

# BIOSPHERE

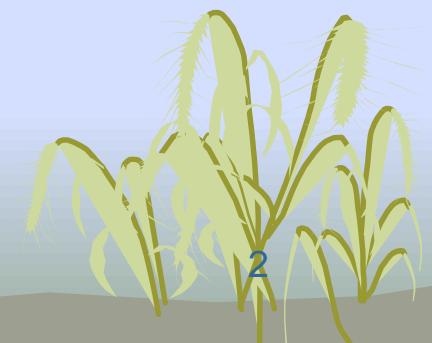
- Vegetation - plant succession
- Psammoxeres - sand dune successions





# What do you need to know?

- Evolution of vegetation communities to climax states
- Example:
  - Coastal dune belts
  - 2/3 examples of plants and their adaptations at each stage
- How to interpret data from vegetation surveys to show succession





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## SUCCESSION



In a plant-free environment, like after a landslide, eruption, tsunami or on a beach or an industrial wasteland, eventually one type of plant will get a foothold.

This is called a **pioneer plant**.

It can get just enough nutrients from the environment to survive.

Its waste products- dead leaves, roots and fluids- slightly enrich the ground around it.



dandelion  
'fireweed'





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As the young soil is altered, a second or third type of plant will find it likes these conditions.

It too joins the plant community, and alters the soil a bit more.

Eventually, the soil is changed enough for the original pioneer plants to die out, and a different set to colonise.

## SUCCESSION



plantain



gorse



bramble

buttercup



daisy



ragwort

broom



nettle





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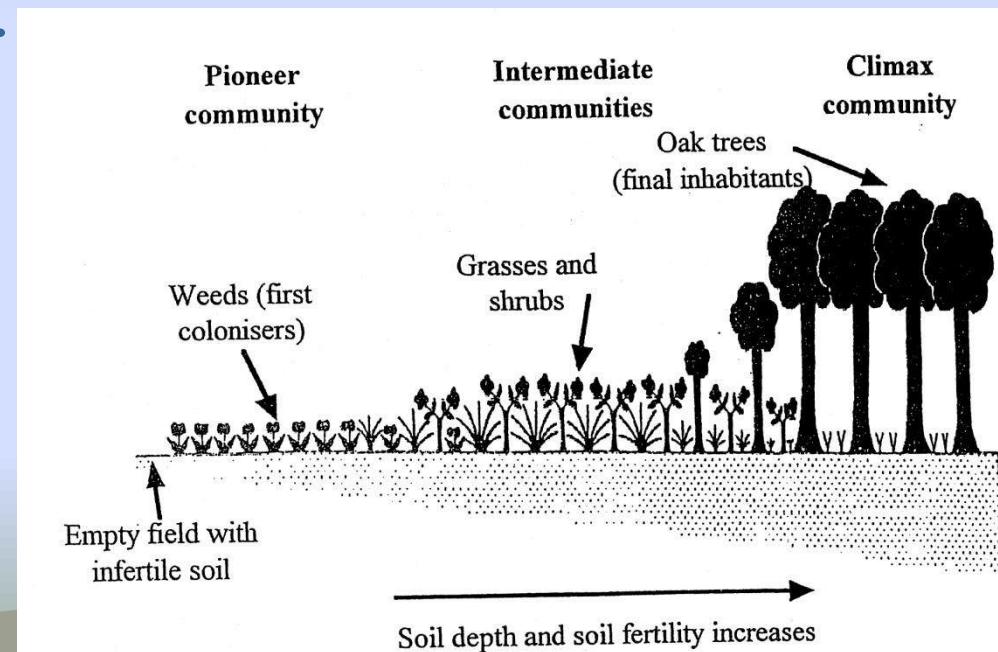
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As time goes on, different groups of plants- with the biota that live with them- change. Each stage is called a **SERE** and develops the soils a bit more. The first sere is called a **prisere**.

The final sere is where established shrubs, like broom and gorse, and trees like rowan, hazel, silver birch and eventually oak, dominate.

These do not alter the soil further, and so **CLIMAX** vegetation ( stability) is reached.



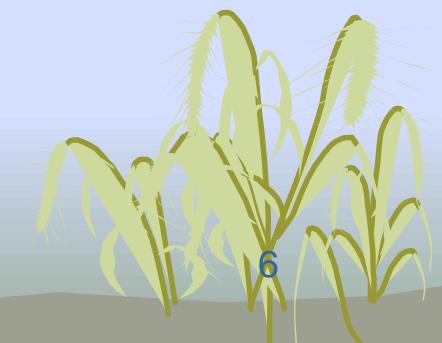
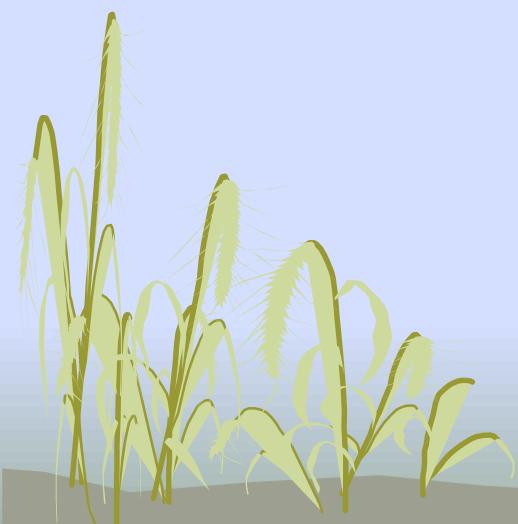
Explain what is meant by the term  
'climax vegetation'. (6)

Typical question

Think out the key concepts that this question wants from you.

You have to discuss a little of what comes before, but...

Be careful not to write too much about non-climax vegetation!

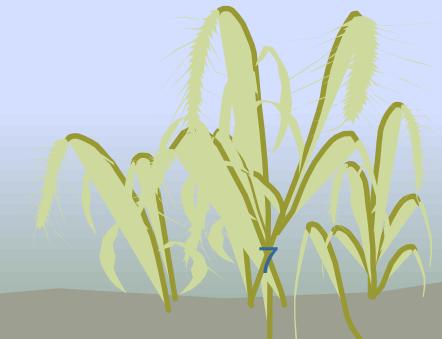




The case study we need to look at is that of a sand dune environment.

Here, there is a very clear transition of plants from the high tide line inland, and it is this that you need to learn.

Dunes at Studland, Dorset





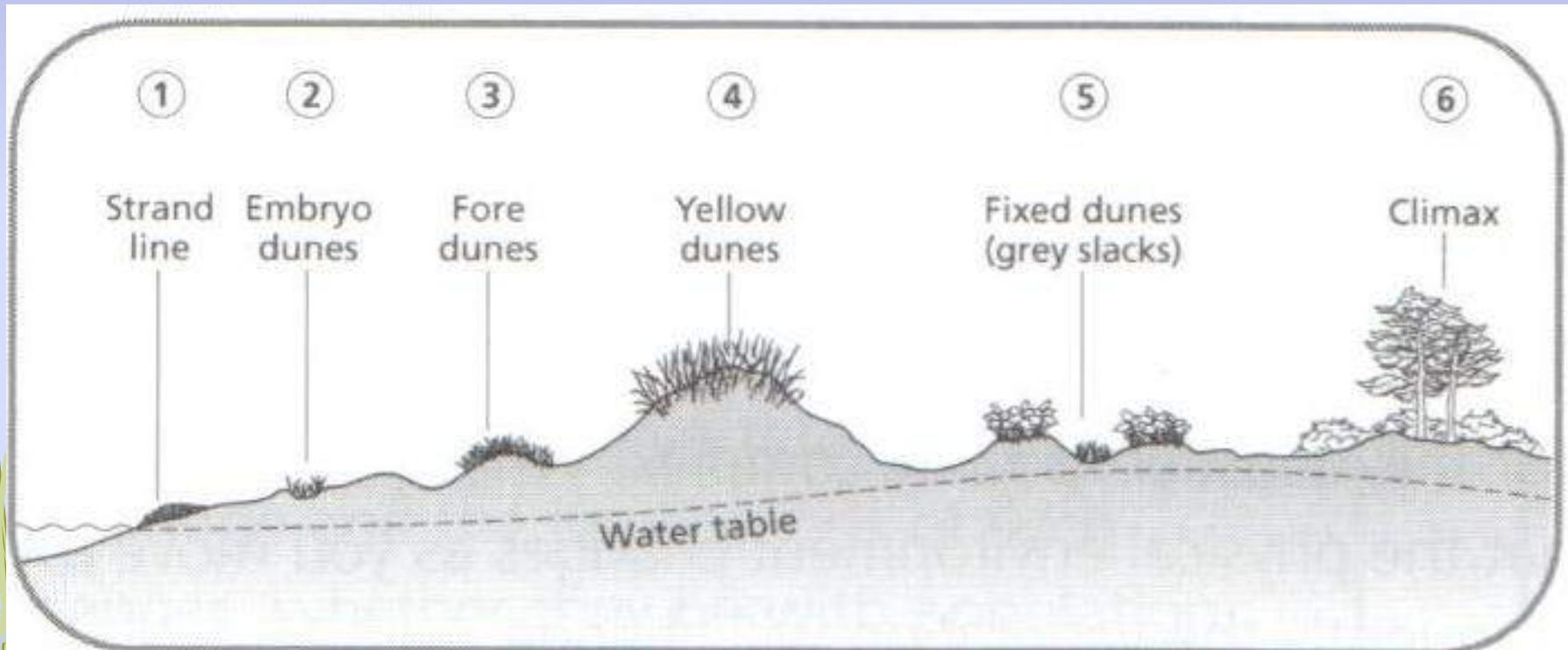
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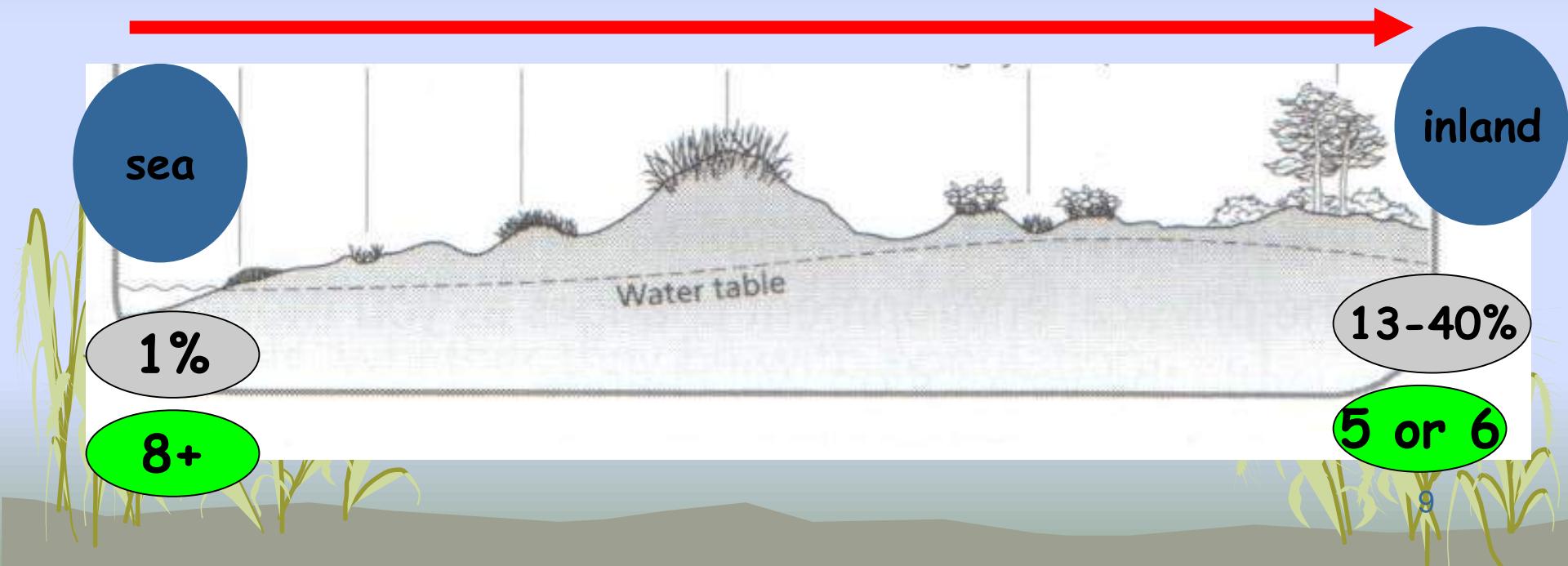
Sand dunes follow a set layout, described in the next slides.

Copy this diagram to act as a key for your notes.



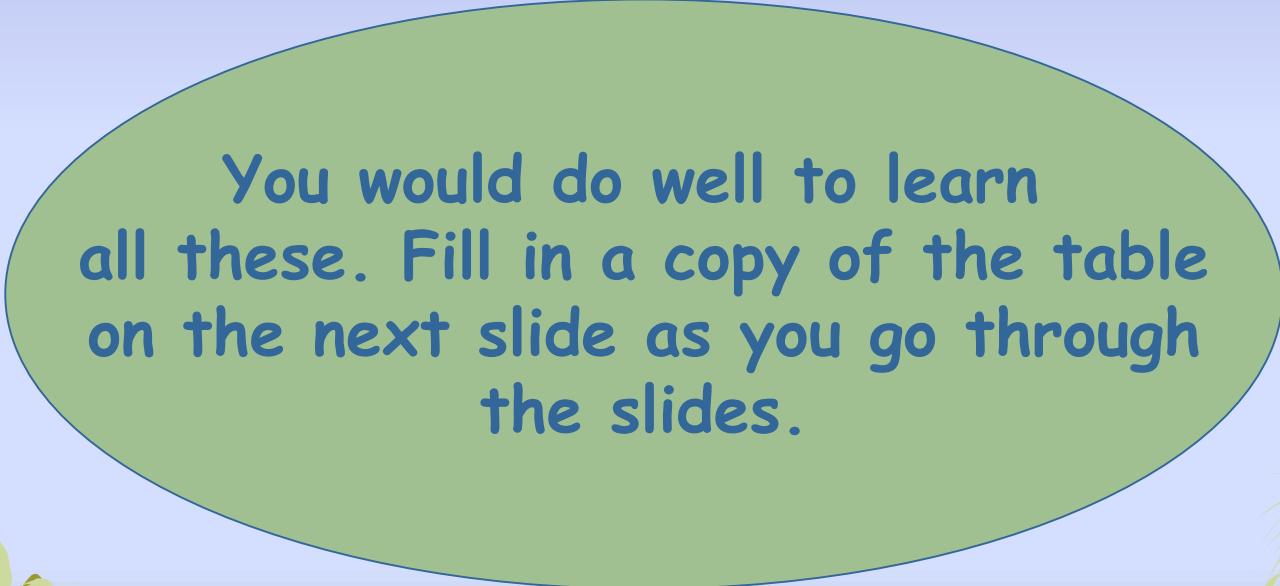
## As you travel inland from the shore:

- The PH gets less alkaline- soil is slightly more acidic.
- The moisture content gets higher- soil is more moist.
- The humus content gets greater- soil has more plant food.
- The wind is reduced- it gets more sheltered.
- So the plant species change too!

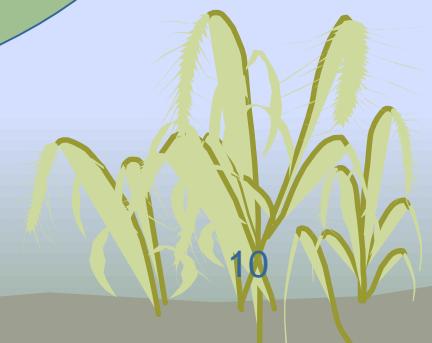
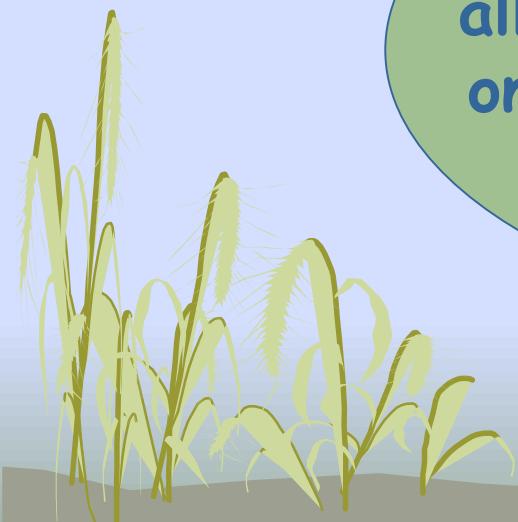


## In the next few slides,

- the top box tells you about the kind of dune at that point.
- the left hand box tells you the conditions found there from a plant's point of view.
- the right hand box gives you the names of plants found there.



You would do well to learn all these. Fill in a copy of the table on the next slide as you go through the slides.



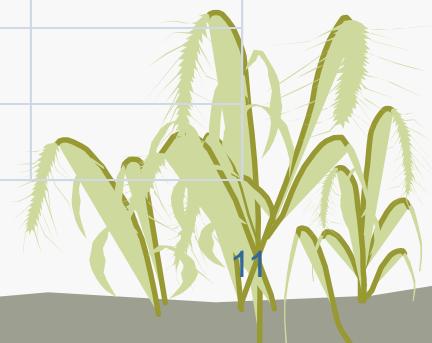
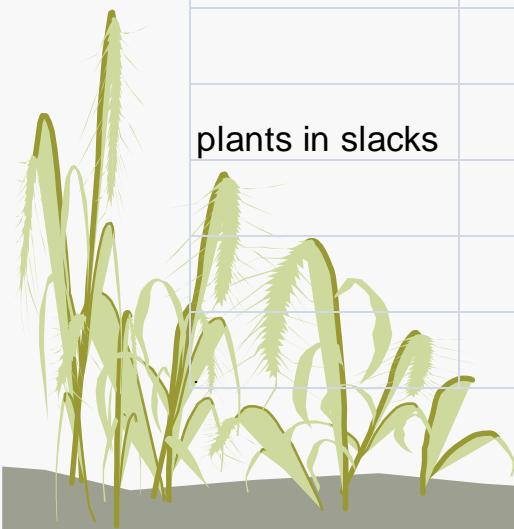


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zone	1	2	3	4	5	6
name						
PH						→
salinity						→
moisture content						→
humus quality						→
wind exposure						→
plants on dunes						
plants in slacks						





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1

The beach ends at the strand line. This is the line highest up from the water where the material deposited by the sea is stranded.

The plants here are tolerant of the harsh conditions- strong winds, sand constantly shifting, salty spray, high alkalinity. There is little evidence of any soil.

Plants here are pioneers:

sea sandwort



sea rocket



saltwort





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2

Embryo dunes are the smallest hummocks of sand. They create a tiny area of shelter from the on-shore wind. It is here that the first pioneer plant may grow. They are very easily destroyed.

The plants here are only slightly better off than at the strand. They have still to put up with very poor conditions. Soil can only be distinguished using chemical analysis.

Plants here are:  
sand couch grass  
sea rocket  
lyme grass





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3

Fore dunes are starting to look like proper dunes, though they are still very small. There is an increase in the amount of humus in the sand, and a little less saltiness in the environment.

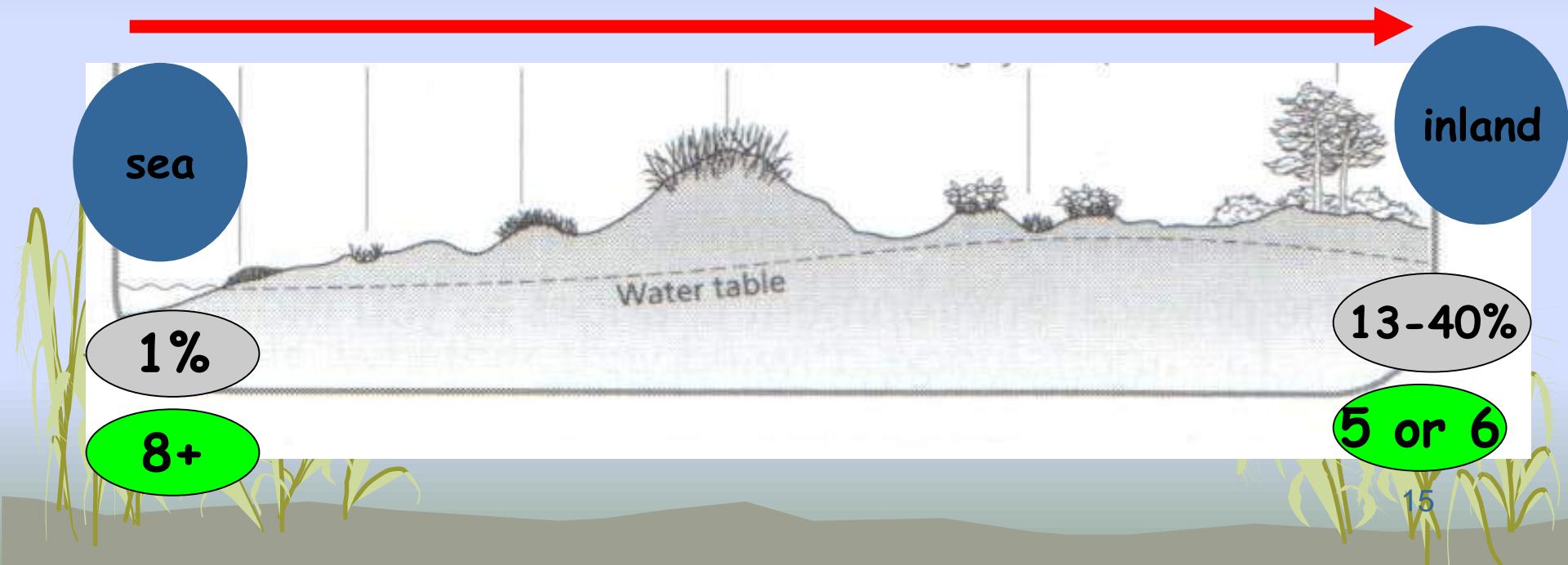
The plants here are modifying their environment and a wider variety of plants can be found here as a result. Their roots are helping to bind the sand grains together and this allows them to get more water.

Plants here are:  
sand sedge grass  
sea holly  
marram grass



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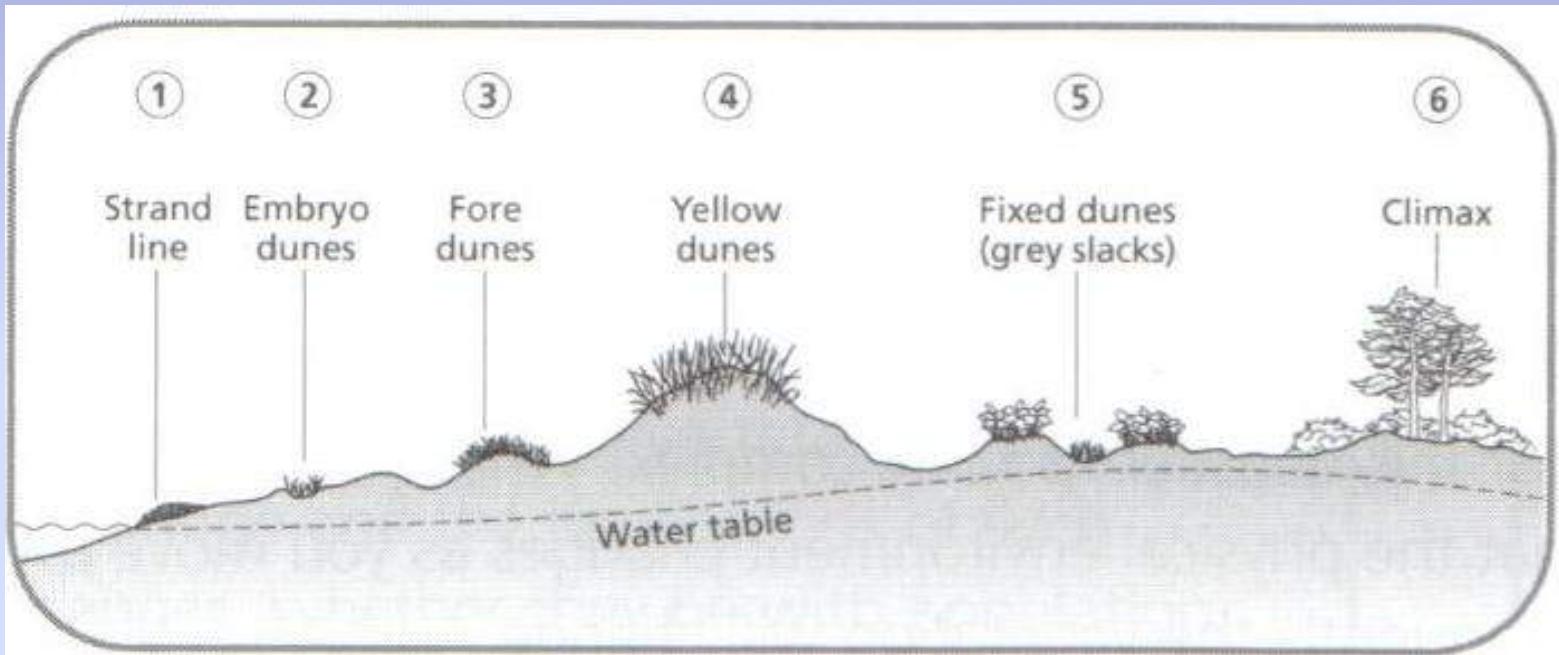
4

Yellow dunes are substantial dunes up to 10m tall. There is a much higher amount of humus (nutrients) and it is more acidic. The younger dunes create much more shelter.

The plants here are less tough in many respects, although it is still not a kind environment. Marram grass is the dominant plant, and its long tap roots bind soil and find water deep down.

Plants here are:  
sand fescue grass  
ragwort  
marram grass







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5

Fixed dunes are often called grey dunes. They are lower and more consolidated than the yellow dunes. They have troughs between the ridges of sandy soil called slacks.

This area supports plants that require more shelter and more acidic conditions. Most need more moisture and find it in the slacks; more specialist plants appear, like reeds, rushes and creeping willow.

Plants here are:  
sand sedge grass  
trefoil  
Buckthorn  
Heather  
lichen





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# Dune Slacks

occur in low lying hollows between  
dune ridges

relief intersects  
the water table

soil acidic

water table high -  
especially in winter



Bog  
cotton



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6

This is the last (climax) sere of the plant succession. The land here is damp, sheltered, acidic, rich in nutrients and humus.

The plants here are as evolved as they are going to get- unless man or storms modify their environment again.

Plants here are true pioneers:  
heathland plants  
gorse



ash, rowan, alder,  
birch and spruce  
trees

Suggest reasons for the changes in vegetation along the line of transect of dunes. Refer to a range of environmental factors. (10)

Typical question

This is simply asking for the changing conditions!

You were given 5 environmental factors - as these change the vegetation that can survive in the transect will also change.

Describe and explain the plant succession in this sand dune habitat. Mention specific plants.(10)

Typical question

You need to start at the sea and work inland.

Describe the different stages giving their proper names.

For each, mention the changing conditions (pH, moisture, and so on). This is the explain bit!

Name one or two different plants at each stage.

# 2010 biosphere question - Answer

- **Question 6: Biosphere**
- Award up to 6 marks (1 per stage) for correctly named and located plant species.
- Award a maximum of 2 for purely descriptive points taken from the graph.
- Credit can be given for factors not shown on the graph such as shelter.
- Students may answer this question using the headings on the graph or the more usual progression from strandline to climax vegetation.
  - **Plant cover increases – the amount of sand showing through the dune decreases as**
  - more of the ground is covered by vegetation. Little cover in the pioneer stage, more in the building stage and complete cover in the climax stage unless disturbed by animals/humans/storms etc.
  - **Soil moisture increases – rain/fresh water is trapped with added humus/plant cover**
  - and longer rooted plants drawing water up from the water table. Xerophytic plants found in the drier strandline (sea sandwort, sea rocket, saltwort) and embryo dune (sea or sand couch, lyme grass, frosted orache). On the yellow dune Marram grass has long rhizomes to spread through the sand. Dune slacks at or near the water table have hydrophytic species like reeds, rushes and flag iris.
  - **Organic matter content increases – decaying pioneer species adding humus to the**
  - sand. In the fore-dune more plants stabilise the sand adding humus (sea bindweed, sea holly, sand sedge, and marram grass) changing the sand to a sandy loam and from the sandy colour of this and the yellow dune to the grey dune.
  - **pH decreases – shells ( $\text{CaCO}_3$ ) producing alkaline conditions on shore, more neutral pH by the climax stage as plants decay and add acid to the soil. The grey dune plants include sand sedge, sand fescue, bird's foot trefoil, heather, sea buckthorn and grey lichens. In the climax stage a range of plants from heathers to birch, pine or oak woodland can grow depending on the final pH value of the soil.**
  - **Salinity decreases – Increased distance from the sea and salt water/tides/spray**
  - increases the amount and variety of plant species that can cope with the conditions. **14 marks**