2.5 Zonation, succession and change

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

KEY WORDS zonation • primary succession • secondary succession • pioneer species • climax community • plagioclimax

Objective

Build the skills to answer exam questions on **zonation** and **succession**: primary and secondary succession, pioneer and climax communities, r- and K-strategists, and human disturbance.

You must be able to:

- distinguish zonation from succession
- describe primary and secondary succession, and how soil, biomass and diversity change
- compare r- and K-strategist species
- explain plagioclimax communities and the effects of disturbance

1 Key knowledge and worked examples

Zonation and succession

Zonation is a change in communities **across space**, along an environmental gradient (up a mountain, across a rocky shore). **Succession** is a change in a community **over time** at one place.

succession	starts on	example	speed
primary	bare ground with no soil	new volcanic rock, a retreating glacier	slow (centuries)
secondary	soil already present	abandoned farmland, after a fire	faster

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Stages (**seres**): **pioneer** species (lichens, mosses) → grasses → shrubs → trees → **climax community**. Pioneers break rock and add dead matter, so soil forms; each stage changes conditions so the next species can move in.

during succession	change
soil depth, organic matter, nutrients	increase
biomass, size of organisms	increase
species diversity	increases, may fall slightly at climax
GPP and NPP	rise; at climax respiration ≈ GPP, so NPP is near 0

	r-strategist	K-strategist
offspring	many, small, little care	few, large, much care
life	short, matures early	long, matures late
where	pioneer stages, disturbed land	climax communities

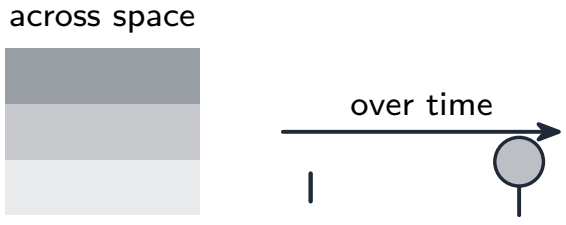
A **plagioclimax** is a community stopped from reaching climax by human activity, e.g. grazed grassland, moorland kept by burning, a mown lawn.

The idea of one fixed climax is debated: disturbance (fire, storms) is normal, and a site may have several possible stable states.

Answer shapes: describe the change, then the reason (what the earlier stage did to soil, light or nutrients).

2 Practice

2.1 Distinguish between zonation and succession. [2]



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2.2 Describe the stages of primary succession on bare volcanic rock. [3]



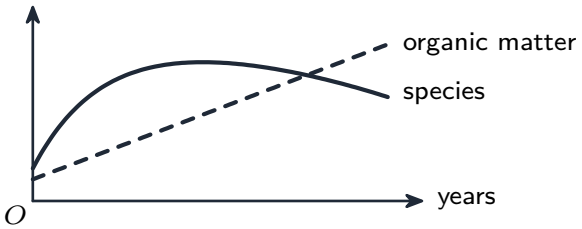
2.3 Heather moorland in Scotland is burned every few years for grouse shooting. Explain why it is a plagioclimax community. [3]



3 Exam-style questions

3.1 The table shows changes during succession on abandoned farmland.

years since abandoned	1	10	50	150
number of plant species	12	35	48	40
soil organic matter (%)	1.2	2.5	4.8	6.1



(a) State the type of succession. [1]

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(b) Describe the changes in the number of species, and suggest a reason for the change after 50 years. [3]

3.2 A dandelion produces thousands of light seeds each year; an oak tree takes 40 years to produce its first acorns.



(a) Classify each as an r- or K-strategist, with a reason. [2]

(b) Explain why r-strategists are common in the early stages of succession. [3]

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3.3 A forest is often burned by natural fires.



Discuss whether the idea of a single climax community is useful for managing this forest. [6]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

zonation: change in communities across space along a gradient; succession: change in the community at one place over time

2.2

pioneers such as lichens and mosses colonize bare rock and start weathering it; dead matter and rock particles form a thin soil, so grasses and small plants can grow; deeper soil allows shrubs, then trees, until a climax community forms

2.3

without burning, succession would continue to woodland (the climax); burning kills young trees and shrubs before they establish; human activity holds the community at an earlier stage

3.1

(a) secondary succession (soil already present)

(b) species rise from 12 to 48 by 50 years, then fall to 40; tall trees shade out smaller plants; a few K-strategist species dominate at climax and out-compete others

3.2

(a) dandelion: r-strategist, many small seeds, matures fast; oak: K-strategist, matures late, few large seeds

(b) they reach new, bare or disturbed land quickly, as many seeds spread widely; they grow and reproduce fast while resources are plentiful and competition is low; later they are out-competed by slower, larger K-strategists

3.3

award up to [6]: useful: gives a target, e.g. the mature forest to protect or restore; helps predict how the forest will recover after a fire; limitations: fire is a normal part of this system, so a patchwork of stages is normal and diverse; some species depend on burned areas; a site may reach different stable states depending on the disturbance; conclusion: manage for a dynamic mosaic (e.g. allow or use controlled burning) rather than one fixed endpoint