

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI  
COLLEGE OF SCIENCE**

**B.Sc. (Biological Sciences, Environmental Science), Semester Two, 2019/2020 Year Four**

**BIOL 452 BIODIVERSITY UTILIZATION & CONSERVATION**

**1a.** Scientists consider *ex-situ* conservation methods as “insurance policy” for biological diversity for the following reasons,

- i. To serve as a complementary means against extinction. They can be conveniently classified according to the part of plant conserved, whole plant or living collection, seeds banks, tissue or generic materials in culture.
- ii. It useful for display and education or research.
- iii. Species take time to reach maturity.
- iv. It protects endangered species, varieties or breed, of plant or animal outside its natural habitat.
- v. It useful for display and education or research.

**1b.** *In-situ* conservation methods such as the creation of national parks, forest reserves, etc. are often preferred to *ex-situ* methods for the following reasons;

- i. This is because it's cheap and convenient way of conserving biological diversity as we play a supportive role only.
- ii. It allows population to maintain itself within the community of which it forms part and in the environment to which it is adapted.
- iii. Allows indigenous species and systems to be protected, thus taking care of the unknowns until such time as methods are found for their investigation and utilization

- iv. Natural selection and community evolution continue and new communities, systems, and material is produced.
- v. It ensures that plants and animals are conserved in their natural environment where biodiversity is protected.

2. What are the main implications of the following theories for the establishment of a forest reserve?

i) Island Biogeography Theory [5points]

ii) Metapopulation Theory [5 points]

i. The numbers of species on an island is determined by the rate of immigration of new species and the rate of local extinction. Therefore, as the number of species on an island increases, niches are filled. This implies that, the population size of each species decreases, where immigration rate equals to extinction rate. Island biogeography is a field within biogeography that examines the factors that affect the species richness and diversification of isolated natural communities. The theory was originally developed to explain the pattern of the species-area relationship occurring in oceanic islands. Island biogeography provides some of the best evidence in support of natural selection and the theory of evolution. The term describes an ecosystem that is isolated by being surrounded by different ecosystems.

**OR**

The number of species on an island is determined by the balanced rate of immigration of new species and the rate of local extinction. This relationship describes migration and extinction of species on their sizes and distance from other species source. The number of species eventually reaches a steady state where immigration equals extinction rate.

ii. Metapopulation are population group of local inhabit patches that have limited interaction with each other and are only linked by immigration or emigration. This theory seeks to emphasize on population size as a result of immigration and emigration of genes where smaller populations are more prone to extinction. The implication of this theory is widely used to predict the importance of connectivity between seemingly isolated population. Metapopulation theory suggests that a species will become extinct in a landscape before the suitable habitat (e.g., refuges) is entirely gone.

**OR**

Metapopulation has patches of population within a large location creating possible links for migration. Large patches accommodate large local groups where the level of connectivity and migration of species between the patches is higher with survival rate and low with extinction rate.

3. The KNUST Botanic Garden is generally considered to be made up of three habitat types due to perceived differences in the composition of the plant species. An ecologists decided to test this hypothesis by collecting data on the plant species present in the garden and determining their diversity using the Whittaker Diversity Index. After analysis of the data, the researcher obtained an index value of 1.4. Use the information provided to answer the following questions:

a) what information does this value give about the number of plant communities or habitats in the Botanic Garden?

It provides a value of the number of different plant community/habitat in the Botanic Garden. Thus, an approximate of 1 plant community. Minimum diversity.

b) the environmental conditions (particularly climate) that prevail in the KNUST Botanic Garden?

Unfavorable climate conditions prevail in the Botanic garden resulting in the loss of species richness from 3 to 1.4 in the plant community. E.g. drought, low humidity and rainfall, light, etc.

c) sensitivity of the species to the prevailing environmental conditions?

Community species have high sensitivity to prevailing harsh climatic conditions, resulting in loss of species habitat.

d) What type/level of biodiversity measurement is the Whitaker Diversity Index, and under what conditions is its use appropriate?

Beta diversity index because it measures average number of species per site.

e) If the use of the Whitaker Diversity Index was not appropriate for the study described above, mention the level of measurement which would have been more appropriate.

Alpha diversity will be appropriate to measure the diversity within a particular area.