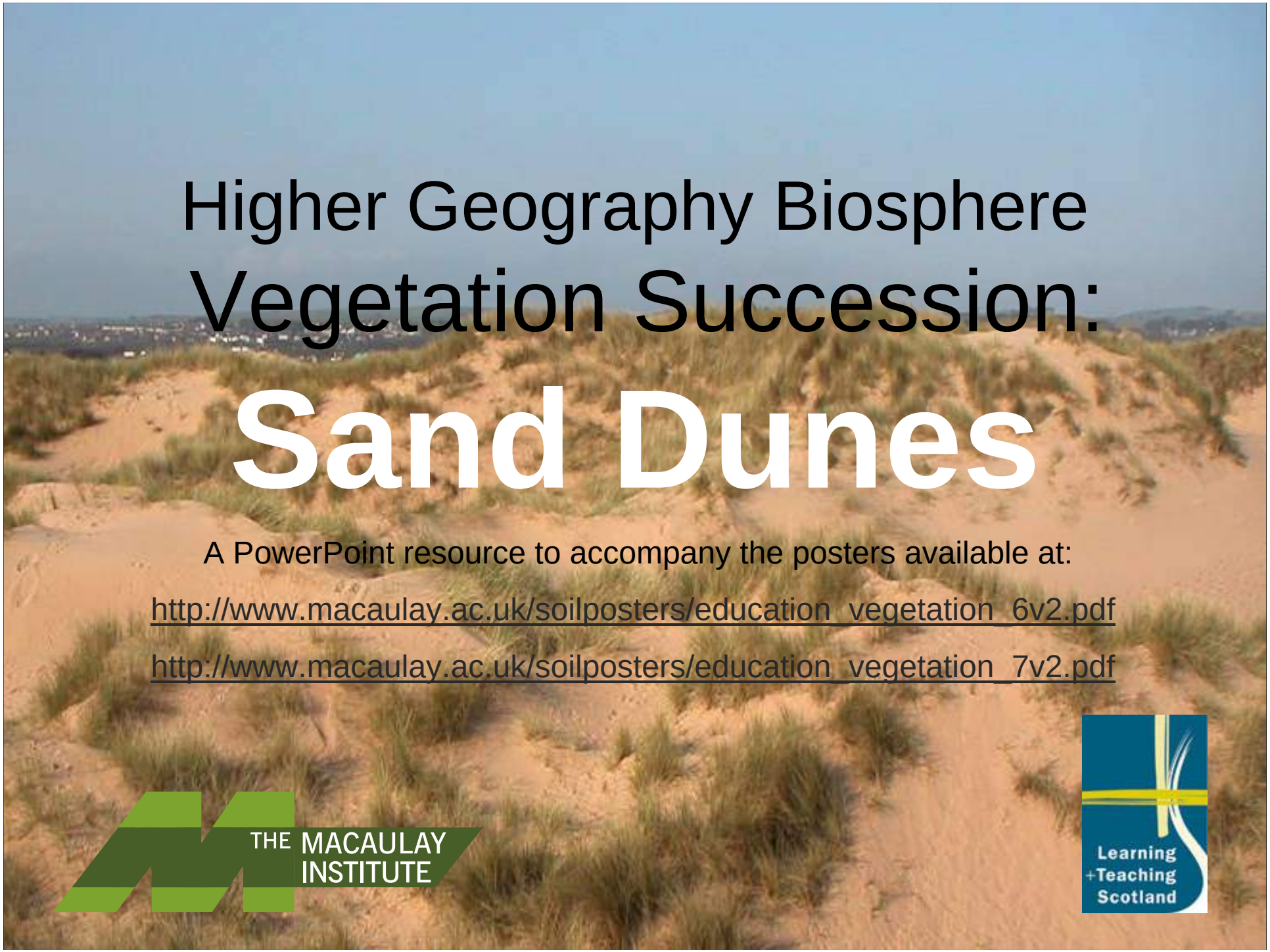


Higher Geography Biosphere

Vegetation Succession:

Sand Dunes

A PowerPoint resource to accompany the posters available at:

http://www.macaulay.ac.uk/soilposters/education_vegetation_6v2.pdf

http://www.macaulay.ac.uk/soilposters/education_vegetation_7v2.pdf

THE MACAULAY INSTITUTE

Learning +Teaching Scotland

A definition of vegetation succession:

- The evolution of plant communities at a site over time- from pioneer species to climax vegetation
- At each stage of the succession the plant community alters the soil and microclimate, allowing the establishment of another group of species
- One community of plants is therefore replaced by another as the succession develops
- Eventually a climax community is reached where the vegetation is in a state of equilibrium with the environment and there is no further influx of new species

Psammosere:

A vegetation succession on sand dunes

- In Scotland there are 5000 ha of partly vegetated sand
- 500+ vegetation types grow there
- Dune belts illustrate well the development of vegetation from pioneer species to climax vegetation
- The plants which grow there have to adapt to an environment which is :

dry

salty

mobile

lacking in nutrients

The development of a sand dune system requires:

- A plentiful supply of sand
- Strong winds to transport sand particles through saltation
- An obstacle to trap the sand e.g. a plant

  Plants are therefore central to the formation, growth and character of sand dunes

Psammoseres: some definitions

Pioneer stage:

- Seeds are blown in by the wind or washed in by the sea
- The rooting conditions are poor due to drought, strong winds, salty sea-water immersion and alkaline conditions created by sea shells
- The wind moves sand in the dunes and this allows rainwater to soak through rapidly

Psammoseres: some definitions

Building stage:

Plants trap sand and grow with it, binding the sand together with their roots

The humus created by decaying pioneer plants creates more fertile growing conditions, and the soil becomes less alkaline as pioneer plants grow and trap rainwater

Less hardy plants can now grow and start to shade out the pioneers

As plants colonise the dunes, the sand disappears and the dunes change colour - from yellow to grey

Psammoseres: some definitions

Climax stage:

Taller plants (such as trees) and more complex plant species (like moorland heathers) can now grow

Plants from earlier stages die out because of competition for light and water

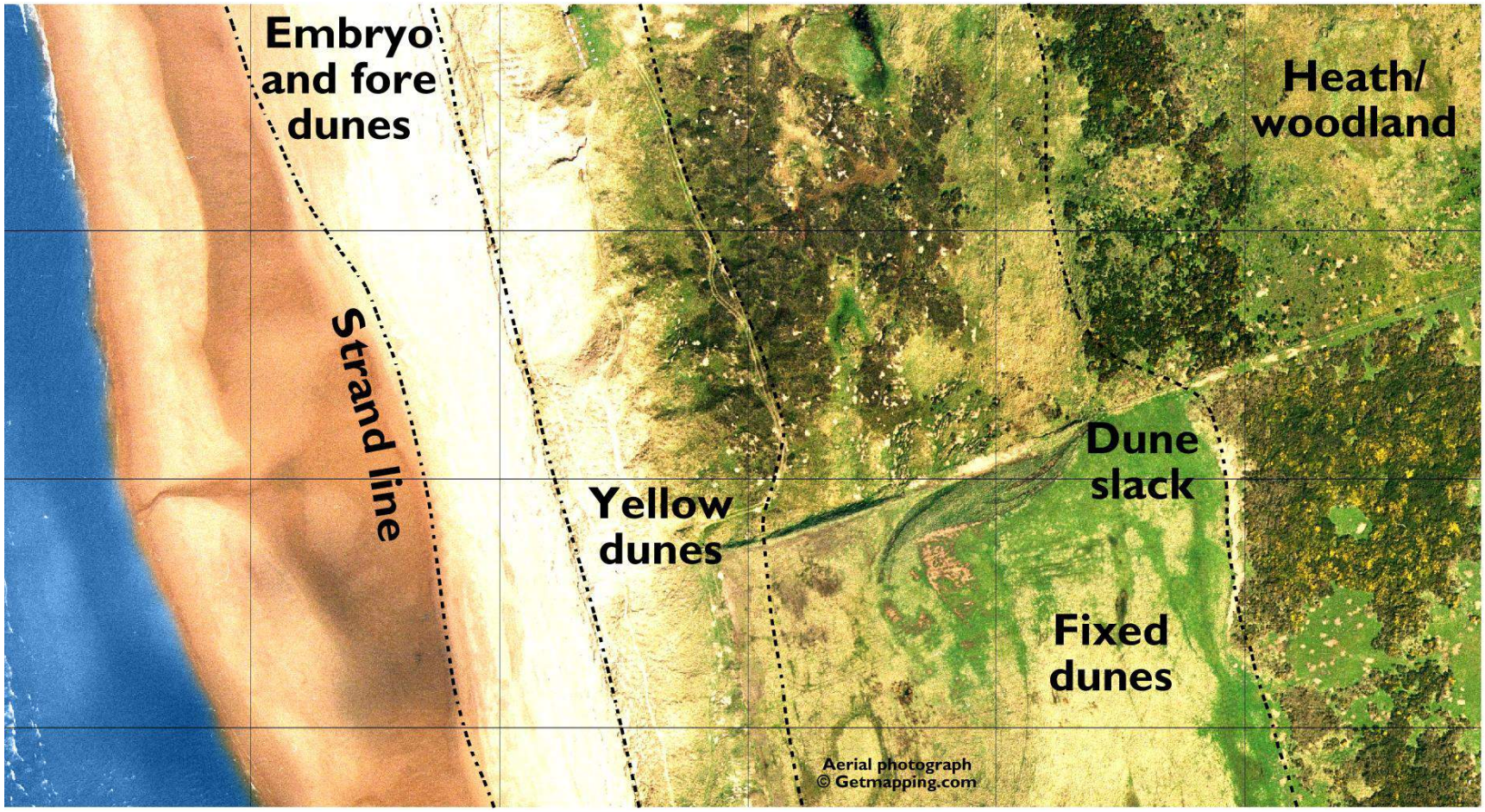
When the water table reaches, or nearly reaches the surface, dune slacks can occur Plants which are specially adapted to be water-tolerant grow here

Sand dune systems develop seawards over time…

- New dunes develop on the foreshore and here the psammosere is in its pioneer stage
- Landwards of this, on the older, more sheltered dunes, the psammosere is in its building stage
- Furthest inland, on the oldest dunes, the psammosere will reach its climax stage

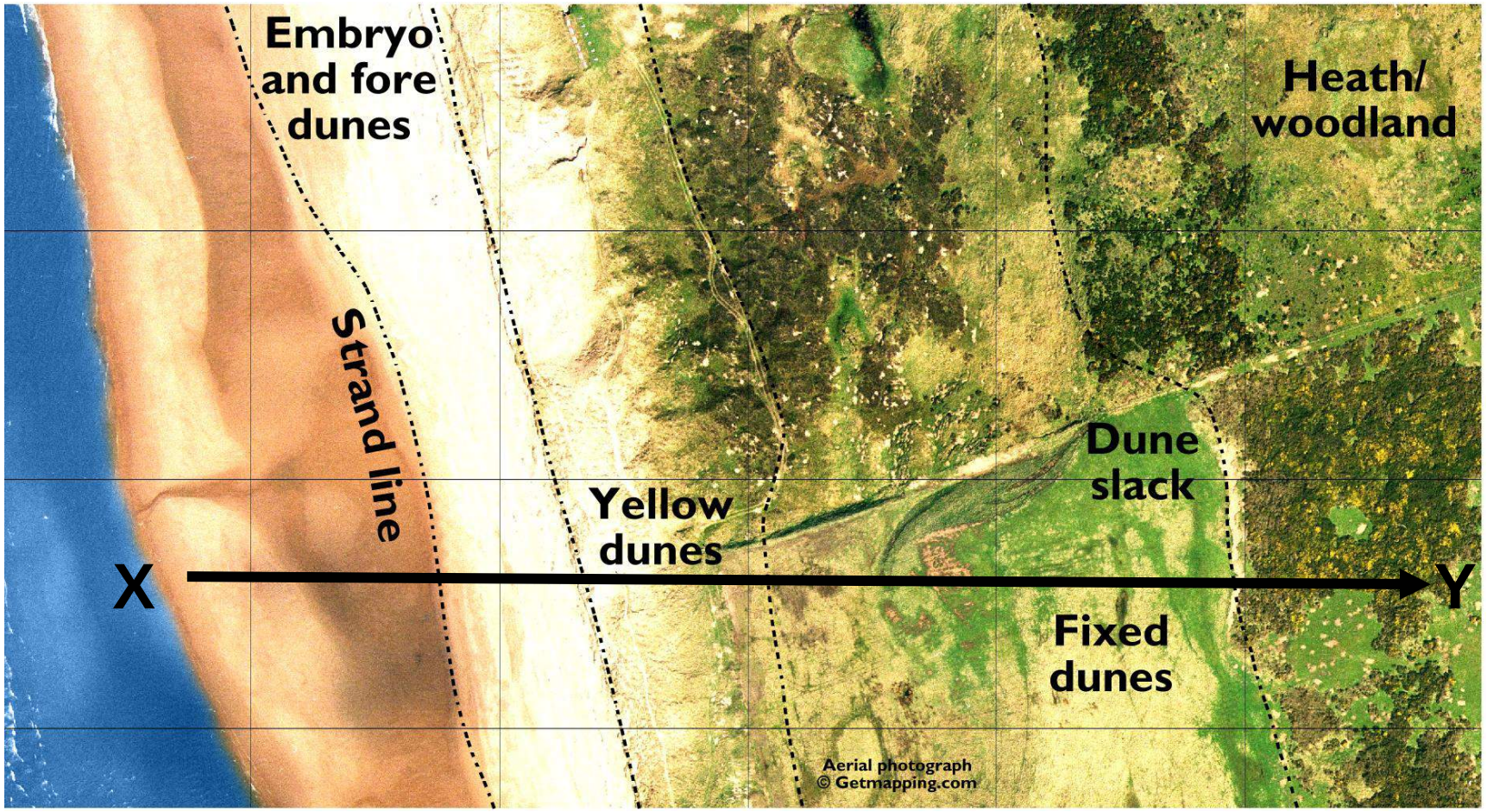
A sand dune system may take hundreds of years to develop but the process can be seen within a few hundred metres of the shoreline

An aerial view of a sand dune system



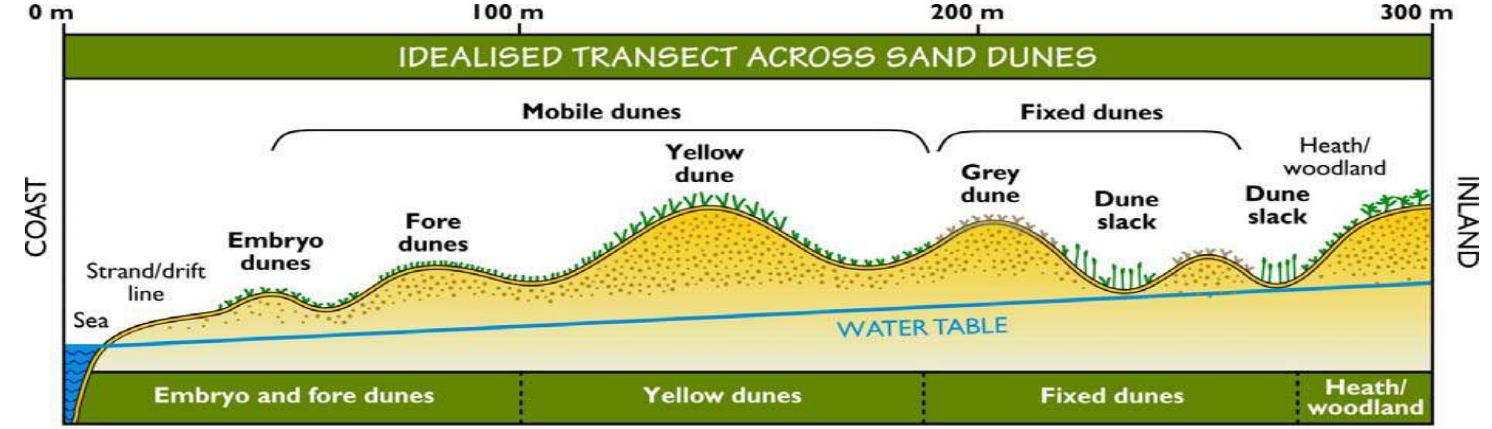
youngest dunes → oldest dunes

A transect across a sand dune system

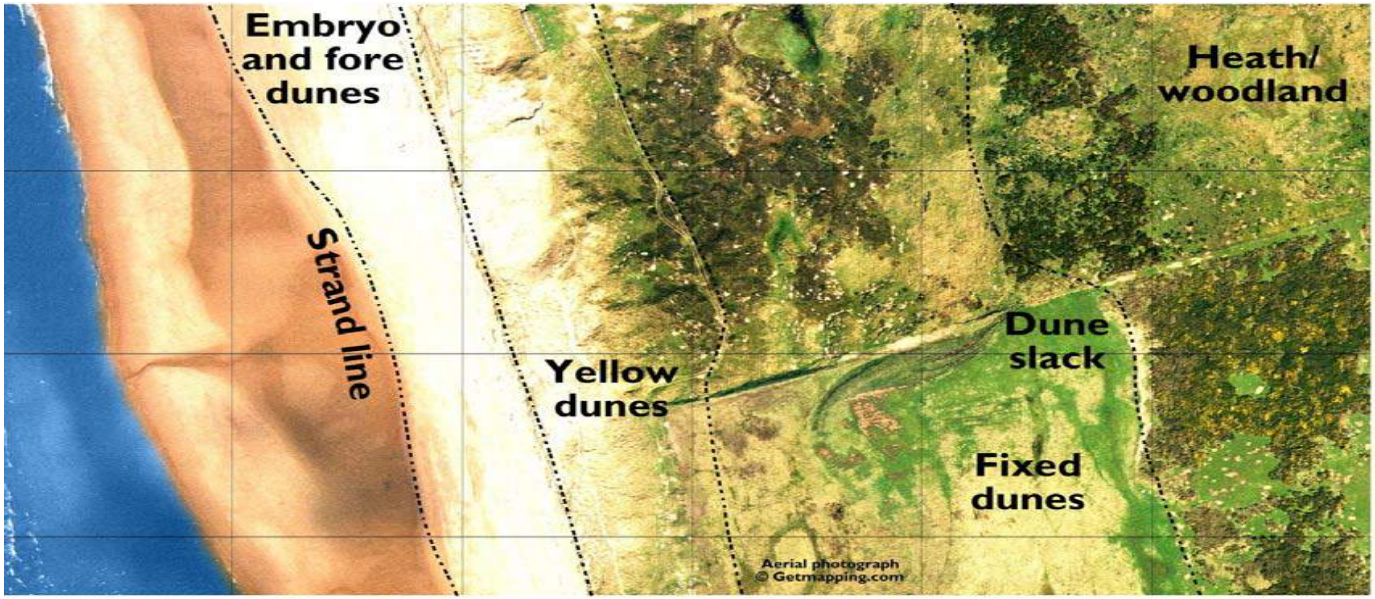


Reveals variations in relief and vegetation …….

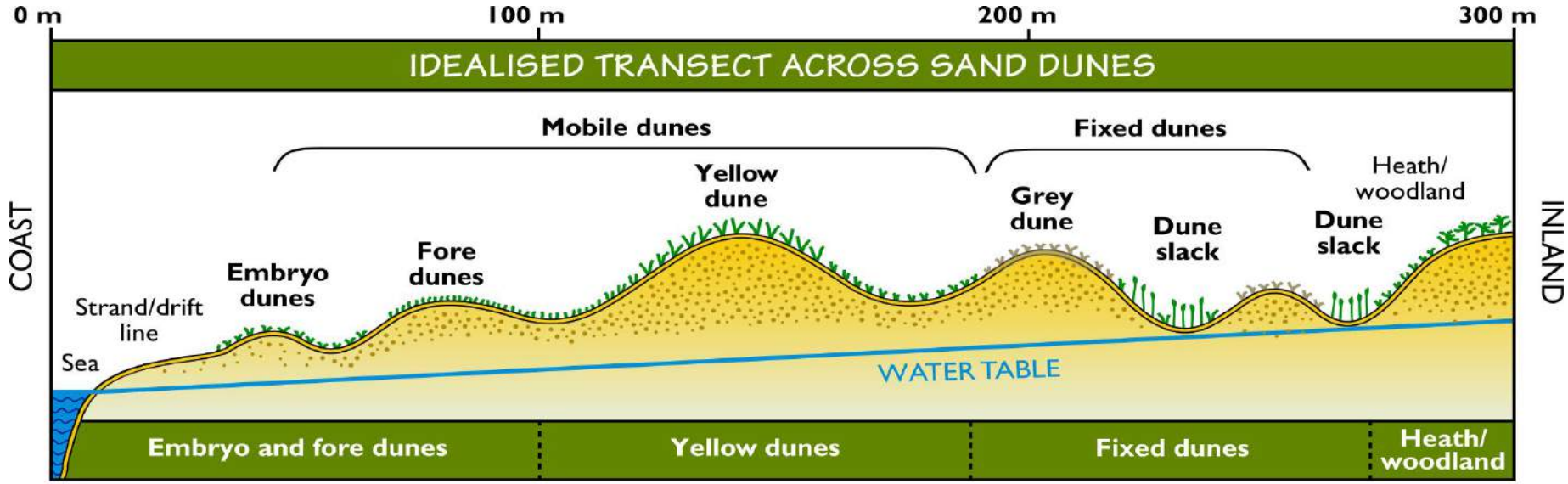
A transect across a sand dune system



X PIONEER SPECIES — pH decreases (more acidic) / soil organic matter increases — CLIMAX Y



A transect across a sand dune system



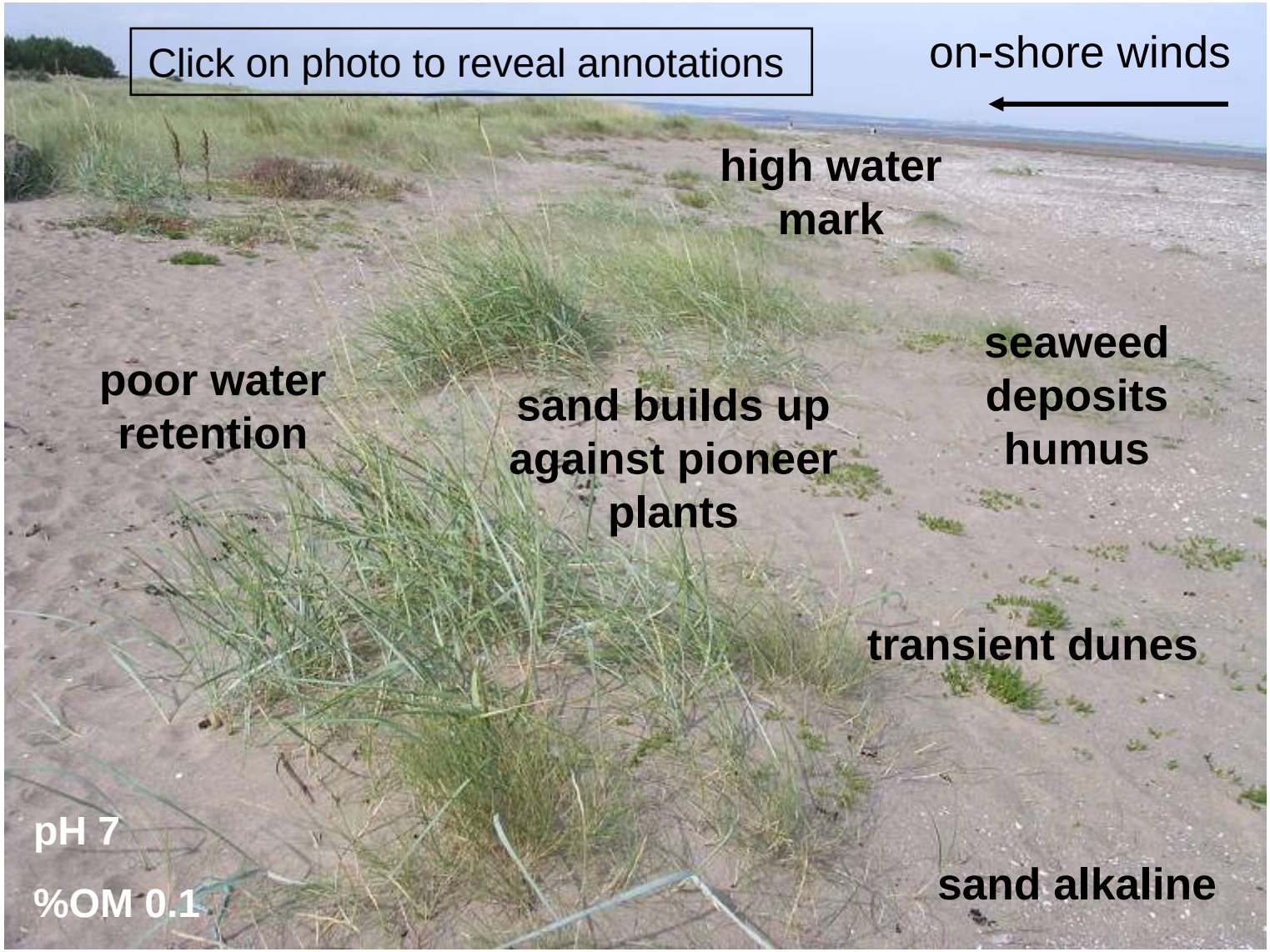
The transect above has hidden ‘hotspots’. Move your mouse over the diagram and these will be revealed. Progress across the transect using these hot spots.

You can return to this diagram at any time by using the return button

You can advance quickly from one slide to the next by using this button

You can go from this slide to the revision materials by using this button

Embryo and Fore Dunes: the environment



Embryo and Fore Dunes: the plants

The plants which grow here have adaptations which allow them to grow in a difficult environment :

- waxy leaves to retain moisture and withstand winds
- prostrate (low) habit to avoid strong winds
- deep tap roots to obtain available moisture
- high salt tolerance


Sandwort

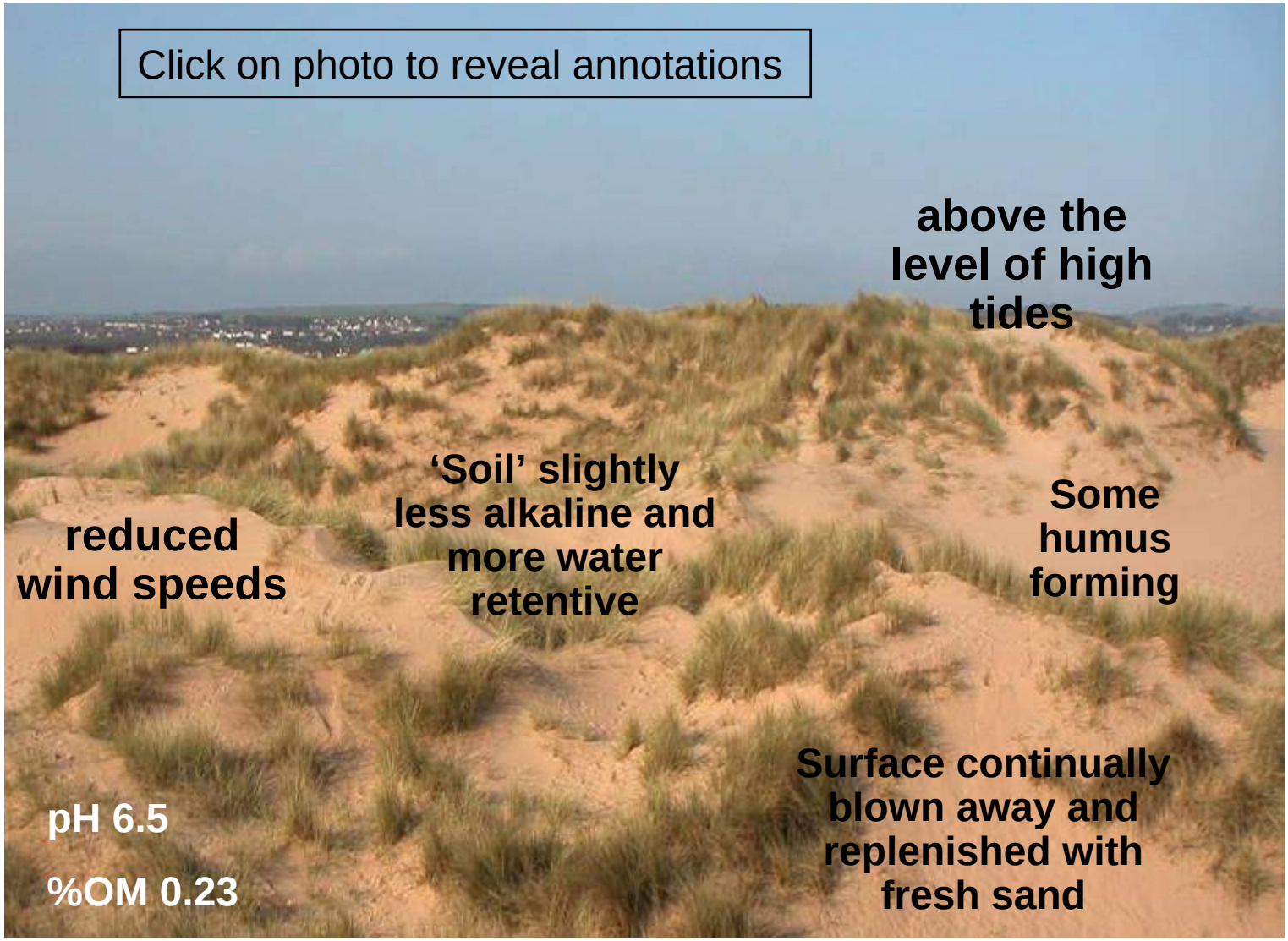

Frosted orache


Saltwort


Sea couch


Sea rocket

Yellow Dunes: the environment



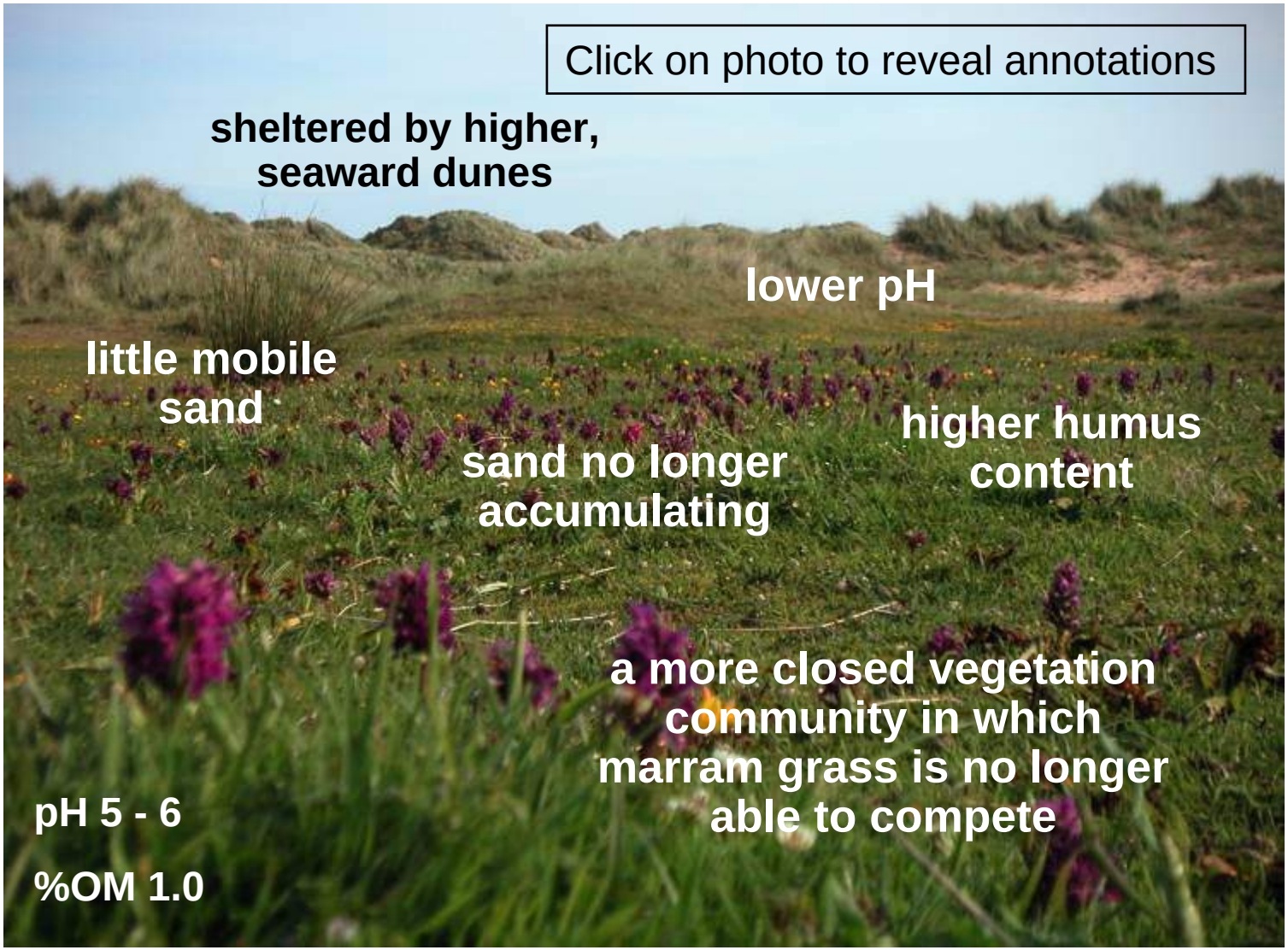
Yellow Dunes: the plants

The dominant plant species is Marram grass:

- Salt tolerant
- Thrives on being buried by sand
- Inrolled leaves to reduce moisture loss
- Long tap roots
- Underground rhizomes stabilise the sand

Other plants such as Ragwort, Red fescue and Sand sedge begin to appear

Grey Dunes: the environment

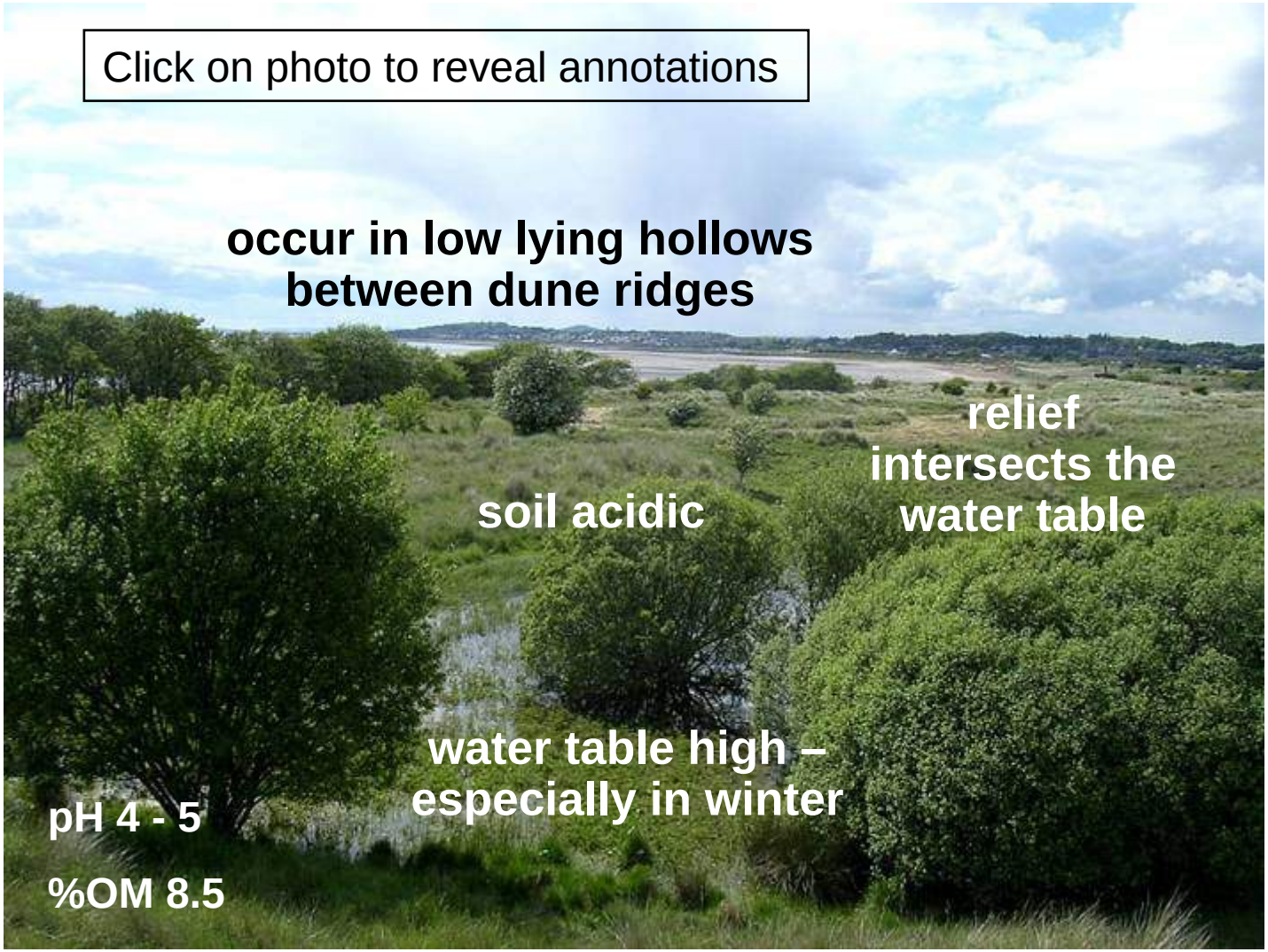


Grey Dunes: the plants

- higher species diversity
- mainly perennials
- marram becomes more sparse
- surface lichens give ‘grey’ appearance

Older grey dunes may have extensive covering of lichens and heather

Dune Slacks: the environment



Dune Slacks: the plants

The community which develops here comprises moisture-loving plants commonly found in many fresh water wetland areas e.g.

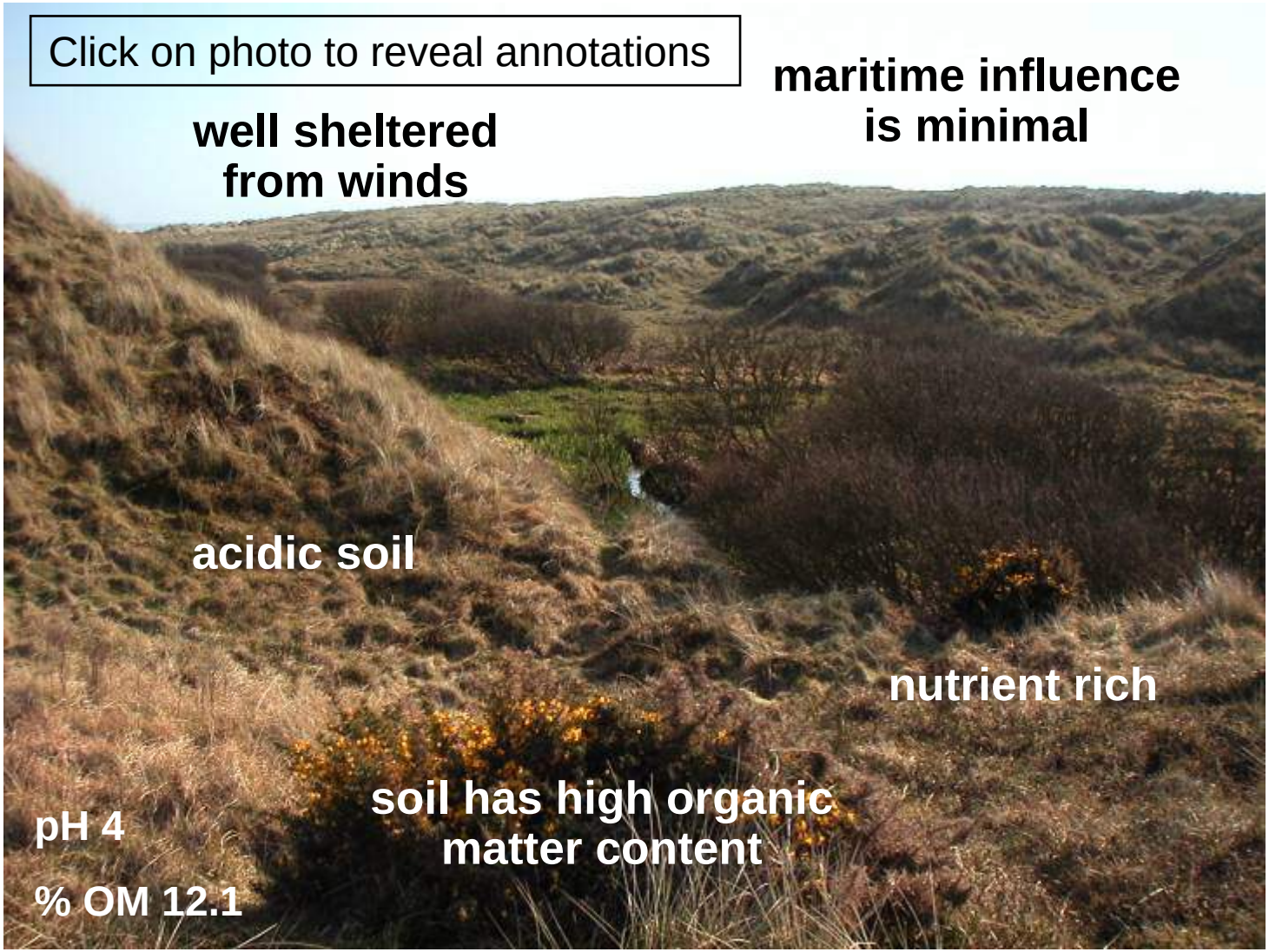

Flag iris


rushes

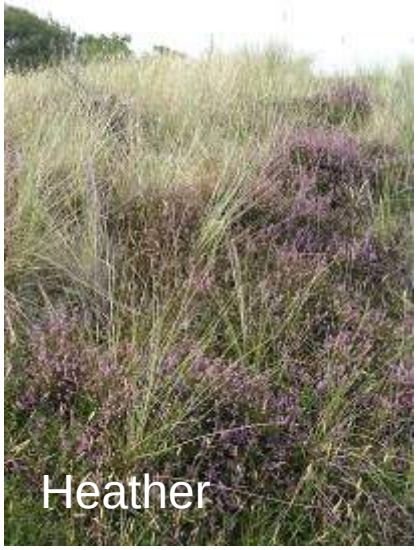

Phragmites reeds


Bog cotton

Dune Heath/Woodland: the environment



Dune Heath / Woodland: the plants


Heather

Human interference means that true mixed woodland climax vegetation is rarely seen on dune systems in the UK

Most dune systems develop into a community of heathland, woody perennials (often spinous) and scattered trees


Heather


Sea buckthorn

Revision materials

Psammosere: summary of stages

Stage in dune sucession

	Mobile dunes		Fixed dunes		
	Embryo and fore dunes	**Yellow dunes**	**Grey dunes**	**Dune slack**	**Heath/ woodland**
Dune characteristics	• On-shore winds • Seaweed (humus build up) • Sand building up • Transient • Alkaline sand	• Surface continually blown away and replenished by fresh sand • Reduced wind speed • Top of dunes above high tide level	• Increased humus content • Surface lichens • Sand no longer accumulating • Marram grass not able to compete well	• Damp, low lying hollows • High water table in winter • Soil acidic and pH variable	• Acid soil and increased organic matter content • Nutrient rich • Shelter developed
Plant characteristics	• Scattered individuals • Low growing prostrate habitat • Waxy leaves • Salt tolerant	• Salt tolerant • Thrives on being buried by sand • Inrolled leaves • Long tap roots • Undergound rhizomes to stabilise sand	• Many plants now co-existing • Mainly perennials • Stablising plants liking increased organic matter content	• Moisture loving plants	• Acid loving plants co-exisiting • Woody perennials plus understory species
Example plant	 Photo courtesy of Carl Farmer e.g. Sandwort	 e.g. Marram grass	 e.g. Grey lichen and heather	 e.g. Rushes	 e.g. Heather and woodland

“A Question of Psammoseres”

The nine number question board which follows is adapted from a template made available by :

www.sln.org.uk/geography

Click on a number to link to a question

Click the back button to link back to the question board 

Once selected, numbers will change colour

“A Question of Psammoseres”

1	2	3
4	5	6
7	8	9

Use ‘end show’ command to exit presentation

1

What type of dunes are forming in the foreground of this photograph?

2

This photo shows ground cover somewhere within a dune system. What stage of the psammosere is it associated with?

Can you name any of the plants growing in the photo?

3

What is the dominant species in this photograph? At which stage of the psammosere would you expect to find it?

How is this plant adapted to its environment?

4

This photo shows ground cover somewhere within a dune system. What stage of the psammosere is it associated with?

What is the dominant species? Why is the other plant also able to grow here?

5

In which stage of the dune succession would plants like these be found?

How are they adapted to the environment there?

Can you name either of the species shown?

6

What name is given to areas of open water such as this which are found within dune systems?

Name some of the plants which you might expect to find growing there

7

This photo shows ground cover somewhere within a dune system

What stage of the psammosere is it associated with?

Can you name any of the plants growing in the photo?

8

The climax vegetation of a dune succession would look similar to this photo

What is meant by the term ‘climax vegetation’?

Why is a community of plants like this one rarely found in dune systems in the UK?

9

The photo shows a dense community of foreshore plants

Name some of the plants you would expect to find here and explain how they are able to survive in this environment