

EXAMINATION #3

[Note: You are given several choices for questions to answer. If you answer more than the required number, I will only grade as many as you were supposed to answer -- any additional answers will not be graded.]

Part I: Identification. Briefly define 5 of 6 (4 points each for a total of 20 points)

1.1 Histisol

1.2 Return Interval

1.3 Photo-inhibition zone

1.4 Thinning stage

1.5 Alpha diversity

1.6 Nitrate Reductase

Part II. Short Answers. Answer 7 of 9 (6 points each for a total of 42 points).

2.1 What are the major mechanisms that have been proposed to account for successional change in community composition and how do they differ?

2.2 What are the major similarities and differences in the symbiotic strategies land plants have developed to aid in the uptake of soil N and P?

2.3 List and define each of the Raunkier life form guilds for plants, and give an example of each.

2.4 Describe two equilibrium mechanisms that can account for species richness patterns over ecological time scales.

2.5 Describe three non-equilibrium mechanisms that can account for species richness patterns over ecological time scales.

2.6 Why do gardeners often add chopped Sphagnum peat to improve plant growth in sandy soils, even though this peat has very low nutrient levels?

2.7 Diagram the major ways that communities have been thought to be organized by showing how their composition varies along a given environmental gradient.

2.8 Show the chemical equations that are vital in describing the global atmospheric Carbon cycle.

2.9 Why are terrestrial ecosystems most often limited by Nitrogen, while aquatic systems are most often limited by Phosphorus?

### Part III. Problem Sets.

3.1 A series of 1x1 meter sample quadrats are placed in a Sphagnum bog in northern Langlade County. A few of these are sealed off, and the atmospheric chemistry inside of them is measured. The yearly levels of energy flux from sunlight on this bog is 1.2 million kcal per square meter. By monitoring the change in CO<sub>2</sub> levels, it is estimated that during an average growing season 9500 kcal of energy in the form of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> is accumulated by the vegetation in this quadrat. By measuring fluctuations in nighttime CO<sub>2</sub> levels, it is estimated that, on average, 8700 kcal of energy per year is released

through respiration. The rare Freija Fritillary butterfly lives on the vegetation found in this bog. On average, this species consumes 2000 kcal of vegetation per year per quadrat. During this time, it releases 700 kcal per year in the form of feces and 200 kcal per year in the form of urine. At the end of each year, 60 kcal of energy has been stored as butterfly biomass, and 15 kcal has been provided to butterfly reproduction.

From this data calculate:

A. GPP efficiency (3 pts)

B. Production efficiency of the Freija Fritillary (3 pts)

C. Consumption efficiency of the Freija Fritillary (2 pts)

D. Lindeman's efficiency between the vegetation and the butterfly (hint: plant assimilation is equal to what?) (3 pts)

3.2 The vegetation of these quadrats is also identified. A total of five species are recorded, and their abundances measured:

Leatherleaf	20
Cranberry	17
Pitcherplant	2
Cottonsedge	22
Bog Rosemary	7

A. Do you think the Probability Theory or Information Theory indices will have the highest heterogeneity? Defend your answer! (4 pts)

B. Now, test your hypothesis. Calculate heterogeneity for this sample using both indices. Was your prediction correct? (8 pts)

Part IV. Longer essay. Answer 1 of 2 (15 points)

4.1 Even though the same genera of forest trees are found in eastern North America and eastern Asia, the richness of tree species in Asian forests is at least five times greater. Propose a series of hypotheses that could help explain this pattern, and defend each.

4.2 Given the information you now know about global biogeochemical cycles, discuss those which you feel most significantly impact Brown County terrestrial systems. Do the same for Brown County aquatic systems. Defend your answers, and suggest ways in which these impacts can be mitigated.