

4.3 Ecosystems, populations and succession

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS habitat • population • community • ecosystem
• succession • climax community

Objective

Practise statements 5.11-5.15 with Core Practical 11: habitat, population, community and ecosystem; biotic and abiotic control; predator-prey cycles; sampling methods; and succession from pioneer species to climax community.

1 Key knowledge and worked examples

■ Four terms, one hierarchy

Habitat → **population** (one species) → **community** (all populations) → **ecosystem** (community + abiotic environment). **Biotic** factors: competition, predation, disease. **Abiotic** : light, water, temperature, pH, salinity.

■ Sampling

Quadrats: random placement (grid + random numbers) for percentage cover or frequency; transects for gradients. Animals: **capture-mark-recapture**, $N \approx \frac{n_1 \times n_2}{m}$ where m is the marked recaptures.

■ Succession

Bare ground → pioneers (tolerant of harsh conditions, change the soil) → grasses → shrubs → trees → **climax community**. Each stage makes the next possible.

■ Worked example: mark-recapture

First catch 60 beetles marked; second catch 45 with 12 marked. $N = \frac{60 \times 45}{12} = 225$. Assumptions: marks persist, no births/deaths/migration between catches, marked mix freely – state one in the exam.

2 Practice

2.1 Define the terms community and ecosystem. [2]

2.2 Give one biotic and one abiotic factor that could limit a woodlouse population. [2]

2.3 Name the first organisms that colonise bare ground in succession. [1]

3 Exam-style questions

3.1 A student samples daisies on a school field with twenty 0.25 m² quadrats thrown by hand, finding a mean of 8.4 per quadrat. Describe two weaknesses of this method, how each biases the estimate, and how the student should place quadrats instead. [5]

3.2 The graph of a lynx-hare system shows hare numbers peaking about two years before lynx numbers. Explain the lag between the two peaks, referring to reproduction and starvation. [5]

3.3 A retreating glacier leaves bare rock. Describe the expected succession over 200 years to climax forest, naming the type of organism at each stage and one way each stage changes the conditions for the next. [6]

Solutions

Original-task marking: M1 method, A1 accuracy, B1 reasoning.

2.1 Community: all the populations of different species living together in one area.
Ecosystem: the community together with the non-living (abiotic) environment it interacts with.

2.2 Biotic: predation (e.g. by birds) or competition; abiotic: humidity or temperature.

2.3 Pioneer species.

3.1 Hand-throwing is not random – throwers tend to aim at daisy patches, overestimating; twenty quadrats is a small sample, so chance swings the mean. Correctly: lay a grid, pick coordinates from a random-number table, place quadrat corners at those points.

3.2 Hares rise when vegetation is plentiful; with abundant prey the lynx population grows through reproduction and survival of young – but that takes a breeding season. More lynx then eat hares faster than they breed, so hares decline; lynx numbers fall later by starvation as their food is gone – hence each lynx peak follows its hare peak.

3.3 Lichens and mosses colonise first – they weather rock and build the first soil from dead matter; grasses and herbs follow on the thin soil, adding organic matter and holding water; shrubs then small trees shade the pioneers and deepen soil; climax forest establishes once soil and microclimate are stable – each stage's remains and shade enable the next.