

SUCCESSION



ECOLOGICAL SUCCESSION

- ★ Communities always changing
- ★ Predictable and orderly change to composition or structure
- ★ Simple → complex
 1. New, unoccupied land (lava flow/landslide)
 2. Disturbance (fire, logging)



Succession

- ★ **Directional** change in species composition or structure
- ★ Not return to original state
- ★ 500 - 1000yrs
- ★ Seasonal changes
- ★ Long-term changes – geological or climatic



Seres

- ★ Series plant communities which follow each other - Pioneer → climax
- ★ **Primary sere** – bare surface not previously altered by vegetation: deglaciaded surface, rocks etc
- ★ **Secondary sere** – revegetation following cultivation, fire etc



Strategists



- ★ Seres = Series plant communities which follow each other -Pioneer → climax
- ★ Typically **r-strategists** initially: rapidly growing, short lives, huge investment in large numbers of offspring.
- ★ Unstable → stable communities dominated by **k-strategists**.
- ★ K-strategists: long lived; investment in small number of offspring



Ecological Change

- ★ Trajectory of change influenced by:
 - Site conditions
 - Interaction of species present
 - Availability of seeds/colonists
 - Weather condition at time of change
- ★ Species diversity ↑ in early succession and ↓ in later succession



Types Succession

1. **Autogenic**: sequence of changes resulting from biological processes which change conditions and resources
2. **Allogenic**: occurring as an outcome of changing external geophysical forces
3. **Degradative**: (**Heterotrophic**) short timescale in which materials such as faeces and leaf litter are broken down



Theories

- ★ Frederick Clements: (1916) postulated that changes in plants were unidirectional and irreversible (autogenic dominates).
- ★ End stage 'climax' – described as the 'potential vegetation' of a site
- ★ Modern ecologists reject this idea: Cowles – study on dunes Lake Michigan (allogenic dominates)
- ★ Disturbance, climate change and introduced species continually reshape communities



Primary Succession

- ✱ Occurs on barren habitats
- ✱ Glaciation or exposure (sand dunes)
- ✱ Colonised by pioneer species (moss or lichens) - r-strategists
- ✱ Modify habitats so new niches occur – **facilitation**; or inhibit other species from colonisation – **inhibition**



Pioneer species

- ★ Extract resources from bare rock
- ★ Break up and fragment rock with roots
- ★ Collect wind-blown dust etc
- ★ Waste products accumulate
- ★ Die and decompose
- ★ Soil development begins



Secondary Succession

- ★ Common
- ★ Natural or deliberate disturbance
- ★ Natural or deliberate fire
- ★ Abandoned farmland
- ★ Tree felling
- ★ Faster timeframe

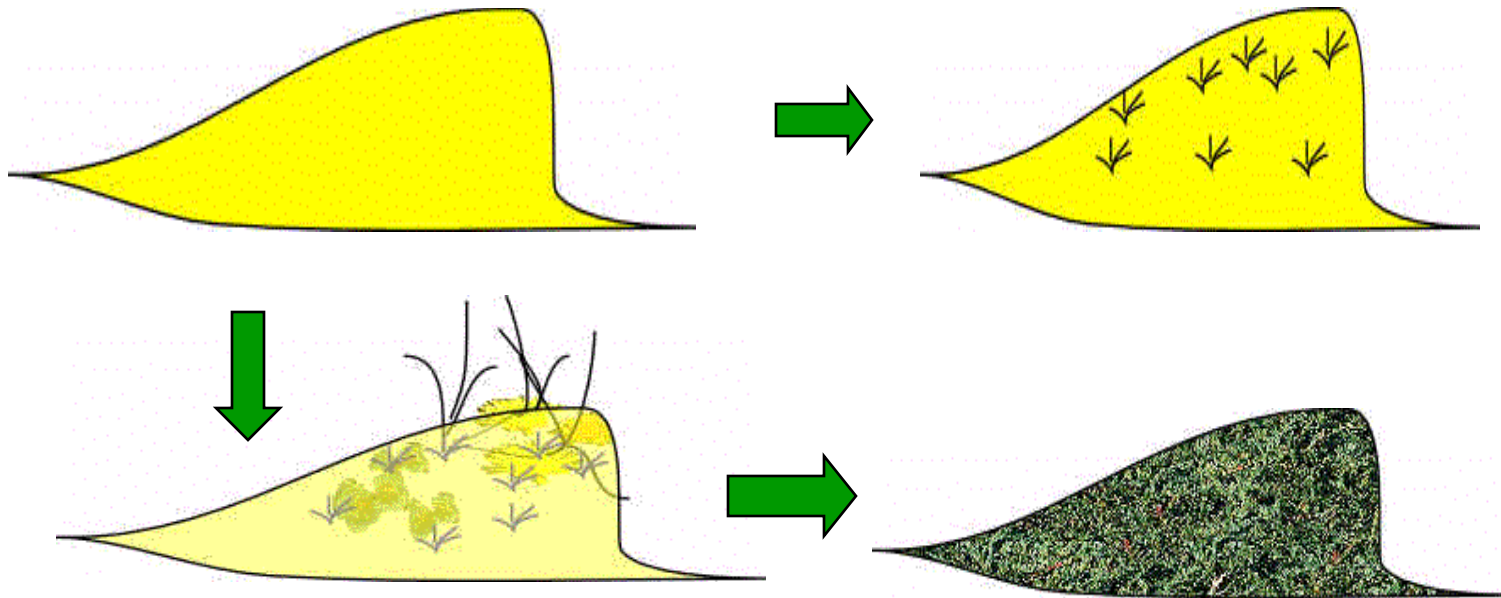


Autogenic / Allogenic Primary Succession

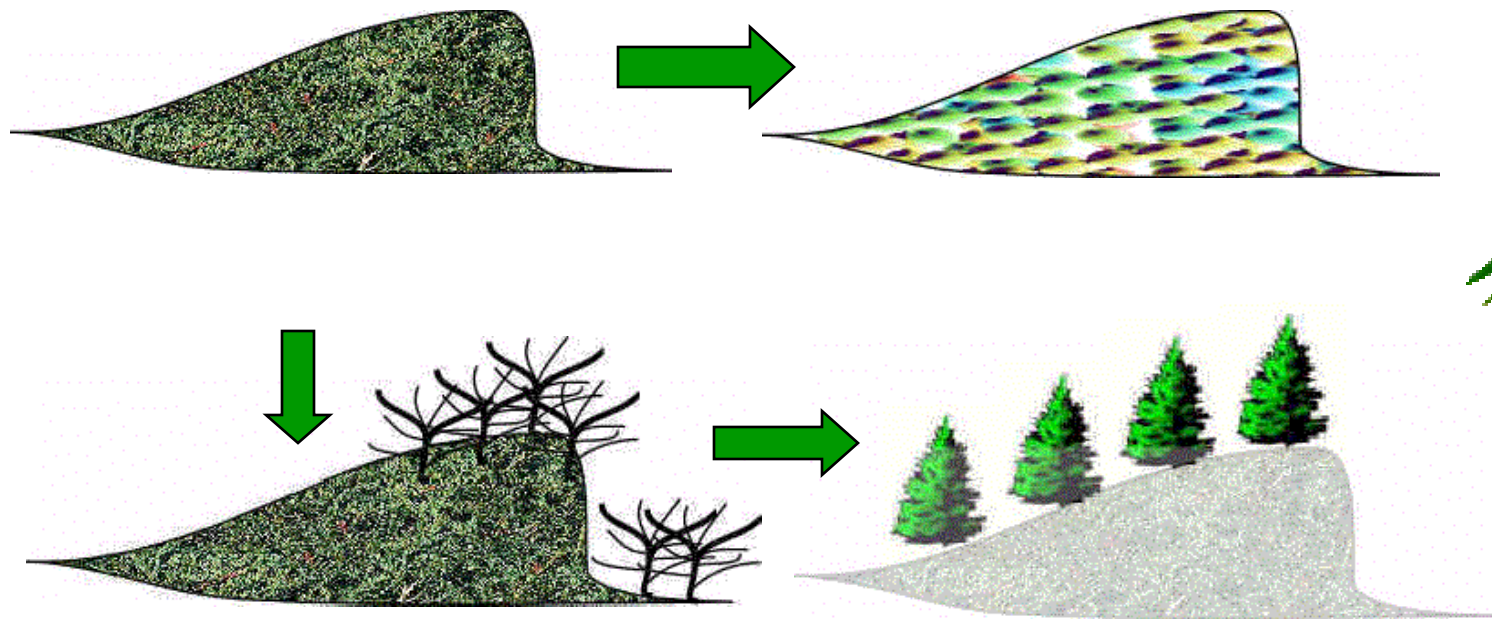
1. Coastal Sand Dunes
2. Volcanic – Mount St Helens
3. Hydrosere – from wetland to woodland



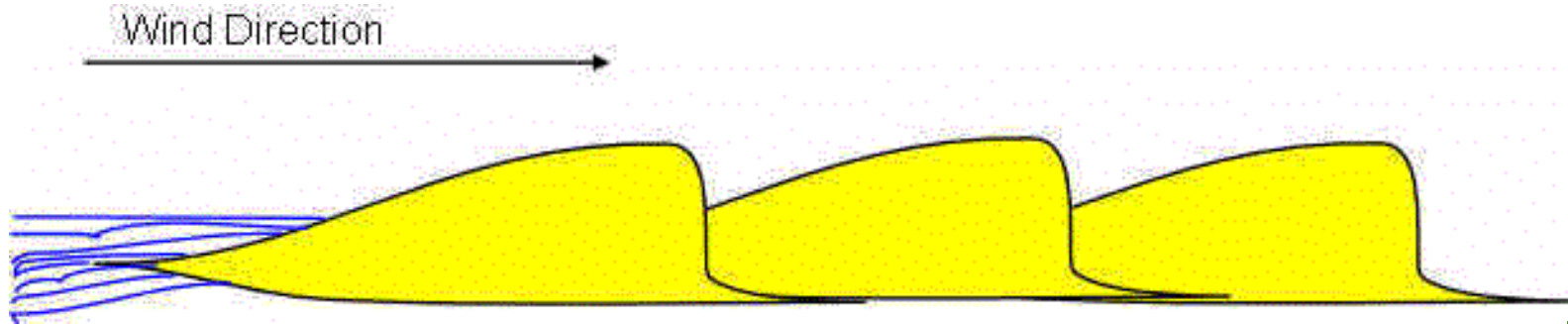
Dune Formation: Psammosere



Dune formation



Coastal Sand Dunes



- ★ Plants, flotsam & jetsam on shoreline provide mini wind breaks – sand deposited
- ★ Sand piles accumulate – a large wind break
- ★ Pioneer plants colonise – hold sand in place with root networks
- ★ New dunes created behind first dune



Coastal Sand Dunes

★ Creation new sand dunes:

- Continually moving sand
- Very little freely available water
- Very few nutrients



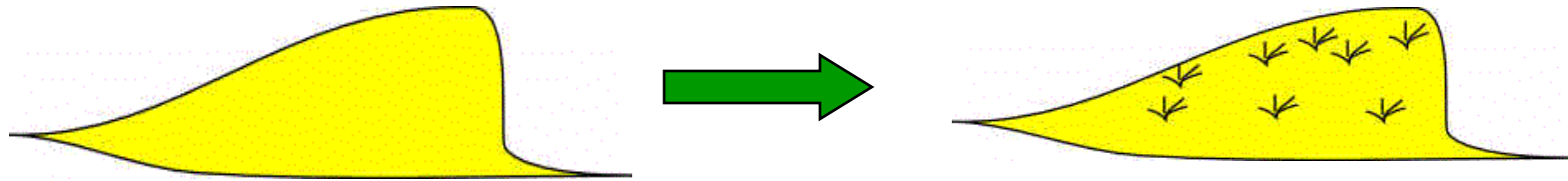
Coastal Sand Dunes

★ Pioneer plants:

- High vertical growth rates
- Extensive lateral or creeping root system
- Night dews
- Xerophytic – to decrease water loss



Dune Formation



- ★ Lyme grass *Elymus arenarius* – salt tolerant
- ★ Waxy coating on leaves
- ★ Stabilise dunes
- ★ As sand deposition increases – out competed by Marram grass *Ammophila arenaria*



Dune formation

- ★ Marram grass takes over binding process – less salt tolerant
- ★ Grown rate can keep pace with 1m deposition per year
- ★ Sideways growth – 3m – trapping sand

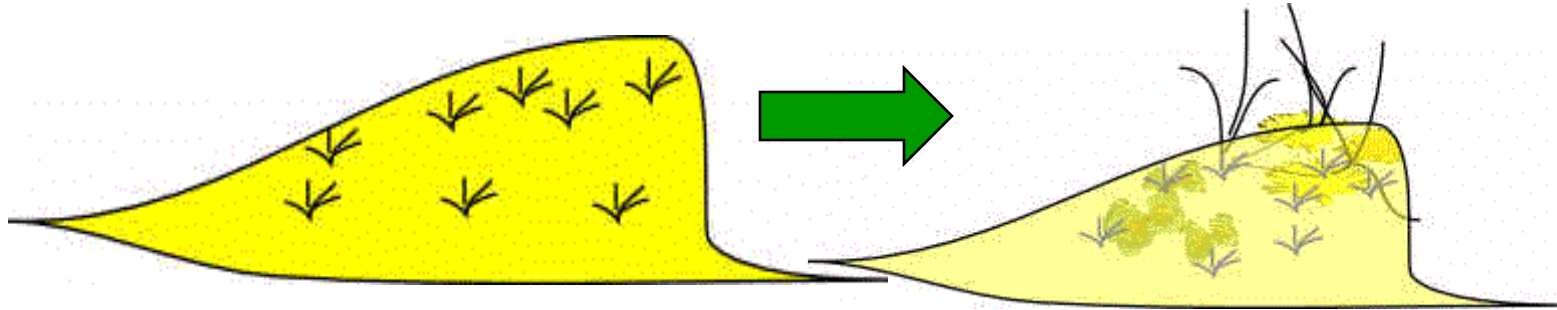


Dune Formation

- ★ Colonisation of grasses - increase in biodiversity:
- ★ Wind blown - Painted Lady
Cynthia cardui



Dune Formation



- ★ Spurges colonise hot, drier slopes
- ★ Fleshy, waxy leaves – high capacity for water storage; white latex in stems & leaves – unpleasant for herbivores
- ★ White dune stage: plant cover is patchy and sand can still be seen over large areas

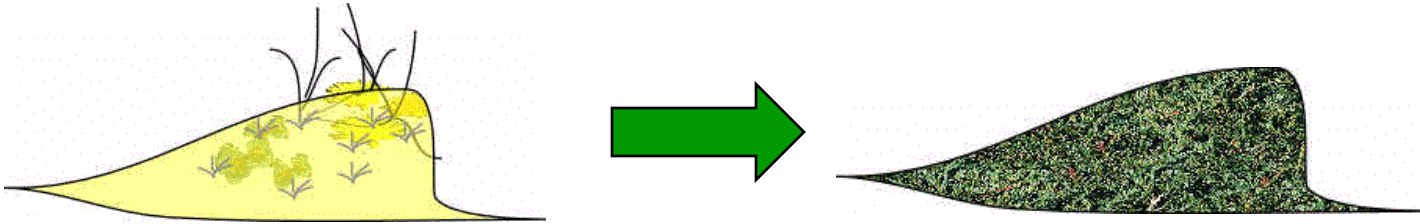


Dune Formation

- ★ Rabbits *Oryctolagus cuniculus* are common
- ★ Vegetation heavily cropped
- ★ Herbaceous plants miniature or stunted
- ★ Increased nutrients
- ★ 'waste ground' plants – dandelions, thistles, ragworts etc
- ★ *Lepidoptera*: Butterflies and moths



Dune formation



- ★ Almost continuous plant cover
- ★ Anchoring dune in place
- ★ Developing humus layer – retains moisture
- ★ Where sand stops being deposited – marram grass dies out
- ★ Grey, green lichens *Peltigera cladonia* will colonise

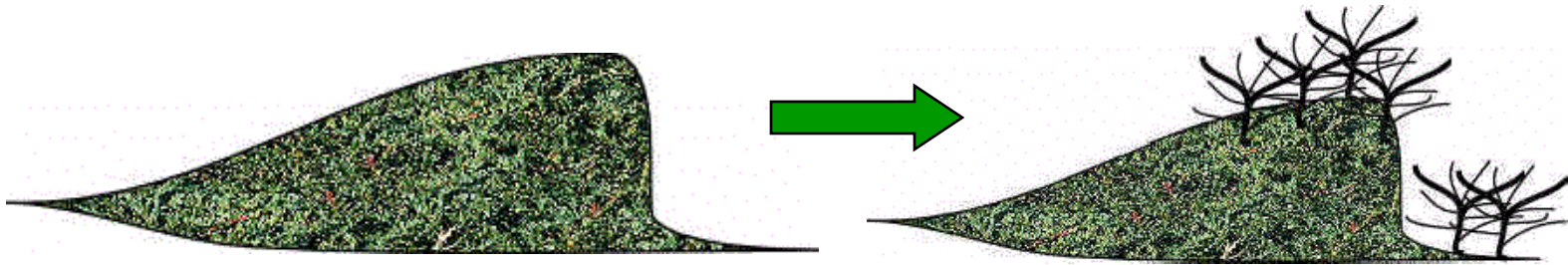


Dune Formation

- ★ Lichens and mosses in summer become dry and give a 'crunchy' texture to dune
- ★ Where large number of pulverised shell in sand – lime loving plants thrive:
Pyramidal Orchid *Anacamptis pyramidalis* or Evening Primrose *Oenothera sp.*
- ★ Invertebrates, mammals and bird life (voles, skylarks etc)



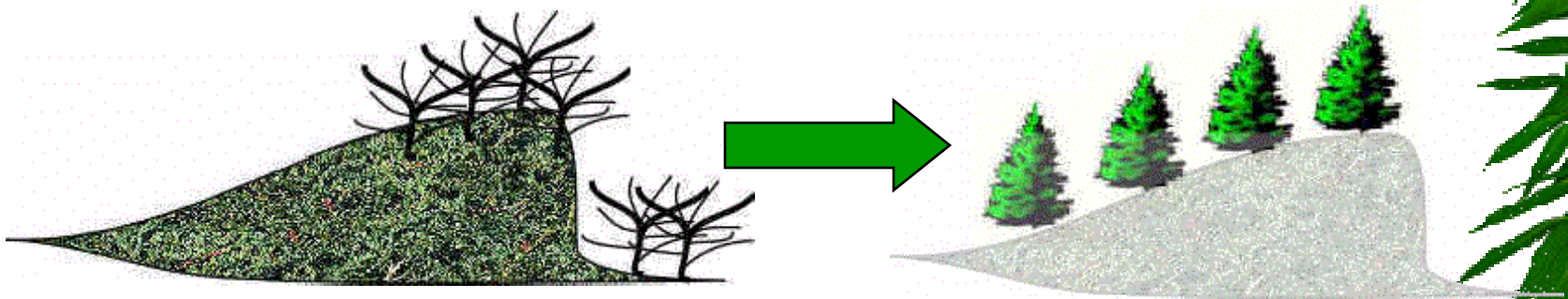
Dune Formation



- ★ Poor sandy soil – grasses and bushes
- ★ Sea Buckthorne *Hippophae rhamnoides*
- ★ Privet *Ligustrum vulgare*
- ★ Dune slacks – wet
- ★ Creeping willow *Salix repens*



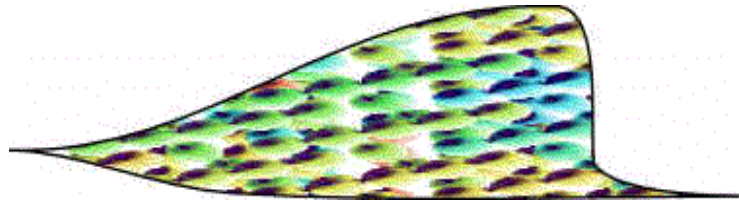
Dune Formation



- ★ Tree planting – final stabilisation using conifers
- ★ Eventually dunes will turn into woodland without intervention



Dune Formation



- ★ Acidic grey dune stage
 - Where sand is purely quartz without pulverised shell – developing soil substrate – acidic
 - Dominated by gorse *Ulex*, bracken *Pteridium aquilinum* and heather *Calluna vulgaris*



Academic Papers

- ★ The papers provided should give a useful insight to dune vulnerability and management. For the rest of the session, please summarise each for a later discussion during y next session (after Christmas?).

