ANSWER KEY for

Ecology Division C 2018 – Student Response Sheet

This test is worth 94 points. All questions are worth one point unless otherwise noted.

Station 1

1. A B C D
2. A B C D
3. Evaporates, is quickly absorbed by plant roots
4. (2pts)__ Flat, long roots/ stomata only open at night/ waxy cuticle
5. (2pts) Burrowing/ being nocturnal/ small size
6. Grasslands – in grasslands water isn't as hard to get, so organisms don't need to be as specialized, so there is greater room for a wider variety of organisms

Station 2 * graphs on last page**

7. A B C
8. Red and green are much greater while orange and yellow are much less than in the original
9. A B C
10. Competitive exclusion (Gause's theory)
11. A B C
12. Red; don't have the right anatomy to be targeted, better natural immune system, etc.

Station 3

13. A B C D
14. A B C D
15. A B C D
16. A B C D
17. A B C D
18. A B C D
19. A B C D
20. A B C D

Station 4

21. A B C D E
22. A B C D E
23. A B C D
24. Vehicles, urban development, petroleum, small rodents, drought, etc.
25. In situ: wild population Greater genetic variation, similar ecological pressures/circumstances, etc.Ex situ: Captive population (IV, zoos)
    For limited populations, what life stage do you xfer?, etc.

Station 5

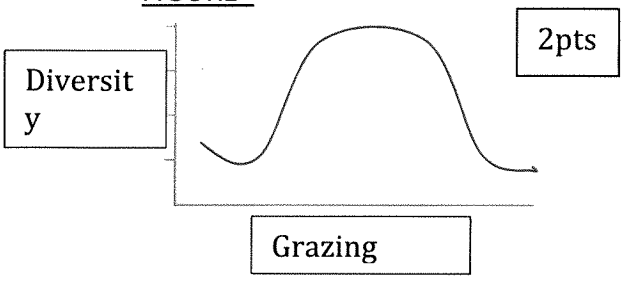
26. Mutualism
27. Parasitism/predation
28. In high nutrient soils the plants no longer need the fungi. They can gather the nutrients themselves.
29. Obligate symbiosis
30. Interspecific competition
31. (2pts) Parasitism (or Predation) & Facultative Symbiosis
32. Interspecific competition
33. Parasitoidism
34. Intraspecific competition
35. Commensalism

Station 6

36. Gila Woodpecker & Grasshopper Mouse
37. A B C D
38. A B C D
39. primary consumer, secondary consumer
40. Elf owl, red tailed hawk
41. kCal
42. Go down because the Grasshopper population size would decrease
43. Detrivores

Station 7

44. The soil
45. Herbivores speed up the rate of N cycling
46. _. Intermediate intensity would be the highest biodiversity. SEE FIGURE



2pts

47. Source
48. Secondary
49. Community could be more homogeneous, fewer trees/shrubs, lower diversity if frequency becomes too low allowing competition to occur
50. Fire causes a loss of carbon and N to the atmosphere, so the lack of it might actually help them to be a better carbon sink and increase nutrient availability in the soil.

Station 8

51. A B C D
52. A B C D
53. A B C D
54. A B C D
55. A B C D
56. Fire is the density-independent factor, however, in the bigger population recovery might happen more quickly because mates are easier to find making recovery density-dependent.

Station 9

57. A B C D
58. A B C D
59. A B C D
60. Frequent Disturbance, or a fluctuating weather pattern, disease, predation, they have different niches
61. A B C D E
62. Deserts
63. A B C D E
64. A B C D
65. A B C D
66. A B C D

Station 10

67. A B C D E
68. Day 29
69. Big ears, living underground, sitting in the shade...
70. Bacteria, Cyanobacteria, Moss, Fungi, Lichen, Liverworts. Erosion, reduced water holding capacity reduced nutrients available for plants, reduced seed beds for plants.
71. _ Driving off road, Livestock grazing

Station 11

72. Temp with cool in the north and hot in south – Lower ANPP in North Compared to South
    Precip – Wet in east dry in west, more ANPP in East
73. A B C D
74. False
75. A B C D E
76. A B C D
77. A B C D
78. A B C D E

Station 12

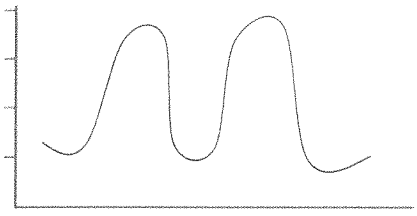
79. 530
80. 2 pts: 586-596 1 pt: 576-606
81. 28 fish/month
82. 0.46-0.49
83. 641-656

Station 13

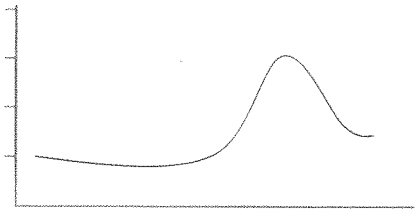
84. NO
85. The process by which nitrogen gas (N_2) from the atmosphere is converted to usable (by plants) form of N by microorganisms
86. A B C D
87. (A) B C D
88. Low nitrogen soils
89. Burns annually
90. Lower nodule presence

Station 2 Graphs (1pt ea):

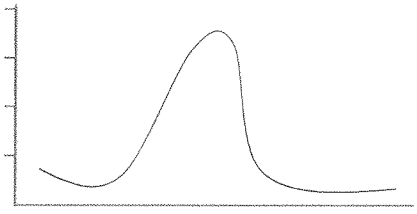
Section A



Section B



Section C



Station 1

1) How much of earth's water is freshwater?
   a. 10%
   b. 3%
   c. 75%
   d. 34%

2) During which season does it generally rain most in a cold desert?
   a. Fall
   b. Summer
   c. Spring
   d. Winter

3) When it rains in a hot desert, what generally happen to the water?

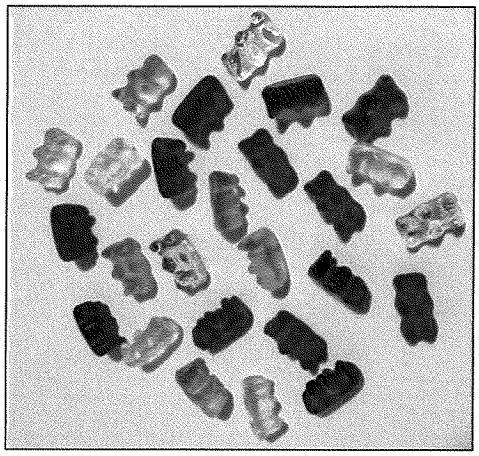
4) Name two adaptations for getting/retaining water in a desert plant.

5) Name two adaptations for getting/retaining water in a desert animal.

6) Which ecosystem has greater biodiversity – the desert or the grasslands? How is this connected to the water cycle?

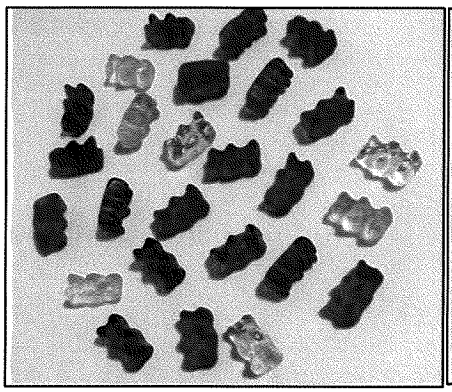
Station 2 – Page 1

A population of *Ursus glucosis* lives on the island of Haribo. In order to keep their color, *U. glucosis* can only eat food that is the same color as it. The founding population on the entire island looked like this:

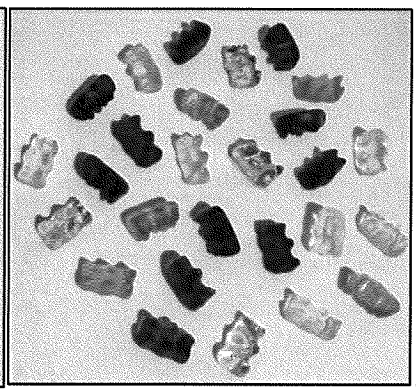


A violent volcanic eruption occurred that formed a deep river with severe rapids, which the bears cannot swim across, that divided the island in three sections. Read the following descriptions of what happened to each section following the eruption. Use these pictures for your reference as mentioned in the descriptions on the next page.

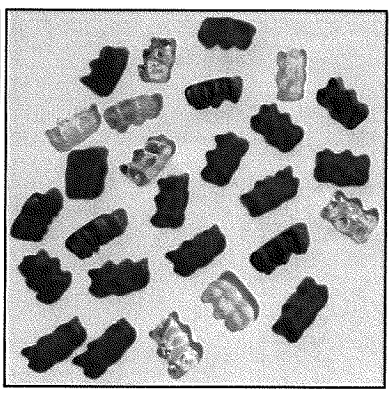
A



B



C



Station 2 – Page 2

For each question, tell what type of natural selection occurred, answer the supplemental question(s), and draw a graphic representation of the selection.

7) Section A of the island is hit by a large storm that drastically changes the flora in the region. Two years later, the population looks like the photo on page 1.

   a. Stabilizing selection
   b. Disruptive selection
   c. Directional selection

8) Justify your selection.

9) Section B of the island gets an invasive species that quickly spreads across the island. Two years later, the population looks like the photo on page 1.

   a. Stabilizing selection
   b. Disruptive selection
   c. Directional selection

10) What ecological principal is this an example of?

11) Section C of the island has an outbreak of a highly contagious disease that effects majority of the *Ursus glucosis* population. Two years later, the population looks like the photo on page 1.

   a. Stabilizing selection
   b. Disruptive selection
   c. Directional selection

12) Which color appears to have a resistance to the disease; why might this be?

Station 3 – page 1

Tell whether each climate graph, description, or picture describes:

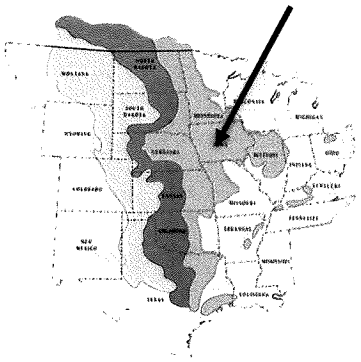
A. Hot Desert
B. Cold Desert
C. Tallgrass Prairie
D. Shortgrass Prairie

13) This is the biome that receives annual rainfall ranging from 1.5 to 28 cm.

14) The climate of this biome is characterized by extremes: hot, dry summers and cold, snowy winters; frigid alpine ridges and warm, windy valleys; days over 90 °F (32 °C) followed by nights near 40 °F (4 °C).

15)

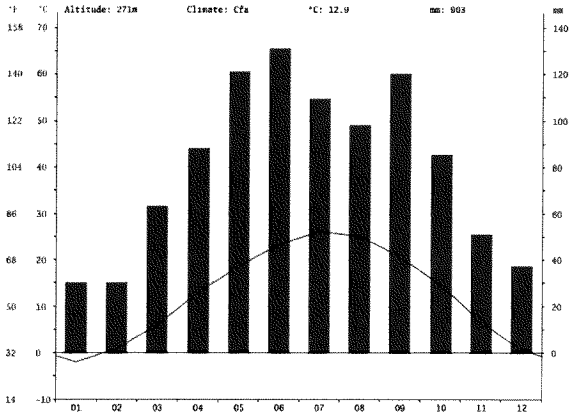
16)



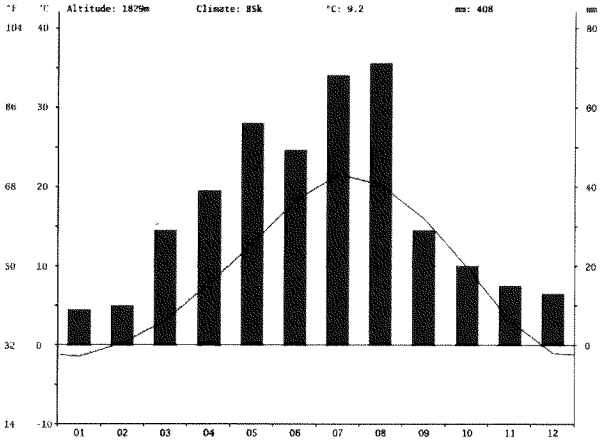
17) This is a biome where potential evapotranspiration is greater than the actual evapotranspiration.

Station 3 – page 2

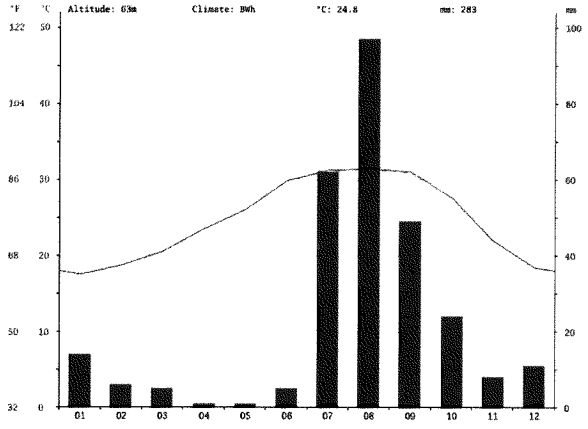
18)



19)



20)



Station 4

21) What is the first step in ecosystem restoration?
   a. to restore the physical structure
   b. to restore native species that have been extirpated due to disturbance
   c. to remove competitive invasive species
   d. to identify the limiting factors of the producers
   e. to remove toxic pollutants

22) What is the goal of restoration ecology?
   a. to replace a ruined ecosystem with a more suitable ecosystem for that area
   b. to speed up the restoration of a degraded ecosystem
   c. to completely restore a disturbed ecosystem to its former undisturbed state
   d. to prevent further degradation by protecting an area with park status
   e. to manage competition between species in human-altered ecosystems

23) Pawnee National Grasslands has two parcels of public land and was recently discovered to have oil and natural gas under it. The government is reviewing several proposals from special interest groups on what to do with the land. Which of the following is most in line with the precautionary principle?
   a. Do a study to optimize estimated damage to the environment vs profits and extract at that level.
   b. Do a study to optimize estimated damage to the environment vs profits and extract below that level.
   c. Extract as much of the oil and gas as possible to help the economy.
   d. Do nothing, keep the land as it is.

24) *P. knowltonii* is an endangered species of small cactus endemic to New Mexico. Name three major concerns conservationists may have with a newly reintroduced population.

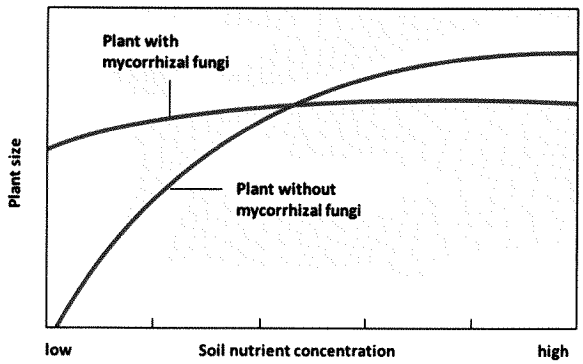
25) Explain the difference between in situ and ex situ sourcing and describe advantages and disadvantages of both.

Station 5 – page 1

Determine what type of relationship is described in each scenario below. Use the terms:

i. commensalism
ii. amensalism
iii. mutualism
iv. parasitism
v. parasitoidism
vi. interspecific competition
vii. intraspecific competition
viii. obligate symbiosis
ix. facultative symbiosis

26) Many grasses in the Great Plains have mycorrhizal fungi associations, where the mycorrhizae provide the plants with nutrients and the plants provide the mycorrhizae with carbon. Using the graph to the right to examine plant size with and without mycorrhizae, what is the relationship at low soil nutrient levels?



27) What type of relationship is the fungi-grass relationship at high soil nutrient levels?

28) Why might the relationship status change based on soil nutrient levels?

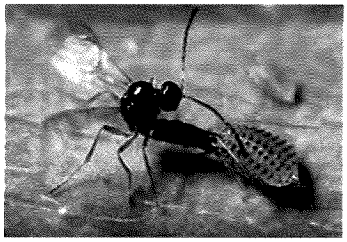
29) While the grass can live without the fungi, the fungi cannot live without the association (i.e., it has no other source of carbon). This type of relationship is a _____.

30) Big Brown Bats feed on insects in the air, particularly beetles, over rivers throughout Kansas grasslands. If a new bat species is introduced into an area which also specializes in feeding on beetles, this would be an example of _____.

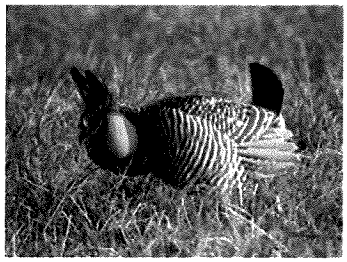
31) Scarlet Indian Paintbrush can connect its roots to other plants to steal nutrients from them. While it can survive on its own, when tapped into another plant, the Paintbrush shows a 40 fold increase in productivity. This interaction between the Paintbrush and the other plant is an example of _____ & _____.

Station 5 – page 2

32) The Eastern woodrat and the Woodland vole both live in the riverine forests of the Great Plains. They share a food resource. This is an example of _____.



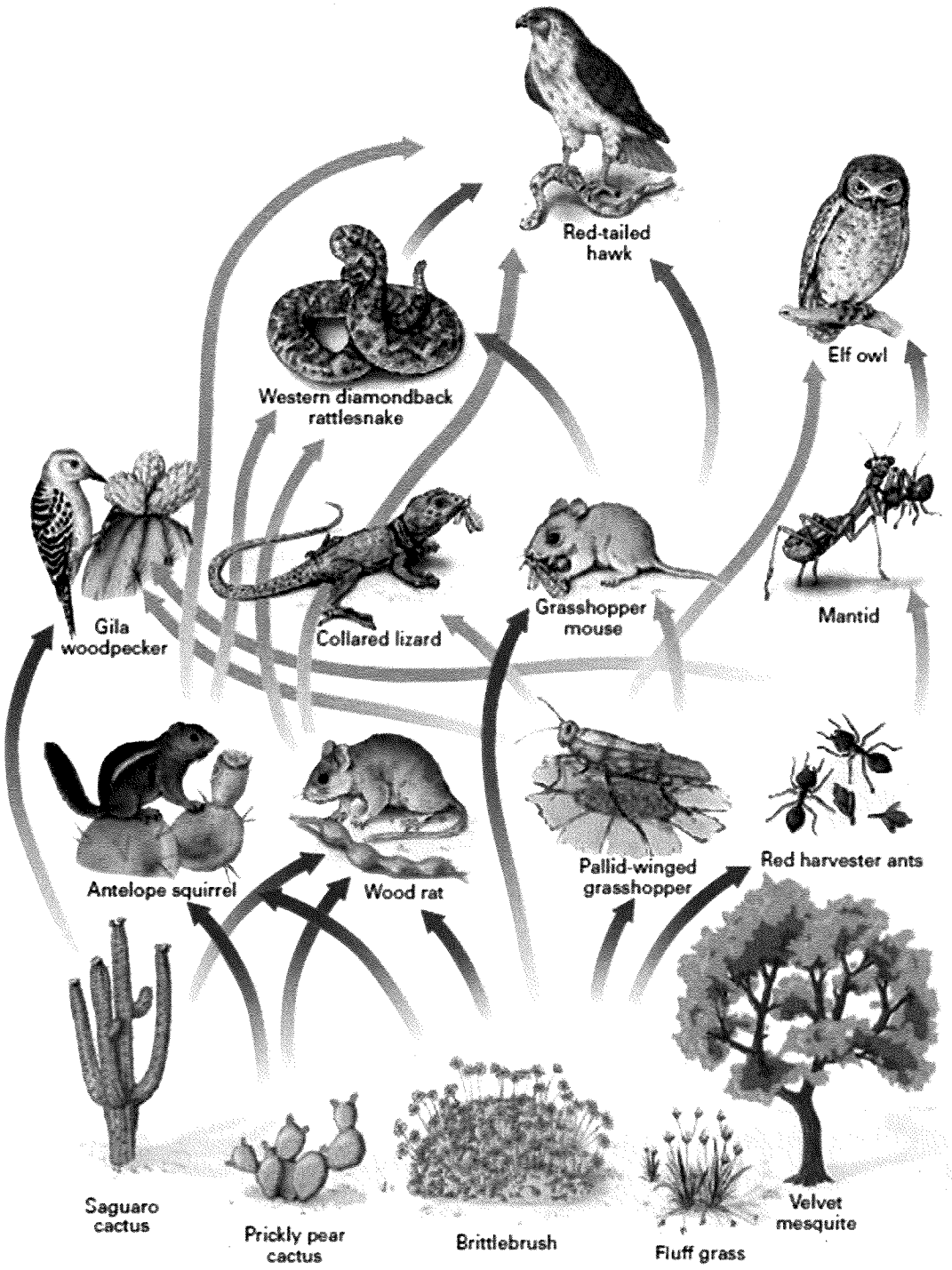
33) Aphids consume many agriculturally important plants. While pesticides are effective means of controlling aphid populations, certain types of wasps also attack aphids and lay their eggs inside of the aphids. The adult wasps do not eat the aphids, but only lay their eggs. The wasp larvae however, eat the aphid from the inside out. This relationship between the wasp and the aphid is known as _____ and can be used as a form of biocontrol.



34) Greater prairie chickens are very territorial birds and defend their booming (courtship ritual) grounds quite fiercely. A male's search for his own territory and the accompanying breeding rights to the females is an example of _____.

35) In many grasslands, cattle egrets can be seen trailing behind cattle. When cattle graze, they disturb the insects living in the grass, essentially flushing the insects out. The egrets then eat these insects. The egrets get the benefit of easier hunting, and the cattle seem to not be bothered by the egrets even though they do not benefit from their presence. The relationship between the cattle and egret is an example of _____.

Station 6 – page 1



Station 6 – page 2

36) Which organism/s are omnivores?

37) In years that the mantids have higher abundances, which of these populations would benefit?
   a) Red harvester ants
   b) Grasshopper mouse
   c) Elf owl
   d) Brittlebrush

38) The relationship between the Western Diamondback Rattlesnake and the Red-tailed hawk is complex. Which **two** from the list below accurately describe this relationship?

   a. commensalism
   b. competitors
   c. parasite–host
   d. predator–prey

39) Is the Grasshopper Mouse a producer, primary consumer, secondary consumer, or tertiary consumer? (list all that apply)

40) Which species are apex predators?

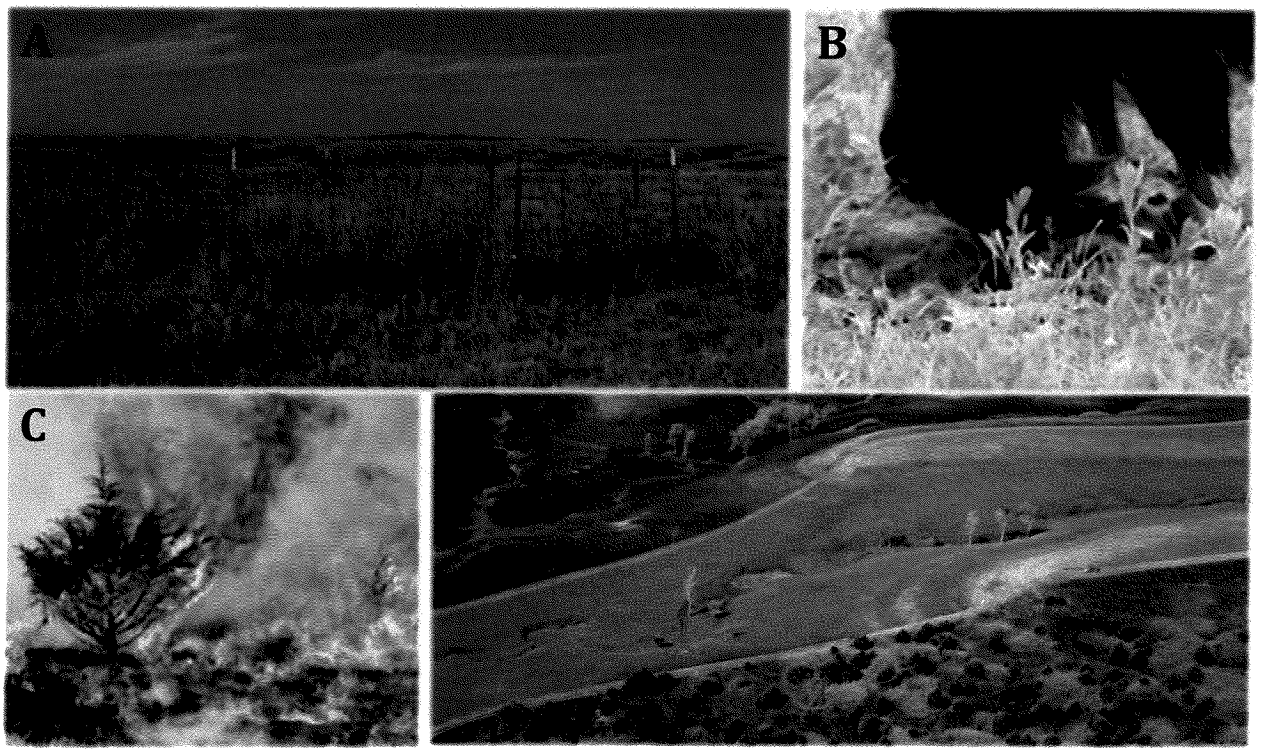
41) If the autotrophs in the diagram have 1000Kcal of energy, how much energy is left for the Hawk, assuming the hawk ate the snake which ate the woodrat which ate the prickly pear AND average trophic efficiency?

42) If the Elf owl increased in population size due to the introduction of a new food source, how would this influence the population size of the collard lizard? Why?

43) What trophic level is missing from this food web?

Station 7 – Page 1

Grasslands in the Midwest are a disturbance driven ecosystem, with grazing (A, B) and fire (C, D) shaping many community, ecosystem, and landscape process. Shown here are four images from the Konza Prairie Long-term Ecological Research Station in Manhattan, KS, which is home to native, unplowed tallgrass prairie. A grazing exclosure (A) illustrates the impact of herbivores on the plant community structure. Inside the fence, no bison can get to the plants, while outside ~ 300 bison graze the grassland. The bottom panels show the importance of fire, with a cedar tree going up in flames after that patch had not been burnt in nearly 30 years! Burning at different frequencies across the landscape creates heterogeneity (D).



44) In grasslands, where is the majority of Carbon stored – in **the plants** or in **the soil**?

45) In the absences of grazers (and fire), plant material can take up to four years to decompose. When herbivores consume biomass, they digest it within a day or two. Does the presence of grazers influence nitrogen cycling rates? If so, does it speed them up or slow them down?

Station 7 – Page 2

46) Thinking about the intermediate disturbance hypothesis, which level of grazing intensity would yield the highest level of biodiversity? Draw a figure which shows the effect of grazing intensity (continuous variable from low to high) on plant diversity (continuous from low to high) assuming the intermediate disturbance hypothesis holds.

47) Burning a grassland causes the grassland to be a temporary **source/sink** of CO_2 to the atmosphere?

48) Fire resets the grassland, allowing succession to start fresh. Is this **primary** or **secondary** succession?

Humans have drastically reduced fire occurrence on the landscape and removed many of the native herbivores. How might the loss of these disturbances influence:

49) Grassland plant community?

50) Grassland carbon and nitrogen cycling?

Station 8

51) The mortality rate of organisms following a type III survivorship curve is
   a. lower after the organisms become established
   b. fairly constant throughout life
   c. higher in post-reproductive year
   d. unrelated to age

52) Which dispersion pattern is most common in nature?
   a. Uniform
   b. Random
   c. Clumped
   d. All are common
   e. None can be found in nature

53) Which of the following is most likely to contribute to density-dependent regulation of desert populations?
   a. the removal of toxic waste by decomposers
   b. intraspecific competition for water
   c. droughts
   d. fires

54) Which of the following groups would be most likely to exhibit uniform dispersion?
   a. red squirrels, who actively defend territories
   b. cattails, which grow primarily at edges of lakes and streams
   c. dwarf mistletoes, which parasitize particular species of forest tree
   d. lake trout, which seek out cold, deep water high in dissolved oxygen

55) Which of the following would NOT be a community?
   a. All the plants, insects, and soil in your back yard.
   b. All the many varieties of birds in your neighborhood.
   c. All the fish in an aquarium.
   d. none of the above

56) Density-dependent and density-independent factors can interact to impact population growth in the wild. Imagine a forest fire killing 10 deer in population A which has a population density of 50 deer per hectare, and a forest fire killing 10 deer in population B which has a population density of 2 deer per hectare. What is the density-independent factor here, and is the rate of population recovery density-independent or density-dependent? Which population will recover faster and why assuming neither population had reached its maximum before the fire?

Station 9 – Page 1

	Number of individuals	
Plant species	**Field A**	**Field B**
Prickly Pear Cactus	200	60
Blue Gramma Grass	300	300
Creosote Bush	250	100
Yucca	250	40
Total	1000	500

Use the data table above to answer questions the next 4 questions

57) Which field has the greater species richness?
   a. Field A
   b. Field B
   c. They are the same
   d. You cannot determine species richness from this data

58) Which community has higher dominance?
   a. Field A
   b. Field B
   c. They are the same
   d. You cannot determine dominance from this data

59) Which field has a more diverse community?
   a. Field A
   b. Field B
   c. They are the same
   d. You cannot determine diversity from this data

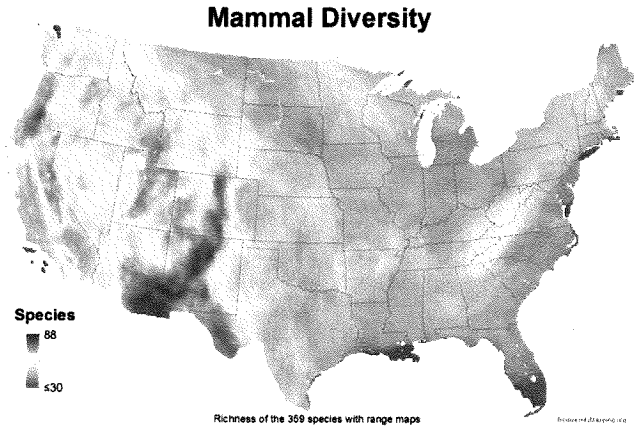
60) List 2 reasons why one species isn't out competing all the other species (i.e., driving them to extinction by competitive exclusion).

61) A population is correctly defined as having which of the following characteristics?
   I. inhabiting the same general area
   II. belonging to the same species
   III. possessing a constant and uniform density and dispersion

   a. I only
   b. III only
   c. I and II only
   d. II and III only
   e. I, II, and III

Station 9 – Page 2

62) According to the mammal diversity figure, is there higher mammal richness in the deserts or the Great Plains grasslands of the US?



63) The California newt is found only in California. This is an example of a(n) _____ species.
   a. Metapopulation
   b. Endemic
   c. Invasive
   d. Homogeneous
   e. Ubiquitous

64) Which of the following best represents a measure of **ecological** density?
   a. number of ants per acacia tree
   b. number of birds per square kilometer
   c. number of mammals per square mile
   d. number of fish per cubic foot

65) Which of the following factors tends to DECREASE biodiversity?
   a. Mild disturbance from fires and storms
   b. Introduction of new species from other areas
   c. Trophic complexity
   d. Habitat diversity

66) What is the relationship between latitude and species richness?
   a. Positive
   b. Negative
   c. Unimodal
   d. No relationship exists

Station 10

67) What is the size of the human population today?
   a. >10 billion
   b. ~7 billion
   c. ~2 billion
   d. ~1 billion
   e. >4 million

68) You are studying the growth of a particular strain of bacteria. You begin with a tiny colony on a Petri plate. One day later, you determine that the colony grew and exactly doubled in size. A calculation showed that if the colony continued to grow at the same (constant) rate, it would cover the entire plate in 30 days. (Assume that colony size is directly proportional to the number of individual bacteria.) On what day would the bacteria cover half the plate?

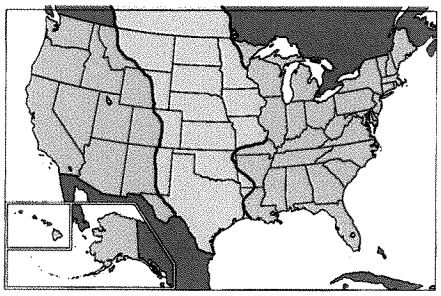
69) Low rainfall and high summer temperatures in deserts make life hard for many animals. List 2 animal adaptations (actions or body structure) that help animals who live in the desert biome.

70) To the right is a common warning on trailheads throughout the Southwestern US – "Don't bust the crust." Other warnings might be, "It's alive. Stay on trails!". These warnings are meant to help preserve biological soil crusts. At first glance a desert topsoil might look just like a dry crust. But that lumpy black crust is actually alive! What types of organisms are in a biological soil crust, and name two consequences to the loss of these crusts?

71) What type of activity besides humans walking off trails might be bad for biological soil crusts?

Station 11

72) The Great Plains are shown in blue. Across this range, many climatic variables differ. List two of these variables, how they differ across the range, and how they might influence aboveground net primary production.



73) Global warming can cause all of the following EXCEPT:
   a. lengthening of the growing season
   b. the lowering of the pH of the oceans
   c. decrease in severe storm frequency
   d. all are consequences of global warming

74) Greenhouse gases have only been in the Earth's atmosphere since the Industrial Revolution began. **True/False**

75) According to Bergman's rule, how would global warming impact the body size of a population through time (i.e., as temperature gets warmer)?
   a. Stabilizing selection would occur on body size of the population
   b. Disruptive selection would occur on body size of the population
   c. Directional selection would occur towards bigger individuals
   d. Directional selection would occur towards smaller individuals
   e. No effect on body size of the population

76) What is the approximate level of CO_2 in the atmosphere today?
   a. 20-30 ppm
   b. 50-80 ppm
   c. 400-500 ppm
   d. >1000 ppm

77) Which part of the Earth is warming the most quickly?
   a. the Arctic
   b. the tropics
   c. the Northern Hemisphere
   d. All parts of the Earth are warming equally.

78) Which of the following is NOT an abiotic change already observed due to global warming that has occurred thus far?
   a. Retreat of mountain glaciers
   b. Early snowmelt each year
   c. Thinning of polar ice caps
   d. Rising sea levels
   e. Changes in butterfly migration timing

Station 12

One way that ecologists can estimate populations is by using a technique called "mark and recapture." Below is a table with data from a pond of fish where the initial marked and released population was 53 fish.
[Hint: $N = (captured_t \times marked_i)/marked_a$]

Trial	Marked	Unmarked	Population Estimate
1	2	32	901
2	5	41	488
3	4	47	676
4	7	50	432
5	4	35	517
6	5	45	???

79) Estimate the population for Trial 6.

80) Based on the data, how many fish would you expect to be in the pond?

81) If the birth rate for this pond is 11 fish a week, and the death rate is 8 fish every two weeks, what is the population growth rate of this pond?

82) If this pond followed an exponential model, what would the per capita growth rate be?

83) How many fish will be in the pond at the start of the third generation?

Station 13

84) Is the N2 in the atmosphere accessible to plants?

85) What is biological nitrogen fixation?

86) How much of the nitrogen that's in the biochemical cycle of nitrogen in an ecosystem comes from biological nitrogen fixation (assume no human inputs)?
   a. 10%
   b. 20%
   c. 50%
   d. 90%

87) Legumes (plants in the pea family) can often have nodules in their roots where rhizobia live. These rhizobia provide the plant with a usable form of nitrogen, and the plant provide the rhizobia with other nutrients and carbon. What type of relationship is this?
   a. Mutualism
   b. Predation
   c. Competition
   d. Amensalism

88) Legumes can kick out the rhizobia when they are not needed. In what type of environment might you expect higher levels of root nodules?

89) Would you expect a grassland that burns annually or one the burns once every ten years to have a higher presence of root nodules?

90) How might the human use of fertilizers impact the presence of root nodules?