Choose the **ONE** alternative that best completes the statement or answers the question. Please mark down the question number in your examination sheet. Each question has 5 points for a total of 100 points. Good luck.

In salt marshes along U.S. southeast coasts, the marsh snail *Littoraria irrorata* is commonly occurs at densities ranging from 40 to 500 individuals per m^2. Long thought to be strictly a detritivore, recent research has shown that *Littoraria* actively grazes live salt marsh cordgrass, *Spartina alterniflora*. When grazing live plants, however, snails do not consume live tissue directly; instead, they create and maintain longitudinal wounds on the leaf surface with their radulae and feed on the senescent material surrounding those wounds. Microscopic examination of injured leaves indicates that ascomycete fungi, the snails' preferred food, are more abundant in snail-maintained wounds than on green leaf surfaces and fungi dominate the microbial communities that invade radulated *Spartina* leaves. Field observations also suggest that snails concentrate deposition of nitrogen- and hyphae-rich fecal pellets on fungus-invaded wounds. [*Littoraria* feces are typically dense with fungal hyphae, and snails digest only ≈50% of the mycelium they consume].

1. Marsh snail *Littoraria irrorata* is also considered a
   a. herbivore
   b. carnivore
   c. omnivore
   d. autotroph

2. A redula (*pl.* redulae) is close to which of the following organ of mollusk?
   a. nail
   b. tongue
   c. hand
   d. foot

3. The relationship between Marsh snail *Littoraria irrorata* and ascomycete fungi is
   a. *Littoraria* promote fungal growth on live *Spartina* plants.
   b. *Littoraria* compete with fungi on live *Spartina* plants.
   c. *Littoraria* contaminate fungi on live *Spartina* plants with its fecal pellets.
   d. *Littoraria* reduce fungal growth on live *Spartina* plants by grazing.

Northern giant petrels (*Macronectes halli*) are among the largest and most sexually size dimorphic species of seabirds, with females being only 80% the mass of males. Both sexes scavenge on seal and penguin carrion in the sub-Antarctic ecosystem, but during the breeding season females also feed extensively on other marine food resources and show more pelagic habits than males. The outstanding sexual segregation in foraging and feeding ecology in northern giant petrels suggests that mechanisms maintaining sexual size dimorphism by ecological factors may be operating. I evaluated this possibility by examining ecological correlates with body size and by static allometry analyses. Fledging sex ratio in four consecutive years did not depart from parity. There was no assortative mating by size neither association between the male size with the breeding performance. By contrast, smaller females raised their chick in better condition. Moreover, bill size showed a size dimorphism beyond that expected by body size dimorphism, i.e. when controlling for body mass, males showed relatively longer bill

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than females. This trait did not deviate from isometry with respect to body size and its phenotypic variability was low, suggesting that the disproportionately large bill of males is related to their more scavenging life style compared to females.

4. Northern giant petrels (*Macronectes halli*) breed in the sub-Antarctic area. The zone in which they breed most often would be
   a. between 35°and 45°S
   b. between 45°and 55°S
   c. between 55°and 65°S
   d. between 65°and 75°S

5. In this study body size of male or female northern giant petrel was more likely to be significantly related to
   a. fledging sex ratio
   b. mating success
   c. chick condition
   d. pelagic habits

6. The most plausible explanation of the sexual size dimorphism in northern giant petrel would be
   a. a result of sexual selection
   b. an ecological causation
   c. difference in nutritional quality at fledging stage
   d. living in a sub-Antarctic ecosystem

Seeds dispersed by tropical, arboreal mammals are usually deposited singly and without dung or in clumps of fecal material. After dispersal through defecation by mammals, most seeds are secondarily dispersed by dung beetles or consumed by rodents. In a series of three experiments with seeds of 15 species in central Amazonia, we found that, on average, 43% of seeds surrounded by dung were buried by dung beetles, compared to 0% of seeds not surrounded by dung. Seeds in dung, however, tended to be more prone than bare seeds to predation by rodents. Of seeds in dung, probability of burial was negatively related to seed size and positively related to amount of dung. Burial of seeds decreased the probability of seed predation by rodents three-fold, and increased the probability of seedling establishment two-fold. Mean burial depth was 4 cm (0.5–20 cm) and was not related to seed size. Probability of seedling establishment was negatively correlated with burial depth and not related to seed size at 5 or 10 cm depths.

7. In this study, dung beetles are considered to disperse seeds secondarily. Who, then, are dispersing these seeds primarily?
   a. wind
   b. gravity
   c. mammals
   d. rodent

8. According to the results of this study, which of the following statement is correct?
   a. Seeds in dung buried by dung beetles were more prone than bare seeds to predation by rodents.
   b. Dung beetles would bury more seeds when there is more dung.
   c. Dung beetles preferred to bury large seeds than smaller seeds.
   d. Dung beetles would facilitate seedling establishment most when seeds were buried at 4 cm deep.

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9. According to the results of this study, which of the following statement is incorrect?
   a. The fate of seeds is affected by depth of burial.
   b. The burial depth of seeds is affected by the amount of dung surrounded.
   c. The burial depth of seeds is affected by their sizes.
   d. The fate of seeds is affected both by dung beetles and rodents.

Rattan, Old World climbing palm, is an extremely valuable nontimber forest product whose canes are gathered for both market and nonmarket uses. I evaluated the effects of harvesting commercial rattan, *Calamus zollingeri*, on genet survival and ramet demography in two primary forest sites near Lore Lindu National Park in Sulawesi, Indonesia. I monitored 168 permanently marked *C. zollingeri* genets for 4 years and surveyed random transects for *C. zollingeri* genet and ramet populations and evidence of cane harvesting in 1996 and 2000. Cane harvesting had no significant effect on genet survival or mean ramet densities. However, current cane extraction rates significantly reduced mean cane lengths and total available cane throughout the area during the study period. Based on observed genet and ramet populations and average cane growth rates of 1.4 m/year, the sustained-yield harvesting potential of *C. zollingeri* is approximately 101 m and 56 m/ha/year in the two study sites. Although *C. zollingeri* exhibits life-history traits well suited to sustained-yield harvesting, including production of multiple canes, cane resprouting following harvest, rapid cane growth, and widespread abundance below 1100 m, current harvest rates exceed growth and yield, and supplies of cane are being depleted.

10. In this report, which of the following parameters of rattan is affected by harvesting?
   a. density
   b. growth rate
   c. size
   d. survival

11. Which of the following may be a factor causing the unsustainable harvesting of rattan?
   a. Rattan cane resprouting following harvest
   b. Rattan cane grow rapidly
   c. Rattan's high market value
   d. Rattan's wide distribution.

With the end of commercial whaling, it was thought that populations of the highly endangered North Atlantic right whale (*Eubalaena glacialis*) would gradually recover. However, recent modeling studies have shown that the population's growth rate increased gradually during the 1980s, but began declining in the early 1990s, when female mortality rates increased substantially. Demographic projections predict that, assuming birth and mortality rates remain comparable to those observed in the early 1990s, the population will become extinct in less than 200 years. Further extrapolations suggest that reducing mortality rates by a few female deaths per year through conservation efforts would be sufficient to support a slow recovery of the population. However, the effects of climate variability and change on calving rates may make the North Atlantic right whale even more vulnerable than previous projections have suggested. Failure to incorporate the effects of climate in demographic projections may lead us to underestimate the conservation efforts required to ensure recovery of this whale population.

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12. What is the main idea of this paragraph?
    a. Discuss the results of a modeling study and population estimate of the North Atlantic right whale
    b. Discuss the impact of commercial whaling on the right whale
    c. The effects of climate pattern in the right whale's conservation program is important
    d. Discuss the history of commercial whaling

13. According the paragraph, what is correct about the North Atlantic right whale?
    a. It is not an endangered species
    b. The genus name for this species is *glacialis*
    c. Studies have shown that the population of this species has steadily increased
    d. Biotic and abiotic factors are important for its conservation

14. According to the paragraph, researches on the North Atlantic right whale are largely based on
    a. Simulation modeling
    b. On-site observation
    c. Catching data
    d. Correlation

Road removal is being used to mitigate the physical and ecological impacts of roads and to restore both public and private lands. Although many federal and state agencies and private landowners have created protocols for road removal and priorities for restoration, research has not kept pace with the rate of removal. Some research has been conducted on hydrologic and geomorphic restoration following road removal, but no studies have directly addressed restoring wildlife habitat. Road removal creates a short-term disturbance which may temporarily increase sediment loss. However, long-term monitoring and initial research have shown that road removal reduces chronic erosion and the risk of landslides. We review the hydrologic, geomorphic, and ecological benefits and impacts of three methods of road removal (i.e., ripping the roadbed, restoring stream crossings, and full road recontour), identify knowledge gaps (such as baseline data, meta-analysis to predict expected outcomes, monitoring after intervention, addressing the impacts of road removal at different spatial scales, quantifying the benefits of road removal on aquatic, riparian, and terrestrial ecosystems), and propose questions for future research, which is urgently needed to quantify how effectively road removal restores these habitats and other ecosystem processes.

15. Which of the following statement is correct?
    a. Road removal is not essential for conservation
    b. Current research is adequate to solve the restoration problem of road removal
    c. There are many methods for road removal and each has ecological benefits and impacts
    d. Road removal is always helpful

16. What is meta-analysis?
    a. An overview analysis of many studies
    b. A statistical approach
    c. An analysis based on field observation
    d. A study based on experimental design

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Ecosystem management and biodiversity conservation are usually implemented using information of several targeted species or cover-types and usually do not include information about communities. This is not because community-level information is unimportant for management purposes, but because the detailed fieldwork required for gathering community-level information at the scale for ecosystem management is usually impractical. We propose two methods to estimate the geographical distribution of plant communities with the objectives of covering large areas with minimal field efforts. The first method estimates the geographical distribution of plant communities by combining clustering methods with vegetation modeling, and the second extrapolates the geographical distribution of gradients in plant communities by combining gradient analysis with vegetation modeling. A dataset collected at Fushan Experimental Forest, an ILTER site located 40 km southeast of Taipei in Taiwan, was used as a test case. Vegetation modeling with clustering methods can be used to allocate sites with potentially higher alpha diversity, with the benefit of having a list of species associated with the clustered type. Vegetation modeling with gradient analysis can be used to identify regions with potentially the highest beta diversity by means of selecting regions with the widest range or highest variability in major DCA axes scores, and thereby help to preserve the scope of environmental conditions that lead to diversity in species assemblages. This is especially important because biological entities such as species, communities, or even ecosystems may cease to exist in the long run, and the preservation of processes that lead to biodiversity will eventually become more meaningful. We conclude that new methods to study and manage the processes that contribute to biodiversity at all scales should be and can be developed.

17. What is the main idea in the paragraph?
    a. Propose and discuss two approaches to predict spatial distribution of vegetation community
    b. Information for ecosystem management is not important
    c. Spatial distribution of plant can be predicted
    d. Fushan is an ILTER site

18. Biodiversity is always seen to include three levels, which of the following is not included?
    a. Gene
    b. Species
    c. Ecosystem
    d. Biome

19. What's the 'ILTER' stand for?
    a. Long-term Employment Reassurance
    b. International Long-term Ecological Research
    c. Taiwan Ecological Network
    d. Long-term Ecological Research

20. Where is Fushan?
    a. In northwestern USA
    b. In southern Japan
    c. In northeastern Taiwan
    d. In northeastern Korea