetation patches available to the animal.
    a. Faster, greater
    b. Slower, greater
    c. Faster, less
    d. Slower, less

IIa. GRAZING MANAGEMENT PROBLEM (5 points)

SEE END OF TEST

III. RANGE IMPROVEMENT (24 points)

22. (**4pts**) If a seedlot sample of 100 g has a germination percentage of 65%, 5 g of weed seeds and 10 g of other inert non-seed material, the pure live seed percentage is:
    a. 55%
    b. 65%
    c. 75%
    d. 85%

23. What are the three primary plant macronutrients?
    a. Magnesium, sulfur and calcium
    b. Nitrogen, magnesium and potassium
    c. Phosphorus, calcium and nitrogen
    d. Potassium, phosphorus and nitrogen

For question 24, please use the following table (Sheley et al. 2008 REM).

Table 3. P-values from ANOVA of density and biomass in 2006.

		Crested wheatgrass		Medusahead	
	df	Density	Biomass	Density	Biomass
Def[1]	5	0.650	0.155	0.205	0.306
Season	2	0.770	0.287	0.015	0.012
Season * def	10	0.923	0.828	0.664	0.455
Site	1	0.001	0.001	0.001	0.001
Site * def	5	0.879	0.875	0.158	0.199
Site* season	2	0.996	0.871	0.016	0.012
Site * def * season	10	0.654	0.999	0.716	0.488

[1]Def indicates defoliation.

24. (**4pts**) Which of the following statements is most correct regarding medusahead?
    a. Defoliation affected both density and biomass
    b. Season affected biomass but not density
    c. Effects of site differed between seasons for both density and biomass
    d. All of the above
    e. None of the above

25. Which class of herbicides does not affect the roots, works only where there the herbicide contacts the plant, and is more effective on annual plants?
    a. Cell membrane disruptors and organic arsenicals
    b. Photosynthesis inhibitors
    c. Growth regulators
    d. Amino acid synthesis inhibitors
    e. Lipid synthesis inhibitors

For question 26, please use the following table (Mellado et al. 2008 REM).

Table 2. Chemical composition and tannin concentration ($g \cdot kg^{-1}$ dry matter) of *Sphaeralcea angustifolia* and alfalfa hay.[1]

Item	*Sphaeralcea angustifolia*	Alfalfa hay
Dry matter	951 ± 4.5a	821 ± 3.7b
Ash	131 ± 2.7a	79 ± 2.2b
Crude fat	39 ± 1.5a	33 ± 1.6b
Crude fiber	241 ± 3.4a	231 ± 1.5b
Crude protein (total nitrogen × 6.25)	170 ± 3.2a	170 ± 2.8a
Nitrogen-free extract	419 ± 3.8a	486 ± 4.6b
Acid detergent fiber	237 ± 4.3a	283 ± 2.9b
Neutral detergent fiber	414 ± 7.7a	379 ± 2.8b
Condensed tannins (soluble)	15	—
Condensed tannins (insoluble)	99	—

[1]Means within a row with different lowercase letters differ ($P < 0.01$).

26. (**4pts**) Which of the following statements is most correct?
    a. Dry matter differs between species
    b. Crude protein is similar between species
    c. Crude fiber is similar between species
    d. Crude fat is similar between species

For questions 27-28, please use the following table (Mazzola et al. 2008 REM).

Table 1. Degrees of freedom (df), F, and *P* values from mixed-model ANOVA for the effects of sucrose (SUCROSE), Vavilov Siberian wheatgrass seeding density (VAV), cheatgrass seeding density (BTSD), and number of growth years after seeding (GROWYEAR) on cheatgrass density, cheatgrass biomass, and number of seeds per plant and cheatgrass biomass and number of seeds per square meter. *P* values in bold are significant.

		Cheatgrass density		Cheatgrass biomass · plant^{-1}		Cheatgrass seeds · plant^{-1}		Cheatgrass biomass · m^{-2}		Cheatgrass seeds · m^{-2}	
Effect	df[1]	F	*P*	F	*P*	F	*P*	F	*P*	F	*P*
SUCROSE	1,12	5.0	**0.0445**	8.3	**0.0137**	5.4	**0.0385**	5.7	**0.0339**	13.6	**0.0031**
VAV	1,150	1.6	0.2009	0.6	0.6945	0.1	0.7771	0.5	0.4855	0.2	0.6084
SUCROSE × VAV	1,150	0.5	0.4640	1.0	0.3159	0.0	0.9766	1.3	0.2471	0.2	0.6244
BTSD	3,150	20.2	**<0.0001**	4.1	**0.0075**	2.3	0.0748	4.3	**0.0056**	3.9	**0.0092**
SUCROSE × BTSD	3,150	1.1	0.3384	0.3	0.7984	0.1	0.9720	1.2	0.2973	0.4	0.7135
VAV × BTSD	3,150	0.3	0.8309	2.2	0.0940	1.6	0.1943	0.5	0.6449	0.8	0.4624
SUCROSE × VAV × BTSD	3,150	2.4	0.0712	0.2	0.8735	1.3	0.2916	0.9	0.4247	1.0	0.3774
GROWYEAR	1,150	469.0	**<0.0001**	95.1	**<0.0001**	86.0	**<0.0001**	97.2	**<0.0001**	62.8	**<0.0001**
SUCROSE × GROWYEAR	1,150	0.1	0.7293	85.5	**<0.0001**	69.9	**<0.0001**	35.7	**<0.0001**	26.6	**<0.0001**
VAV × GROWYEAR	1,150	0.2	0.6642	1.9	0.1651	1.8	0.1820	0.3	0.5868	0.0	0.9225
SUCROSE × VAV × GROWYEAR	1,150	0.1	0.7387	0.4	0.5184	0.2	0.6681	0.4	0.5192	0.0	0.8393
BTSD × GROWYEAR	3,150	5.4	**0.0015**	1.7	0.1595	0.6	0.5993	1.9	0.1266	1.6	0.1882
SUCROSE × BTSD × GROWYEAR	3,150	1.1	0.3545	2.5	0.0574	1.8	0.1476	2.4	0.0651	1.3	0.2800
VAV × BTSD × GROWYEAR	3,150	1.5	0.2030	0.1	0.9405	0.4	0.7159	0.5	0.6457	0.1	0.9315
SUCROSE × VAV × BTSD × GROWYEAR	3,150	0.5	0.6955	1.1	0.3402	0.9	0.4080	1.3	0.2672	1.4	0.2408

[1]df indicates numerator degrees of freedom, denominator degrees of freedom.

27. **(4pts**) Which of the following statements is most correct?
    - **a. Effects of sucrose depended number of growth years after seeding to affect cheatgrass biomass**
    - b. Sucrose and the seeding density of Vavilov Siberian wheatgrass interacted to affect all variables
    - c. Sucrose and the seeding density of cheatgrass interacted to affect density only
    - d. All of the above
    - e. None of the above

28. **(4pts**) Which of the following statements is most correct?
    - a. Cheatgrass density was affected by sucrose but not the number of growth years after seeding
    - **b. Cheatgrass biomass per plant was affected by sucrose and the number of growth years after seeding**
    - c. Cheatgrass seeds per plant was affected by sucrose but not the number of growth years after seeding
    - d. All of the above
    - e. None of the above

IIIa. RANGE IMPROVEMENT PROBLEM (5 points)

SEE END OF TEST

IV. RANGE REGIONS (16 points)

29. Which of the following is ordered correctly from shortest to longest for natural fire return intervals?
    a. Sonoran desert, ponderosa pine, tallgrass prairie
    b. Tallgrass prairie, ponderosa pine, Sonoran desert
    c. Ponderosa pine, tallgrass prairie, Sonoran desert
    d. Ponderosa pine, Sonoran desert, tallgrass prairie

30. Which of the following is a correct difference between the physiognomy of the hot desert and the desert grassland?
    a. There are more species of grasses in the desert grassland
    b. Grasses in the hot desert transpire more rapidly than grasses in the desert grassland
    c. Grasses in the desert grassland transpire more rapidly than grasses in the hot desert

31. The most common type of woody plant in tundra regions is:
    a. *Pinus* spp.
    b. *Salix* spp
    c. *Arctostahylos* spp.
    d. *Abies* spp.

32. The Prairie Pothole region of North America has a unique geological landscape due to _____, and is known for the _____ across its landscape.
    a. glaciers, depressional wetlands
    b. sea sediments, playa lakes
    c. alluvium, intermittent streams
    d. volcanoes, vernal pools

33. Which of the following statements is most correct regarding range regions and the continent of Africa?
    a. Temperate rain forests are found in northern Africa
    b. **Tropical deciduous forest and thorn forest is found in southeastern Africa**
    c. Tropical rain forest is found in southern Africa
    d. All of the above
    e. None of the above

34. Which of the following range types occurs at the highest altitude?
    a. Oak woodland
    b. Pinon-juniper
    c. Mountain browse
    d. alpine tundra

35. In the Douglas fir-aspen zone of the Western Coniferous forest, which of the following statements is correct?
    a. Douglas fir is fire tolerant, but not shade tolerant
    b. Aspen is fire tolerant, but not shade tolerant
    c. Aspen is both fire and shade tolerant
    d. Aspen is shade tolerant, but not fire tolerant

36. Which of the following combinations of range regions and grazing resistance is correct?
    a. Palouse prairie – high grazing resistance
    b. shortgrasss prairie – low grazing resistance
    c. southern pine forest – low grazing resistance
    d. All of the above
    e. None of the above

V. RANGE INVENTORY AND ANALYSIS (20 points)

37. (**4pts**) A ranch manager fertilizes a pasture and then estimates biomass (kg/ha) on a yearly basis for the next ten years. He computes a linear regression equation between standing crop in June (Y) and year (X) of: Y = 48.6x + 5.4. What is the yearly increase in kg/ha on the pasture?
    a. 5.4 kg/ha
    b. 43.2 kg/ha
    c. 48.6 kg/ha
    d. 54.0 kg/ha

For questions 38-39, please use the following table.

Number of hits of ground cover at each site

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

38. (**4pts**) What is the percent bare soil at site 2?
    a. 12.0%
    b. 16.7%
    c. 30.0%
    d. 40.0%

39. (**4pts**) What is the percent basal vegetation at site 1?
    a. 3.0%
    b. 10.0%
    c. 15.0%
    d. 23.1%

For questions 40-41, please use the following table of canopy cover using the Daubenmire (1959) technique.

Cover Class	Range of Coverage	Midpoint of Range
1	0–5%	2.5%
2	5–25%	15.0%
3	25–50%	37.5%
4	50–75%	62.5%
5	75–95%	85.0%
6	95–100%	97.5%

Below are results from estimating canopy cover in 10, 20X50 cm quadrats.

Species	**Quadrat**									
Code	1	2	3	4	5	6	7	8	9	10
ACHY	1		1	2	5	1		2		4
BOGR	5	4	3	3	2	4	1	2	1	1
HECO	3	2	3	1	1		2	4	3	1
KOMA	1		2		1		3	1	1	1

40. **(4pts**) What is the canopy cover for species code BOGR?
    a. 2.6%
    b. 26.0%
    c. 32.3%
    d. 35.8%

41. **(4pts**) What is the density of the species coded HECO?
    a. 20 plants/m^2
    b. 25 plants/m^2
    c. 16.9%
    d. 80%
    e. None of the above

Va. RANGE INVENTORY AND ANALYSIS PROBLEM (10 points)

SEE END OF TEST

VI. MULTIPLE USE RELATIONSHIPS (14 points)

For question 42, please use the following table (Koler et al. 2008 REM).

Table 2. Mean values (SE) of runoff parameters for rainfall simulation plots on shortgrass prairie, 2002.

Variables ($n = 36$)		Time to runoff (min)	Total runoff (mm)
Range condition	Good	4a[1] (0.2)	30a[1] (1.2)
	Fair	2b (0.1)	60b (1.3)
Soil surface configuration	Single microchannel	3a[1] (0.1)	54a[1] (2.5)
	Multiple microchannels	3a (0.2)	50a (2.1)
	Sheet	3a (0.3)	34b (1.7)
Soil removal level	11.2 $t \cdot ha^{-1}$	4a[1] (0.2)	51a[1] (1.4)
	22.4 $t \cdot ha^{-1}$	3a (0.1)	41a (1.5)

[1]Means with the same letter, within a class of variables in a column, are not significantly different ($P > 0.10$).

42. **(4pts)** Which of the following statements is most correct?
    a. Time to runoff was twice as long with fair compared to good range condition
    b. Total runoff was twice as large with good compared to fair range condition
    c. Range condition did not influence either time to runoff or total runoff
    d. All of the above
    e. None of the above

Soil was collected in a container measuring 5 cm in height and 6 cm in diameter. The fresh (moist) weight of the soil without the container was 230 g. The dry weight of the soil without the container was 177 g. Using this information, please answer questions 91-92.

43. **(4pts)** What is the bulk density of the soil?
    a. 0.37 g/cm^3
    b. 0.98 g/cm^3
    c. 1.25 g/cm^3
    d. 1.63 g/cm^3

44. **(4pts)** What is the gravimetric water content of the soil?
    a. 1.3%
    b. 23.0%
    c. 29.9%

45. You have been asked to design a 1000 ha forest clearcut that would create maximum edge for wildlife. Your 1000 ha clearcut would resemble:
    a. A circle
    b. A square
    c. A rectangle

GRAZING MANAGEMENT PROBLEM (5 points)

One of your best friends has recently purchased a ranch in Kazakhstan and invites you to provide consulting for the operation regarding grazing management. Some preliminary aboveground biomass sampling was completed last year for initial baseline information for monitoring purposes in a management plan. Ocular estimates were conducted prior to destructive harvests of aboveground biomass to ground level within 40 X 40 cm quadrats. Biomass harvested was weighed immediately in the field for determinations of green weights and then dried for determinations of dry weight (see table below).

Plot	Ocular estimate (g)	Clipped – green wt (g)	Clipped dry wt (g)
1	52	70	40
2	18	20	11
3	27	47	25
4	73	85	44
5	28	53	28
6	36	47	27
7	22	45	28
8	4	7	2
9	29	38	21
10	44	55	30

Using the obtained data displayed in the table above, determine how many hectares should be allocated to each cow/calf pair (AUE=1.3) for a May 1 to September 1 grazing season if the utilization level of total forage is 50% and half of the desired utilization will be lost to trampling, defecation, or other consumption, and the monthly consumption by an animal unit is 273 kg?

46. (**5 pts**) Using the obtained data displayed in the table above, determine how many hectares should be allocated to each cow/calf pair (AUE=1.3) for a May 1 to September 1 grazing season if the utilization level of total forage is 50% and half of the desired utilization will be lost to trampling, defecation, or other consumption, and the monthly consumption by an animal unit is 273 kg?
    a. 1.37 ha
    b. 1.77 ha
    c. 2.73 ha
    d. 3.55 ha

Calculations for answer:
Average dry weight for the 10 plots is 25.6 g, so this converts to 1600 kg/ha (using 0.16 m2 quadrat)
Use by the livestock will be 25% (half of the 50% desired use), so 25% of 1600 kg/ha is 400 kg/ha
Consumption by 1 AU = 273 kg for one month, so consumption by 1.3 AU for one month is 354.9 kg
Needed consumption of 354.9 kg per month times 4 month grazing season = 1419.6 kg
Divide consumption need of 1419.6 for the cow-calf pair over the 4 months by 400 kg/ha = 3.55 ha

RANGE IMPROVEMENTS PROBLEM (5 points)

Another one of your best friends has recently purchased a ranch in Mongolia and invites you to provide consulting for the operation regarding range improvements. Preliminary assessments of the property conducted last year suggest that there is a need for seeding one-eighth of the 10,000 hectare ranch. In the table below are two possible seed mixes provided by a local company. All of the species listed have a minimum 80% PLS.

	Bulk rate in mix (kg/ha)	$/kg bulk seed
Seed Mix A		
Species 1	2.0	8.75
Species 2	2.5	6.50
Species 3	4.25	6.00
Seed Mix B		
Species 4	4.0	4.50
Species 5	3.0	8.25
Species 6	3.5	5.50

47. **(5 pts**) Using the data displayed in the table above, which of the following statements is most correcting regarding the seeding for this range improvement?
    a. On a per hectare basis, species 4 is the cheapest to seed
    b. On a per hectare basis, species 5 is the most expensive to seed
    c. The total cost to seed the desired area will be $3437.50 more for Seed Mix B than Seed Mix A
    d. The total cost to seed the desired area will be $27,400 more for Seed Mix B than Seed Mix A

Calculations for answer:
Species 1: $17.50/ha
Species 2: $16.25/ha
Species 3: $25.50/ha
Total for Seed Mix A: $59.25/ha

Species 4: $18.00/ha
Species 5: $24.75/ha
Species 6: $19.25/ha
Total for Seed Mix B: $62.00/ha

Seed Mix B costs $2.75/ha more to seed and there is 1250 ha (1/8 of 10,000) so $3437.50 more costs.

RANGE INVENTORY AND ANALYSIS PROBLEM – 10 points total

Another one of your best friends has recently purchased a ranch in central Alberta that has the shrub *Salix bebbiana* present. This friend invites you to provide consulting for the operation regarding predicting twig weight from measuring twig basal diameter. Your friend collected some data last summer and has provided it to you (see table below). She has asked you to calculate and present to her a simple linear regression line that predicts twig weight from twig basal diameter.

Twig weight (g)	Twig basal diameter (cm)
0.3	0.22
42.1	0.975
10.2	0.68
1.5	0.325
23.9	0.72

The following formulas may be needed to complete the calculations:

$Y_{mean} = B_0 + B_1X_{mean}$

$$B_1 = \frac{(\Sigma XiYi) - \Sigma Xi\Sigma Yi)}{(\Sigma Xi^2 - (\Sigma Xi)^2)}$$

48. (**10 pts**) The value of the slope of the regression line is:
    a. 9.05
    b. 15.31
    c. 53.30
    d. -9.05

Calculations for answer:

	Twig Weight	**Basal Diameter**		
	(grams)	(cm)	XY	X^2
	0.30	0.22	0.07	0.05
	42.10	0.98	41.05	0.95
	10.20	0.68	6.94	0.46
	1.50	0.33	0.49	0.11
	23.90	0.72	17.21	0.52
Summation	78.00	2.92	65.75	2.09
Mean	15.60	0.58		

$$B_1 = \frac{5(65.75) - (78 \times 2.92)}{5(2.09) - (2.92)^2}$$

$$= \frac{(328.75 - 227.76)}{(10.42 - 8.526)}$$

= 53.30 = slope (positive, absolute value of 53.30, or something close due to rounding)