Rangeland Plant Ecophysiology **Name:**
EXAM 3, REWM 3500, Fall 2009

Multiple choice. Circle the letter corresponding to the single most correct answer for each of the following. [2 points each]

1) The immediate impact of reduced canopy leaf area with foliar herbivory includes a reduction of canopy photosynthesis. But the reduction in canopy photosynthesis often is NOT proportional to the amount of leaf area lost to the herbivore because of:

a) the compensatory photosynthetic responses of remaining leaves
b) a change in the microclimate of remaining leaves
c) preferential loss of new leaves rather than old leaves
d) none of the above
e) all of the above

2) Grass leaves often produce distinctively shaped silica bodies in their epidermis that confer some level of grazing resistance. These silica bodies are called:

a) spines
b) opal phytoliths
c) awns
d) vascular bundles
e) none of the above

3) Grazing tolerance mechanisms are those that:

a) reduce the probability or severity that a plant is grazed
b) allow for persistence with grazing, either by avoidance or resistance
c) dampen the large-scale ecosystem effects of grazing
d) increase a plant's capacity to recover from the loss of foliage
e) alter the microclimate feedbacks on a grazed plant

4) Grazing avoidance mechanisms are those that:

a) reduce the probability or severity that a plant is grazed
b) allow for persistence with grazing, either by grazing tolerance or resistance
c) dampen the large-scale ecosystem effects of grazing
d) increase a plant's capacity to recover from the loss of foliage
e) alter the microclimate feedbacks on a grazed plant

5) Complete compensation of grassland production to grazing pressure occurs when the:

a) cumulative total weight of the grazed plants exceeds that of non-grazed plants
b) amount of carbon reserves used for regrowth equals the amount of foliage removed
c) cumulative total weight of the grazed plants is lower than that of non-grazed plants
d) amount of photosynthesis equals the amount of foliage grown after leaf removal
e) cumulative total weight of the grazed plants equals that of non-grazed plants

6) From your recollection of the Bilbrough and Richards (1993) study discussed in lecture, which one of the following shrub species overcompensated in growth when shoot tissue was removed:

a) *Purshia tridentata* (antelope bitterbrush)
b) *Larrea tridentata* (creosote bush)
c) *Ambrosia dumosa* (white bursage)
d) *Artemisia tridentata* (big sagebrush)
e) *Atriplex confertifolia* (shadscale saltbush)

7) Which one of the following represents an important type of interference competition?

a) mutualism
b) facilitation
c) allelopathy
d) amensalism
e) parasitism

8) The interaction between *Agave deserti* seedlings and *Hilaria rigida* bunchgrasses in the Mojave Desert is one of:

a) facilitation
b) mutualism
c) predation
d) amensalism
e) parasitism

9) Xylem-tapping mistletoe plants that extract water and nutrients directly from the tissues of their host plants, but are capable of their own photosynthesis are known as:

a) holo-parasites
b) partial consumers
c) hemi-pathogens
d) partial predators
e) hemi-parasites

10) Of the approximately 400 million hectares of rangeland in the U.S., about what percentage is infested with noxious weeds?

a) 2.5 %
b) 5 %
c) 12.5 %
d) 25 %
e) 50 %

11) One teragram (Tg) is 10^{12} grams. The natural background rate of nitrogen fixation from the atmosphere at a global level is approximately:

a) 0.011 Tg of N per year
b) 0.11 Tg N per year
c) 11 Tg N per year
d) 110 Tg N per year
e) 1,100 Tg N per year

12) The current rate of anthropogenic nitrogen fixation from the atmosphere at a global level is:

a) one tenth of background levels
b) one half of background levels
c) now equal to background levels
d) slightly higher than background levels
e) more than twice background levels

13) Which of the following is the largest contributor of anthropogenic nitrogen fixation at a global level?

a) coal burning power plants
b) the Haber-Bosch process
c) planting of leguminous crops like soybean
d) hydroelectric power plants
e) gasoline engine exhaust from automobiles

14) From the McDowell et al. 2008 paper on tree die-off, you learned that an isohydric plant is one that:

a) reduces stomatal conductance during daytime to maintain a high leaf water potential
b) comes into energy equilibrium with soil water on a nightly basis
c) maintains a constant leaf fresh weight and water content
d) allows the leaf water potential to decline over time as soil dries
e) is less likely to die of carbon starvation during drought compared to an anisohydric plant

15) The Blumenthal et al. 2008 paper on weedy plant invasion in mixed-grass prairie found that:

a) elevated CO_2 allowed the invasive species to compete successfully for limited nitrogen
b) high soil moisture reduced the success of invasive species
c) summer irrigation alone accounted for the successful establishment of dalmation toadflax
d) nitrogen addition had no impact on any invasive species, with or without added snow
e) added snow increased germination, establishment and growth of invasive species

16) The Briggs et al. 2005 paper on shrub encroachment presented findings showing that:

a) a 4-year fire return interval enhanced shrub establishment compared with annual burning
b) annual fire enhanced shrub establishment compared to less frequent burning
c) nitrogen addition greatly increased regrowth of burned shrubs
d) grazing suppressed shrub expansion into grassland

Short answer

17) List three grazing tolerance mechanisms in grasses. **[6 points]**

18) List three grazing avoidance mechanisms in grasses. **[6 points]**

19) List three intrinsic and three extrinsic processes that influence the compensatory growth response to grazing. Label each as either “intrinsic” or “extrinsic.” **[6 points]**

20) Explain clearly how the expansion of agricultural land devoted to growing leguminous crops (such as soybean used to make tofu) is linked to the growth of greenhouse gas concentrations in the atmosphere. **[8 points]**

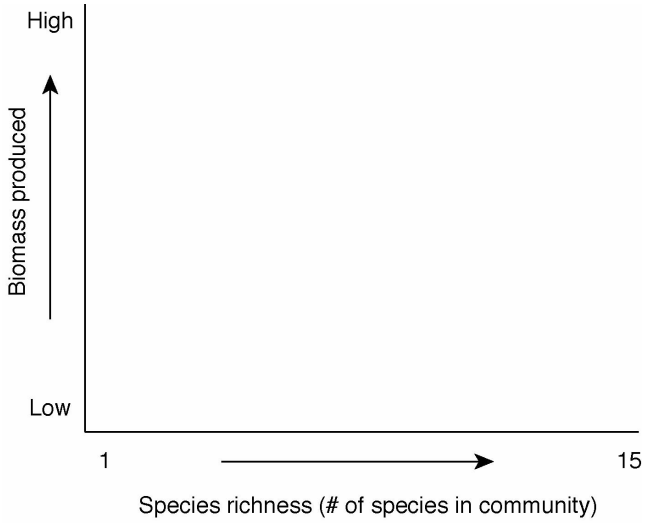
21) Clearly describe the three **{physiological?}** hypotheses offered in the McDowell et al. 2008 article that explain drought-induced tree die-off. **[8 points]**

22) Describe three ways in which invasion by non-native plants can alter ecosystem processes or dynamics and give a clear and specific example for each. **[6 points]**

23) List and describe the **(three main hypotheses??)** or causes that have been proposed to explain the ecological success of non-native plant invaders. **[9 points]**

24) It was thought for many years that the amount of reserve carbon (stored carbohydrates) in grasses was a good predictor of regrowth potential after defoliation. Provide an argument contrary to this assertion and present evidence supporting your argument. **[6 points]**

25) On the graph below, draw a curve for the relationship between biomass production and plant species richness (diversity). Underneath the graph, *name* and clearly *explain* the two hypotheses discussed in class to account for this relationship. **[7 points]**



26) In your opinion, what was the single most important concept (**not covered on today's exam**) introduced this semester in REWM 3500? Why did you choose this concept? What is the direct application of this concept to management of rangeland, forest, or wildlife resources? **[6 points]**