

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

- Nitrogen is essential component of proteins and is important for growth and reproduction of living organisms. Although nitrogen is the most abundant gas in the atmosphere, it is in a form (N_2) not available for plant to uptake. To enter the ecosystem, global nitrogen cycle involves several biological processes. Please (a) explain each process: N_2 Fixation, Ammonification, Assimilation, Nitrification, Denitrification (3% each, total 15%).

Human activities have dramatically changed the rates of nitrogen deposition. Please (b) give an example of possible sources, the pattern of changes and the ecological consequences. (5%)
- Processes that regulate biodiversity are fundamental questions in ecology. David Currie of the University Ottawa investigated the relationship between number of species and several environmental factors in North America. He observed following patterns, where each point represented a quadrat with richness estimated from public resources. How would you explain the relationships between potential evapotranspiration and species richness? (7%) Why does it differ among taxonomic groups? (8%)

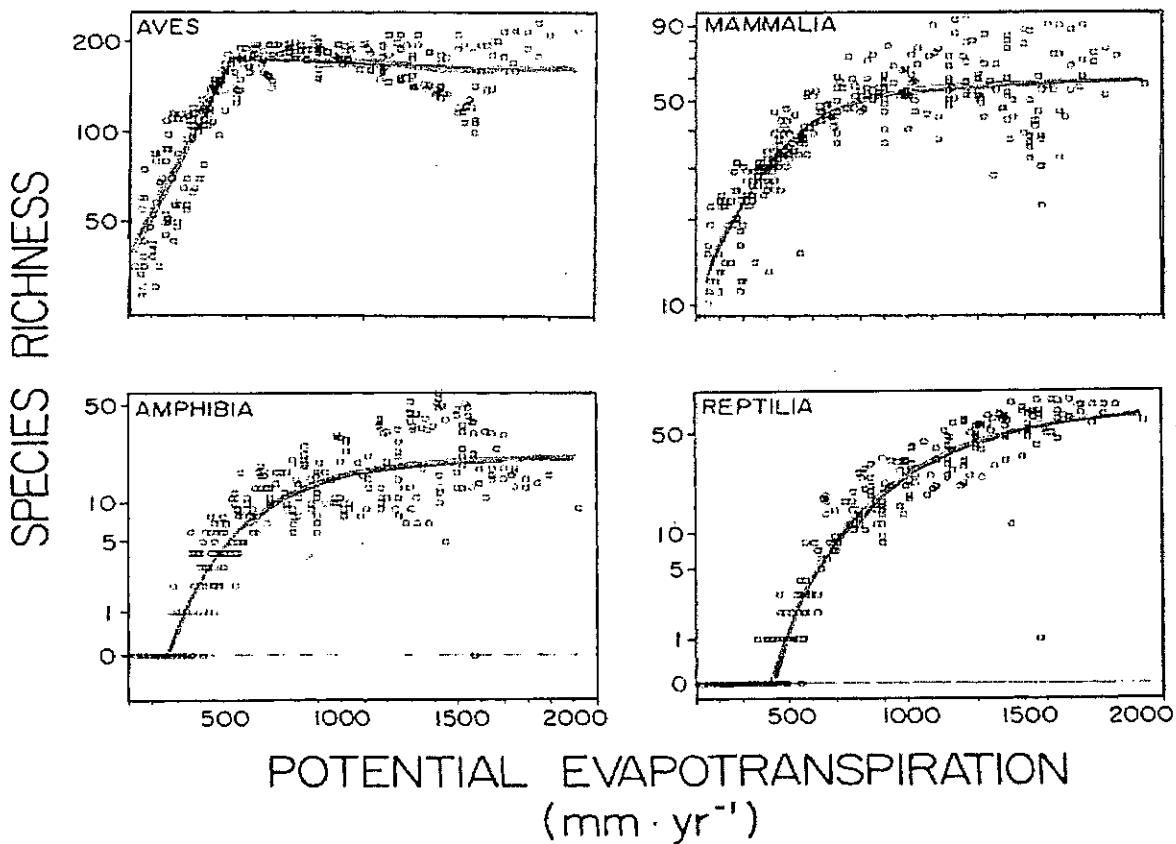


Figure 1. Relationship between potential evapotranspiration and species richness for birds, amphibians, mammals and reptiles in North America. (Currie 1991)

3. Channeled applesnail (*Pomacea canaliculata*) is one of the worst invasive freshwater gastropod mollusk around many places including Taiwan. One obvious sign of their presence is the notorious egg masses that are bright pink or orange in color.
Put forward 3 potential biological functions of the color of eggshell. (3%)
Design some experiments to test the most plausible hypothesis. (7%)
4. Flagship species is a famous or popular species used as the focus of conservation marketing campaign. Discuss the pros and cons of flagship species on environmental protection and conservation. (10%)
5. Discuss the ecological impacts of overdraft of ground water and construction of dams across flowing rivers. (10%)
6. Explain (a) what phenotypic plasticity (PP) is? (3%)
(b) Why PP is related to ecology of any particular species? (4%)
(c) How PP can be proved or disproved present experimentally? (5%)
7. Distinguish (a) density-dependent (DD) vs. density-independent (DI) population regulation. (6%)
Discuss (b) whether and how DD and DI may be generally correlated with the ecology and life history of organisms, using two factors that you can think of? (6%)
8. Exploration is an important behavioral trait. Discuss whether more exploratory organisms (or their populations) may aid to range expansion or invasion of species, and why or why not? (6%)
9. Give an example of “trophic cascade” and discuss its significances for community structure. (5%)