I. Multiple choices (2 points each)

1. A biome is characterized primarily by

A. flora and fauna. B. temperature and moisture.
C. climate and predominate plant types. D. global weather patterns.
E. none of the above.

2. When an organism becomes acclimated to a new environmental situation, the process will generally involve

A. physiological changes.
B. genetic changes.
C. sociological changes.
D. both physiological changes and genetic changes.
E. both genetic changes and sociological changes.

3. Water movement in a terrestrial plant is

A. from less negative water potential to a more negative water potential.
B. from more negative water potential to a less negative water potential.
C. from less positive water potential to a more positive water potential.
D. from zero water potential to a more negative water potential.
E. from zero water potential to a more positive water potential.

4. Herbivores, carnivores, and detritivores are all

A. omnivores. B. autotrophs. C. animals.
D. browsers. E. heterotrophs.

5. The _____ defines the physical conditions under which a species might live, in the absence of interaction with other species.

A. functional niche B. realized niche C. principle niche
D. fundamental niche E. primary niche

6. In a _____ distribution, individuals have a much higher probability of being found in some sites than in others.

A. regular B. clumped C. uniform
D. random E. partitioned

7. Which of the following cannot be determined using a fecundity schedule combined with a life table?

A. per capita rate of increase B. net reproductive rate
C. mean generation time D. dispersal rates
E. geometric rate of increase

8. In the logistic model of population growth if r (realized per capital rate of increase) <0 then

A. the population expands. B. the population declines.
C. $N>K$ D. $N=K$
E. both the population declines and $N>K$

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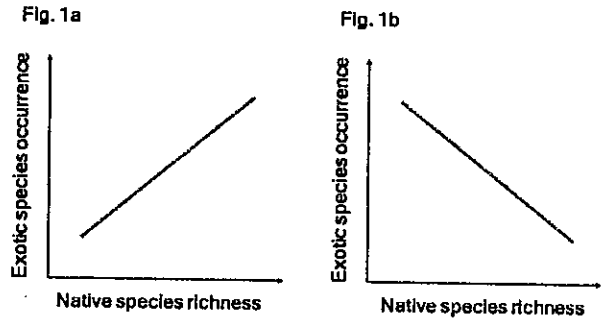
9. Because natural selection shapes fish life history traits, one could expect that
A. fish species with high adult mortality tend to mature at a younger age.
B. fish species with high adult mortality tend to mature at an older age.
C. fish species with high adult mortality tend to invest relatively large amounts of energy in reproduction.
D. Both fish species with high adult mortality tend to mature at a younger age and fish species with high adult mortality tend to invest relatively large amounts of energy in reproduction are true.
E. Both fish species with high adult mortality tend to mature at an older age and fish species with high adult mortality tend to invest relatively large amounts of energy in reproduction are true.

10. Which of the following environments for germinating seed is most likely to favor a plant species that makes many small seeds, compared to one that makes fewer larger seeds?
A. nutrient limitation
B. competition from established plants
C. shade
D. deep burial in soil
E. disturbance

II. Explain the following terms (3 points each)
11. equilibrium model for island biogeography
12. biogeochemical cycle
13. competitive exclusion principle
14. keystone species
15. succession
16. resilience
17. metapopulation
18. concept of sustainable development
19. phenology
20. bioremediation

III. Short answer questions (10 points each)
21. A) Please explain "biotic resistance hypothesis" and its implication in biodiversity conservation. B) The relationship between native species richness and exotic species establishment is often positive in observational studies (Fig. 1a) but negative in experimental studies (Fig. 1b). Which figure (1a or 1b) will support the biotic resistance hypothesis? What factors may explain the different results between observational and experimental studies?



22. A) Please define top-down control, bottom-up control, and trophic cascade. B) Sambar deer (水鹿) in Taiwan browse shoots of mountain plants (Fig. 2a). If the restoration of black bears (黑熊) in Taiwan is successful, you may observe the pattern of Fig. 2b. Based on the results, please explain how black bears may directly and indirectly (e.g., trait-mediated effect) affect deer and then influence plants.

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Fig. 2a

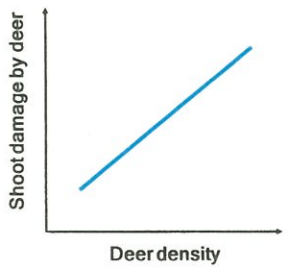
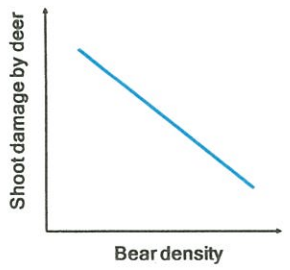


Fig. 2b

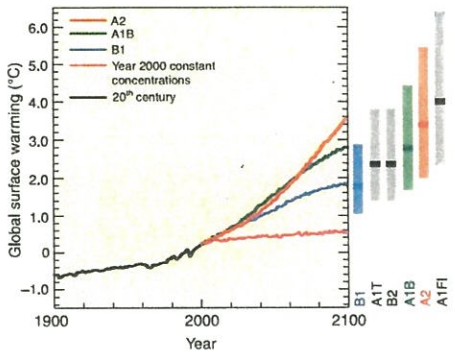


23. A) The Millennium Ecosystem Assessment report (2005) defines four categories of ecosystem services. Please explain which category is more related to the service provided by pollinators (e.g., bees and butterflies)? B) Bee colony collapse disorder (CCD) has been reported worldwide. Please provide at least four causes that have been proposed by the scientific community.

24. After the invasion of *Bidens pilosa* var. *radiata* (大花咸豐草) in Taiwan, some native plants become less abundant in invaded habitats. Based on the observation, please A) list your hypothesis, and B) design an experiment to test your hypothesis.

25. A) Please define phenology and functional traits. B) Global temperature has increased over the past few decades and will continue to rise this century (Fig. 3 by IPCC). Numerous studies have documented that this climate warming affects many plant and animal communities in different regions. Please describe how species have changed in ranges (space), phenology (time), and body size (functional trait) in response to climate warming.

Fig. 3 (IPCC)



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