

Ecosystems

Ecosystems at a local scale

Section outline

Succession of one ecosystem

The arresting role of physical factors in creating subclimax communities

Role of human factors in maintaining plagioclimax communities

What is succession?

The term describes how plant communities change through time.

Primary succession begins in an area where no plants previously existed.

It begins in a place without soil...

Suggest some examples of such locations

What will conditions be like in these areas?

Plants arrive and some begin to grow...

How do they arrive?

Can all plants that arrive here as seeds survive? Justify your answer.

What will affect which species (spp) do arrive?

What are the spp that can survive in these conditions called? Examples?

What characteristics do they have?

What is succession?

The pioneer plants that colonise these places begin to change the environment...

What aspects of the environment do they change and how do they change them?

Seeds from less specialised plants continue to arrive at the site (as long as they are present nearby), but now they are able to survive in this area.

How is this possible?

These plants tend to be larger and slower growing, with woody stems.

What impact do these plants have on the survival of some of the pioneer spp?

What is succession?

These changes are why succession happens.

Each stage in a succession is called a **seral stage** (sometimes just 'sere').

Each stage will tend to be characterised by certain types of plants.

These are the **dominant spp** and are often used to describe the stage.

Eventually the community stabilises so that it is equilibrium with the area's climate.

This is called the **(climatic) climax community**.

The entire succession from area of no life to climax community is also called a **prisere**.

Types of succession

Priseres have different names depending on the conditions that exist at the start:

Xeroseres – where water is limited, e.g.:

Lithoseres – bare rock (e.g. new volcanic island, landslide...)

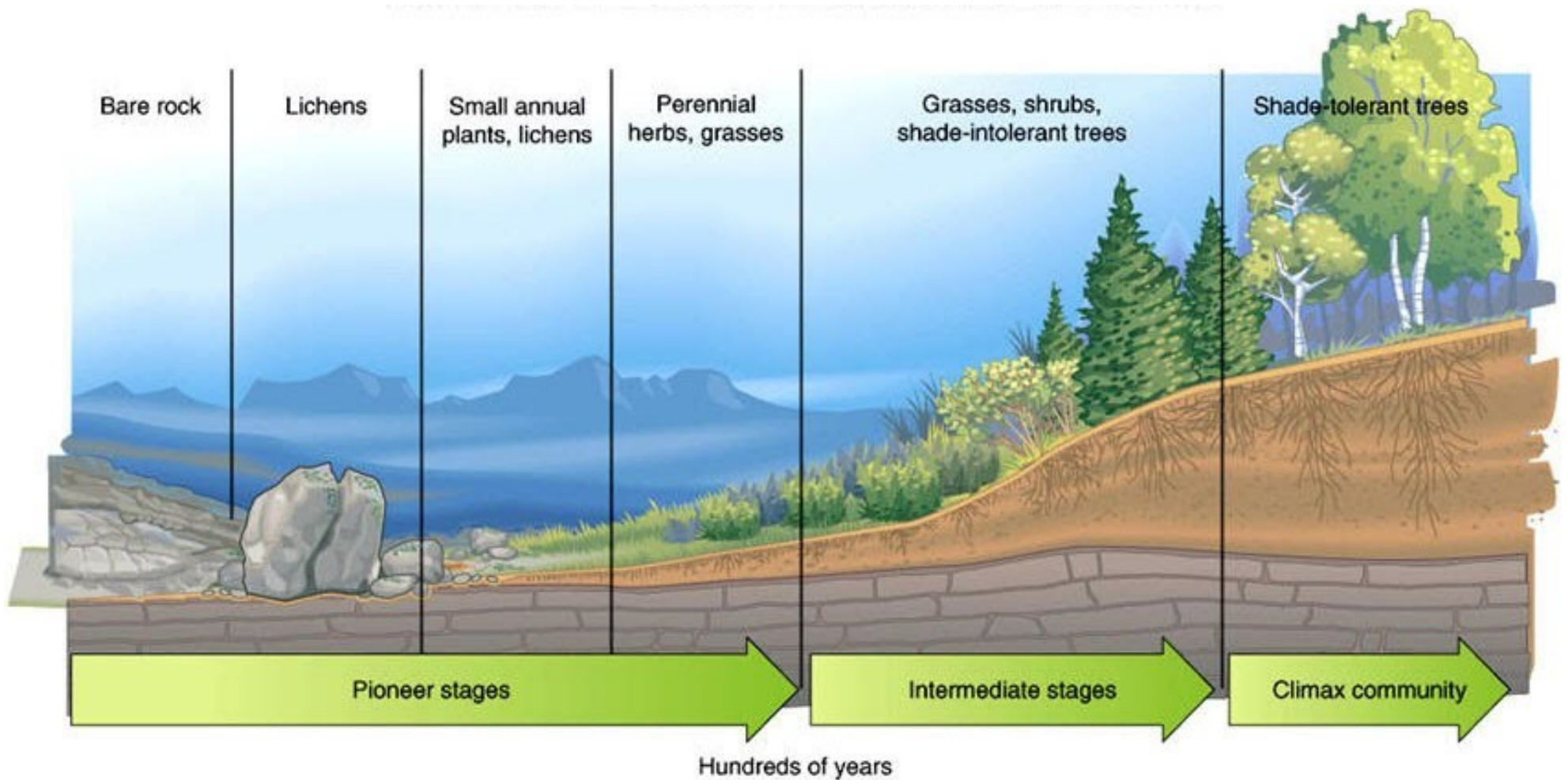
Psammoseres – sandy conditions (i.e. sand dunes)

Hydroseres – where there is plenty of water, e.g.:

Hydroseres – fresh water conditions (e.g. ponds, wetlands)

Haloseres – salt water conditions (i.e. saltmarsh)

Example succession: after a glaciation



Sketch a series of line graphs to show how you think the following change with succession: biomass, biodiversity and NPP

Justify your decision in each case.

A Psammosere: coastal sand dunes

Whilst watching the video, make notes on the following:

- What conditions are needed for coastal sand dunes to develop?
- What changes are observable as succession proceeds? (Flora, soils, microclimate)
- Why do these change, and how are they interconnected?

A Psammosere: coastal sand dunes

What changes are observable as succession proceeds? Why do these change?

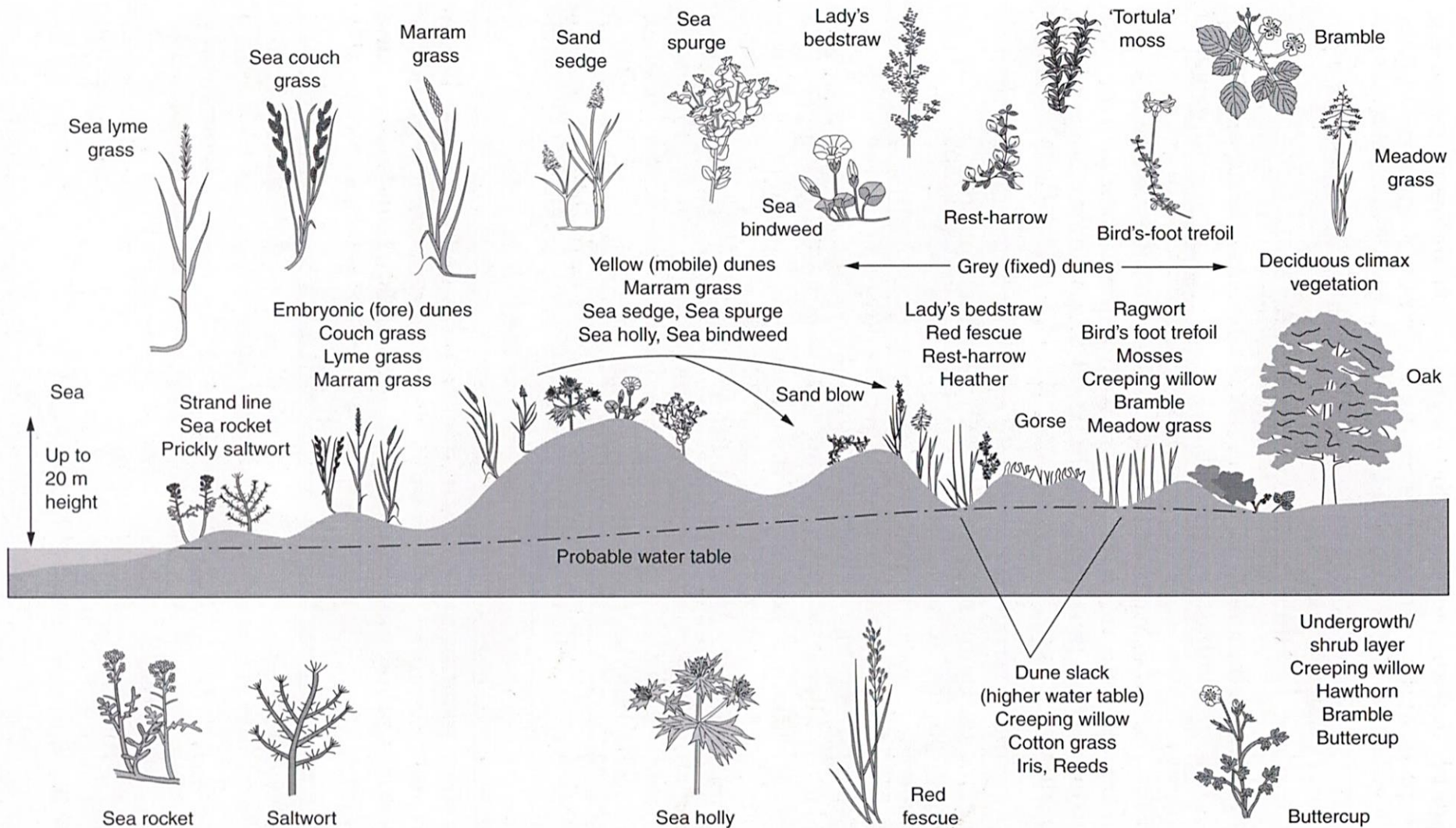
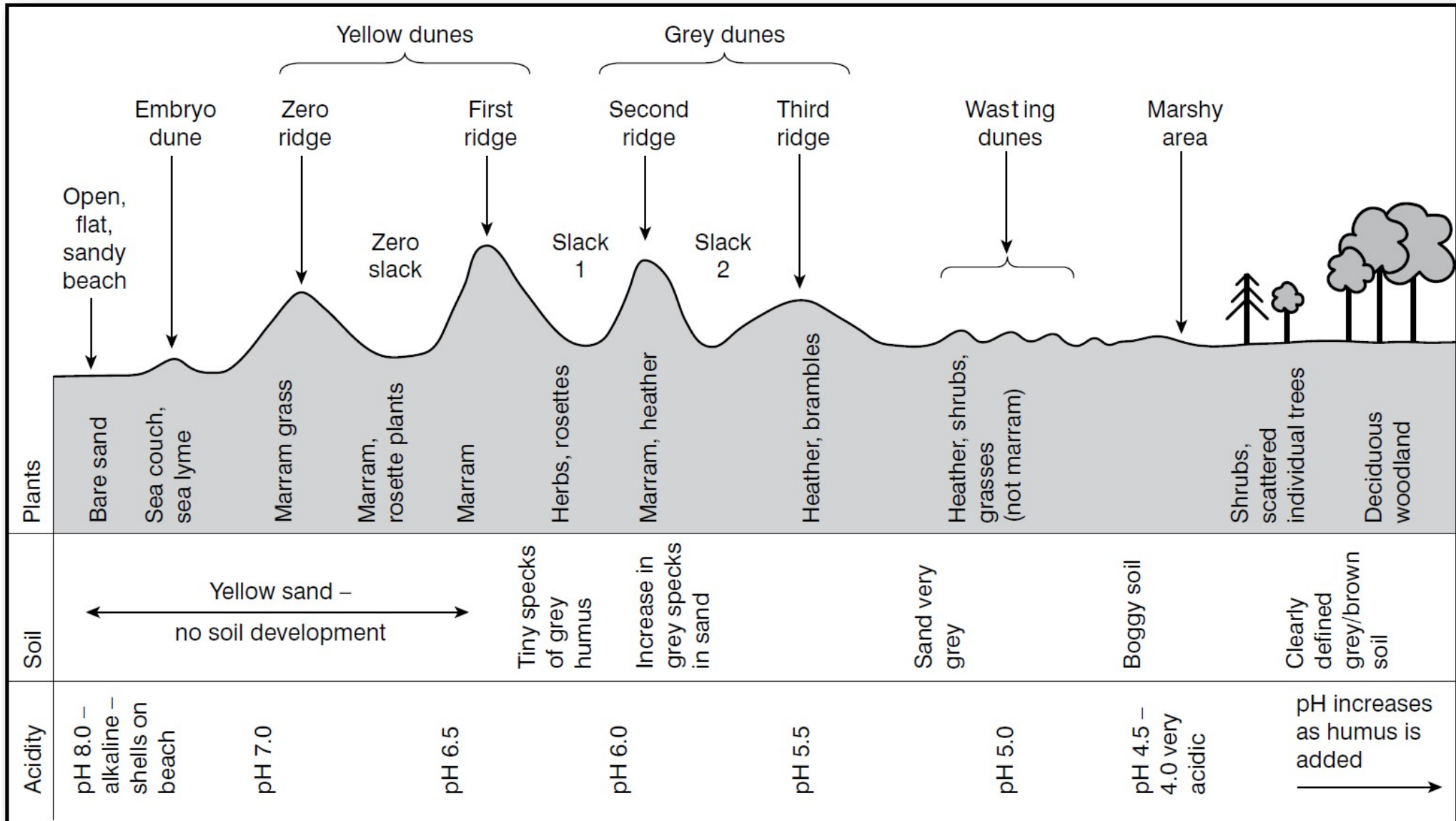


Figure 6.2 Cross-section through a typical sand dune showing the development of the vegetation succession.

A Psammosere: coastal sand dunes

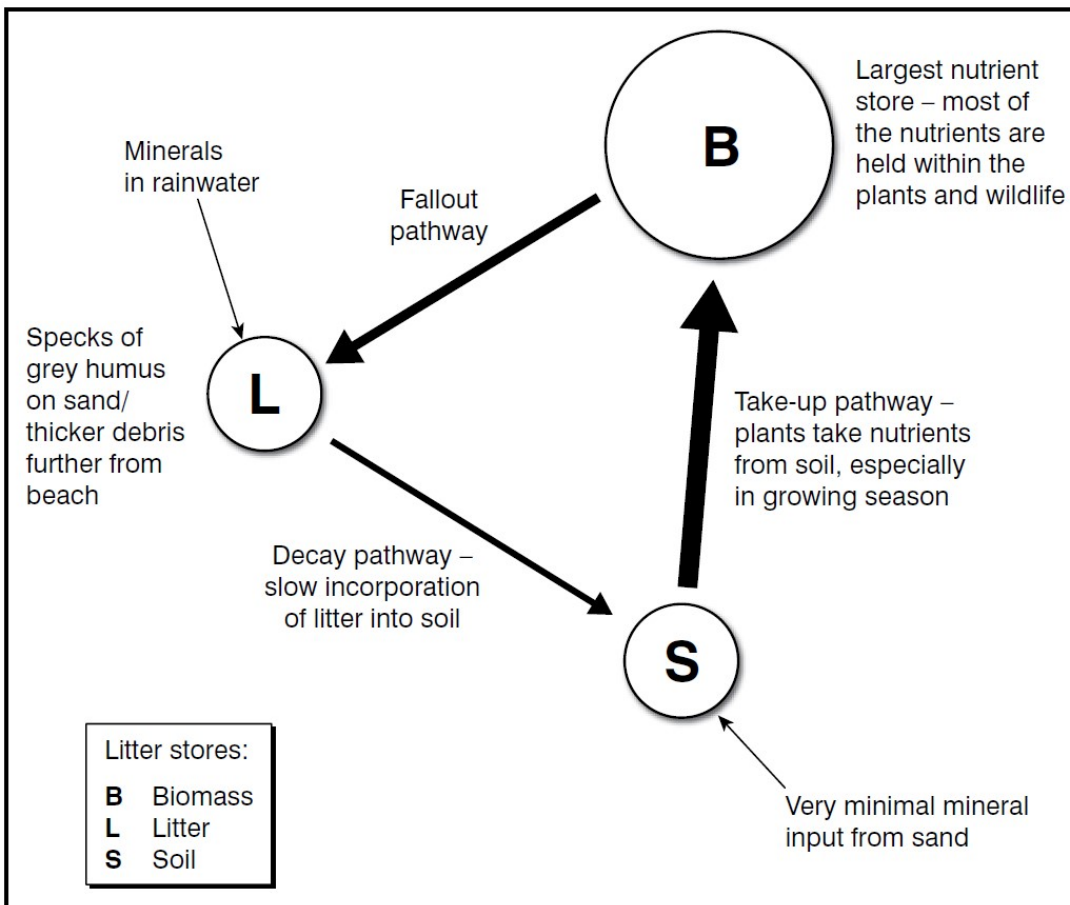
What changes are observable as succession proceeds? Why do these change?



Cross section through dunes

from *The Functioning and Management of Psammoseres in Studland Bay, Dorset*, GeoFile #710, April 2014

A Psammosere: coastal sand dunes



from *The Functioning and Management of Psammoseres in Studland Bay, Dorset*, GeoFile #710, April 2014

Psammosere nutrient cycle

Biomass store largest due to the lack of nutrients elsewhere.

Larger shrubs and trees on wasting dunes contribute significantly to total biomass.

Litter store small as very little litter produced from grasses/shrubs.

Decay pathway small due to dry conditions and low pH which reduces decomposer activity.

Soils store quite small – water percolates easily through sandy soil removing minerals.

Most soil nutrients found in wasting dunes where trees are more common.

Soil nutrient take-up greatest in summer when plants are growing.

A Psammosere: coastal sand dunes

Thinking about your NEA...

1. Suggest some hypotheses that could be investigated at an area of coastal dunes.
2. Choose one of these and consider:
 - i. What would you look for in a suitable location?
 - ii. What risks would you need to consider/manage?
 - iii. What data would you collect?
 - iv. What equipment would you need to collect this data?
 - v. What sampling strategy would you employ to collect the data?
 - vi. How would you process the data in order to test your hypothesis?

A Psammosere: coastal sand dunes

Interesting background reading...

[http://www.coastalwiki.org/wiki/Sand dune - Country Report, Great Britain](http://www.coastalwiki.org/wiki/Sand_dune_-_Country_Report,_Great_Britain)

Types of succession

The concept of succession from pioneer to climax community is called the **monoclimax theory** (Clements, 1936).

It holds that each climatic area will have just one type of climax community towards which all communities are developing.

For the UK, this would be oak-ash woodland, whereas in Kenai Fjords NP, S. Alaska it's hemlock-spruce woodland.

Have a look at <https://www.nps.gov/kefj/learn/nature/plant-succession.htm> for an example of how succession is occurring as Exit Glacier retreats

Types of succession

Some have argued that this is too simplistic.

Instead, areas can have a range of climaxes controlled by soil conditions (**edaphic factors**), activity of animals (**biotic factors**) and other factors

This is called the **poly-climax theory** (Tansley (1939) and Daubenmire (1966)).

Thus, chalky areas in the UK tend to be dominated by beech, and wetter areas by birch.

Interruptions in succession

[Specification: The arresting role of physical factors in creating subclimax communities]

Many successions are affected by outside influences that deflect or halt the process to climax community.

These can be temporary or permanent.

Natural interruptions result in **sub-climaxes**. *Examples of edaphic and biotic factors?*

Anthropogenic interruptions result in **plagioclimaxes**. *Examined in more detail later...*

If the disturbance is removed, then succession continues.

As this now takes place on a previously colonized, but disturbed or damaged habitat it usually results in a (slightly) different climax community.

For this reason it's called **secondary succession**.

Secondary succession

This is usually much quicker than primary succession because:

- there's an existing seed bank of suitable plants in the soil.
- undisturbed root systems in the soil, stumps and other plant parts from previously existing plants can rapidly regenerate.
- soil fertility and structure has also already been substantially modified by previous organisms to make it more suitable for growth and colonization.

A good example: The Heathland Restoration Project , Devon:

<http://www.countrysideinfo.co.uk/successn/second.htm> (and handout)

Plagioclimaxes

[Specification: The role of human factors in maintaining plagioclimax communities]

How can human activities arrest succession to produce a plagioclimax (rather than total destruction)?

- [agriculture?](#)
- [land management?](#)
- [resource extraction?](#)

How might coastal dunes be affected by human activity to produce a plagioclimax?

Plagioclimaxes

Example of a plagioclimax: Lowland heathlands (handout).

Referring to the handout:

- i. Briefly describe the location of this lowland heath.
- ii. Answer Qs 1&2 on the last page.
- iii. Make notes on how the different management strategies help to maintain this as a plagioclimax (this could be done diagrammatically).
- iv. Why is it important for this area to be managed in this way? (refer to ideas covered in other parts of this unit as well as specialised concepts)

Plagioclimax e.g.: agriculture



<http://www.stockjournal.com.au/story/4544588/excellent-grazing-land-in-barossa/>

Plagioclimax e.g.: agriculture



<https://new.devon.gov.uk/historicenvironment/land-management/woodland-and-the-historic-environment/>



Plagioclimax e.g.: land management



<https://biogeography.weebly.com/plagioclimax.html>

Plagioclimax e.g.: land management



<http://www.moorlandassociation.org/who-we-are/>

Managed for wildlife, grouse shooting, water storage...



Plagioclimax e.g.: resource exploitation



<http://www.geograph.org.uk/photo/2303452>

Reeds used for thatching...

Plagioclimax e.g.: resource exploitation



Also managed for wildlife and water treatment

Plagioclimax e.g.: resource exploitation



<https://www.highlandtitles.com/2014/09/carry-on-coppicing/>

Plagioclimax e.g.: resource exploitation



Garston Wood



The Creation and Maintenance of Heather Moorland

Extracts from this document...

Introduction

Heather moorland Plagioclimax- the plant community that exists when human interaction prevents the climatic climax vegetation being reached. Climatic climax vegetation- the vegetation that evolves in a climate region if the seral progression is uninterrupted by human activity, tectonic processes, etc. The climatic climax vegetation for the UK is Oak and Ash trees. Heather moorland is one of the major components of the British Isles, especially in the upland areas, but it was never a major part of the primary succession that followed the retreat of the ice at the end of the last ice age, about 20,000 years ago. ...[read more](#).

Middle

Instead the heavy rainfall, which would have been intercepted by the trees, was able to leach the nutrients out of the soils. So the upland areas were often colonised by bracken, grasses, scrub woodland and heather. As long as the moorlands were grazed heavily this mixed moorland vegetation was maintained. Sheep often grazed these areas as they are indiscriminate eaters, which means they would eat anything. In many areas, such as the North York Moors, parts of the Pennines and large parts of the Eastern Scottish Highlands, there is a deliberate management policy to maintain the land as Heather moorland. ...[read more](#).

Conclusion

To encourage the growth of new shoots, the old, woody heather plants are burnt off every three or four years. Estate managers burn off sections of their moor in rotation, so that at any time the moor has a variety of different habitats, with some areas of new Heather providing food supplies and areas of older Heather providing good cover for the grouse. If burning and grazing stops the Heather will grow old and woody. It would then be possible for scrub and woodland to invade. Overgrazing can lead to destruction of the young Heather shoots and invasion by the bracken or by mat grasses. ...[read more](#).

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