Environmental Science 362-302 Name_____

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 Thinning Phase

1.2 Chamaeophyte

1.3 John Curtis

1.4 Facilitation

1.5 Cation-exchange capacity

1.6 Denitrification

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

2.1 What is meant by exogeneous vs. endogeneous disturbance regimes? How might the frequency of the four main stages of succession differ between communities effected by them?

2.2 The number of nitrogen-fixers in native Wisconsin grasslands has apparently fallen over the last 50 years. How this might be the result of human alternations to the Nitrogen cycle?

2.3 Provide at least three reasons why are tropical forest communities more species rich than Wisconsin forests.

2.4 Graphically represent, using the theory of Island-Biogeography, what may happen to species richness of a forest if habitat size is drastically reduced due to deforestation.

2.5 Soil communities (made primarily of small invertebrates) often have up to 8 trophic levels, starting with the smallest decomposing bacteria and ending with the largest predatory beetles and spiders. The above-ground communities in the exact same place will have no more than 4 (and usually only 3) trophic levels. What differences in the basic energetics of these communities could account for this difference?

2.6 You are given a bottle of radioactively-labeled CO2. How could you use it to measure NPP in a grassland community? (Yes, I mean NPP here!)

2.7 Diagram how species distributions tend to change along a wet-dry environmental gradient in the sand prairies of Illinois (where Gleason did his research) vs. the prairie-forest boundary along the Platte River near Lincoln, Nebraska (where Clements did his research). How did these lead to different views of community structure?

2.8 Draw and label a soil profile for a typical northern Wisconsin (pine forest) and a typical southern Wisconsin (prairie) habitat. How do they differ, and why?

2.9 Diagram the chemical processes that have allowed the Finger Lakes of central New York (underlain by calcareous shale & limestone) to maintain constant water acidity, even though lakes in the Adirondacks a hundred miles to the north (underlain by granite) have had their acidity increase, even though both are being exposed to pH 4 rainwater.

Part III. Problem Sets.

1. You mark out a $1m^2$ meter quadrat at the dunes at Point Beach State Forest. During a given year, approximately 1.2 million kcal of sunlight strikes this area. Using various techniques, you discover that 85,200 kcal in plant biomass is accumulated per year in this quadrat. Living in this quadrat are isopods that have been shown to have an ecological (production) efficiency of 25%. In this quadrat over the course of a year, 900 kcal in isopod body mass increase and 1000 kcal in reproduction was recorded. The amount of energy loss from feces and urine for these isopods was determined to be 7250 kcal. The isopods are eaten by predatory Carabid Beetles, which were found to accumulate 1504 kcal in assimilation energy per year in the quadrat.

For this system, calculate:

NPP efficiency (2 pts)

Consumption efficiency of the isopods (5 pts)

Lindeman's efficiency between the isopods and Carabid Beetles (2 pts)

2. Following is data on species abundance for two Tamarack wet forests faunas. Using both heterogeneity indices, determine if one has clearly greater evenness than other? If your answer is 'no', give me some possible reasons why. (14 points)

Battle River

Beltrami County Location: 94.5240 W., 48.0325 N.
Habitat Type: Wet, acidic Tamarack-White Cedar wetland with abundant Sphagnum.

Carychium exiguum	162	Euconulus alderi	10
Gastrocopta tappaniana	27	Vertigo elatior	10
Nesovitrea electrina	19	Striatura milium	2
Punctum minutissimum	13	Vertigo nylanderi	2

Tamarack Lake 1
Clearwater County Location: 95.4492 W., 47.4363 N.
Habitat Type: Very wet Tamarack, Alder, Bog Birch swamp forest.

Carychium exiguum	45	Catinella avara	4
Nesovitrea electrina	25	Vertigo elatior	4
Gastrocopta tappaniana	10	Euconulus alderi	1
Striatura milium	7		

Part V. Short Essay. Answer 1 of 2 (15 points) on back of page.

5.1 One of the great debates in conservation biology over the last 2 decades is whether more species will be protected if a single large area is protected vs. proteceting many smaller areas that sum to the same total size. Considering our class discussions of species richness, give me your thoughts about this debate. In particular, suggest situations in which each of these approaches would protect the greatest number of species, and why.

5.2 One of the greatest problems facing biodiversity currently is the threat of rapid climate change due to global warming. Assuming for the moment that such changes will occur, suggest strategies that might need to be taken to help maintain biodiversity in nature reserves. Defend your suggestions using ideas we've talked about over the semester!