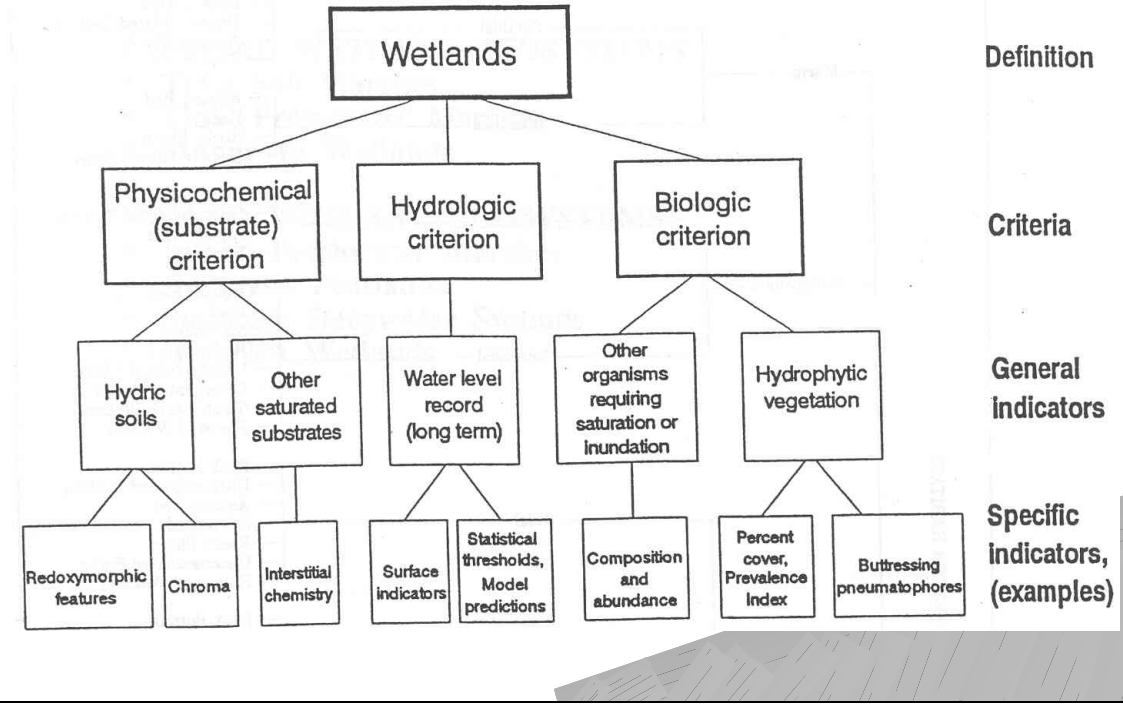
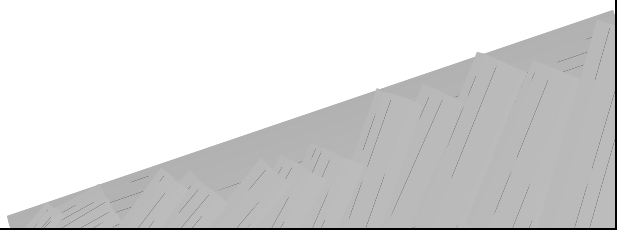
Wetland Organisms

Wetland Definition Diagram



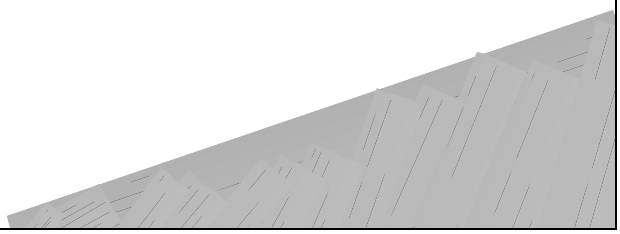
Stress Experienced In Wetlands

- Anoxia
- Salt Concentrations
- Water Fluctuation



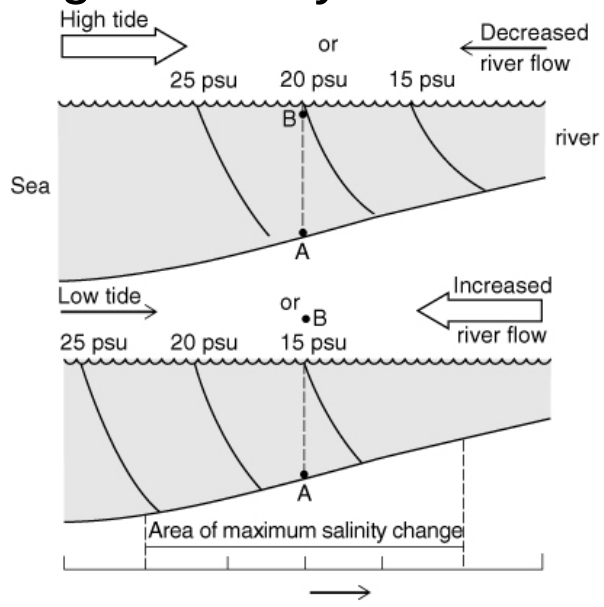
Anoxic Conditions

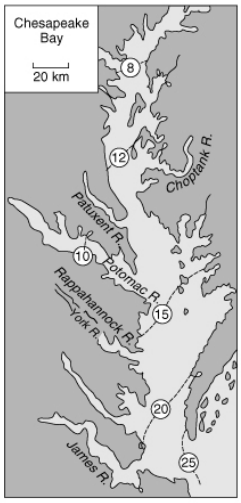
- Soils saturated/inundated
- Anaerobic Conditions
- May vary with season



Salt Concentrations

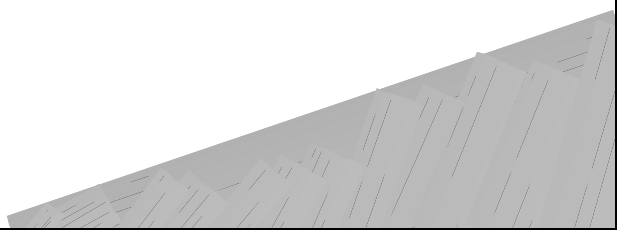
High salinity flux from





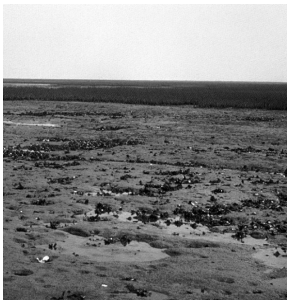
Salinity gradient types

- **Intermittent (Seasonal) estuary**: in Mediterranean climates, estuary forms during rainy season, dries or cut off in dry season.
- Salinity varies across seasons.



Water Fluctuation

- Tidal Systems



- Non-Tidal Systems

Protists

- Anoxia (respiration)
  - Ability to use internal organic compounds as electron acceptors
  - Ability to use inorganic ions in respiration
  - Ability to use specific electron acceptors rather than oxygen
    - sulfate
- Salt (osmotic & toxicity)
  - Complex potassium in cytoplasm
  - Enzymes function normally

Vascular Plants

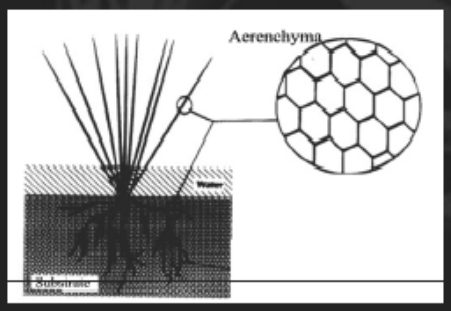
- Anoxia
  - Structural
  - Nutrient absorption
  - Metabolic
  - Whole Plant Strategies
- Salt
  - Barriers
  - Secretory organs
- Water
  - Photosynthesis

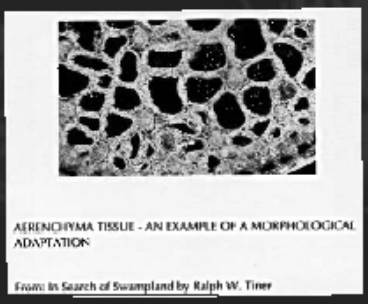
Structural Adaptations

- Aerenchyma
- Adventitious Roots
- Lenticels
- Pneumatophores
- Pressurized Gas Flow
- Rhizosphere Oxygenation

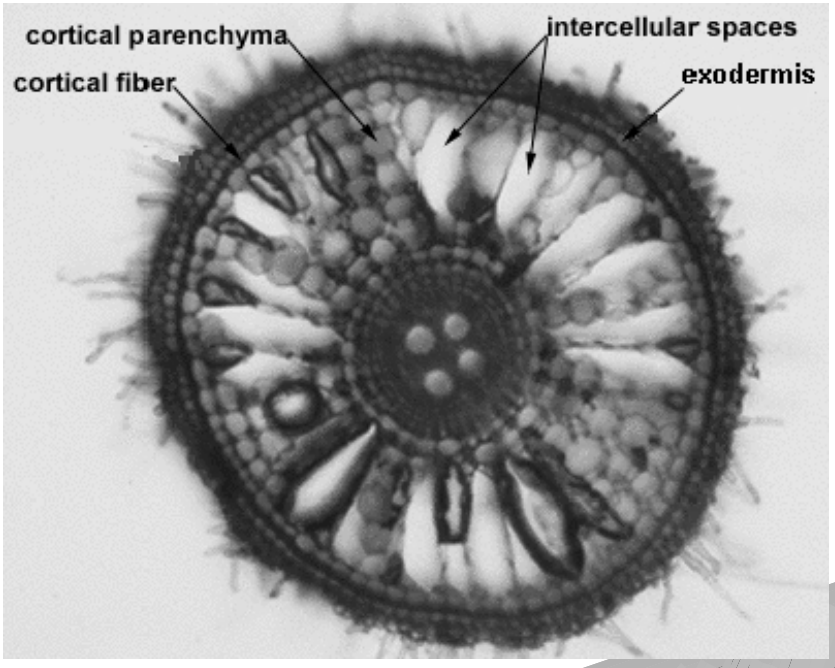
Aerenchyma

- The air spaces found in the stems and roots of herbaceous wetland plants.
  - Lends stability
  - Allows oxygen to diffuse from the leaves (exposed to the atmosphere) to the roots that are often surrounded by saturated/anaerobic soils.

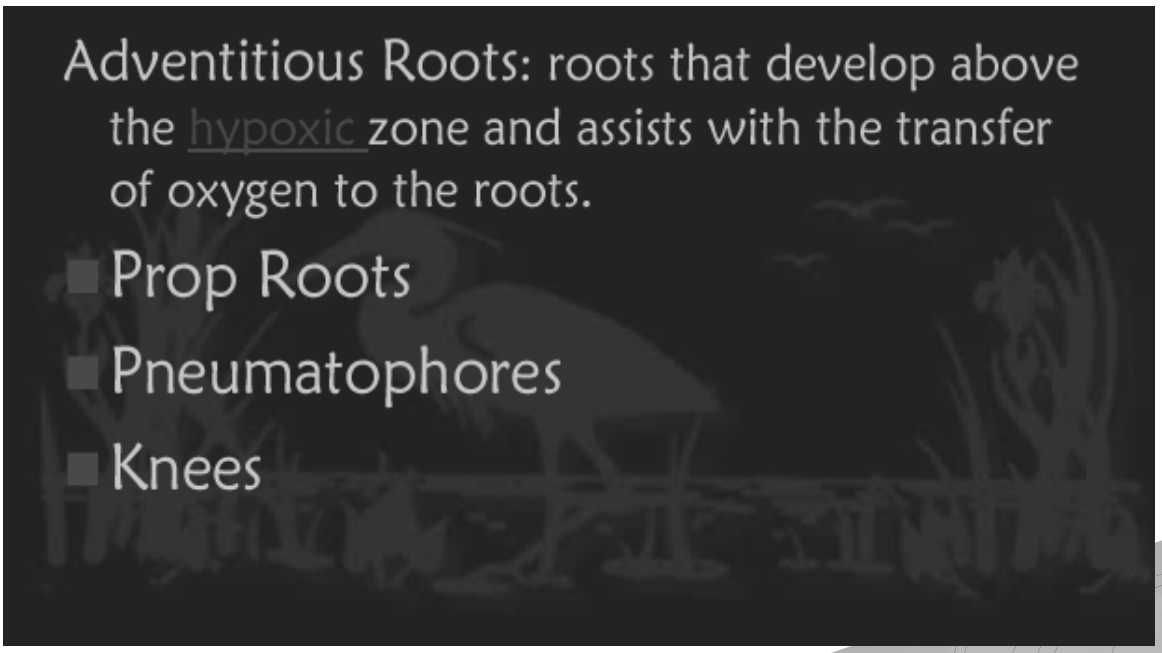




Aerenchyma

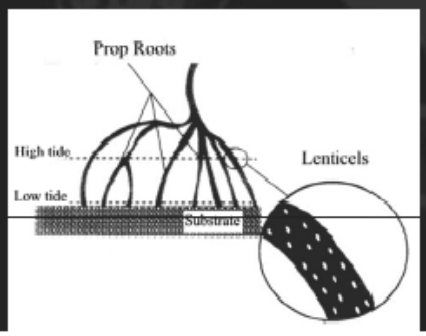

cortical parenchyma
cortical fiber
intercellular spaces
exodermis

Adventitious Roots



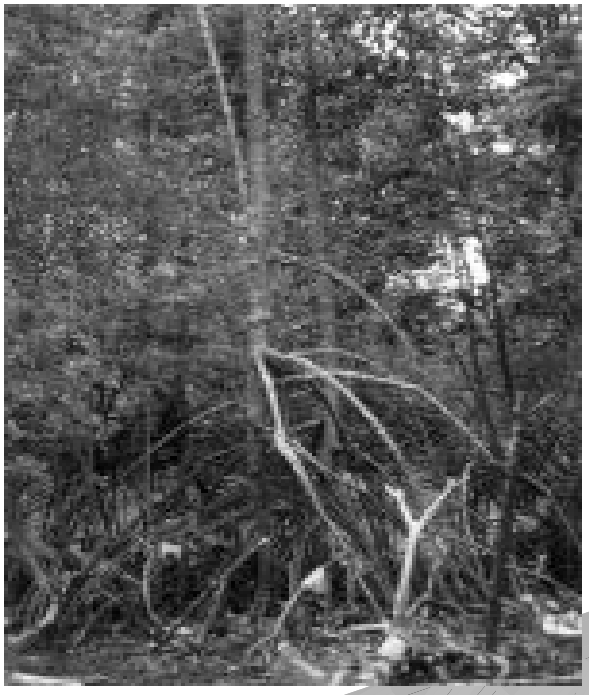
Prop Roots

- Prop roots are roots produced above the anoxic zone that are able to function normally in anaerobic environments. They are covered in numerous small pores called lenticles. The prop roots terminate below the waterline in long spongy air-filled submerged roots
  - Lenticels are small pores found on the above-ground roots of some wetland plants. They aide in oxygen transport to roots located below the water line.

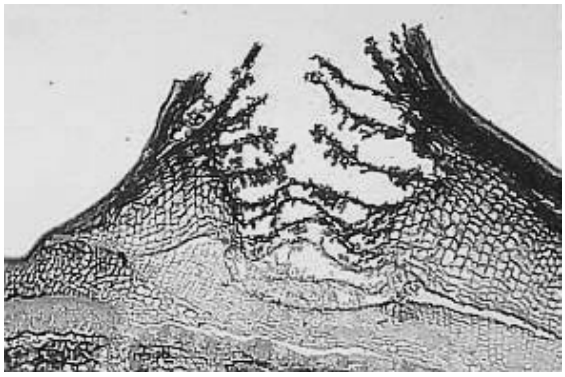


Red Mangrove

Prop Roots

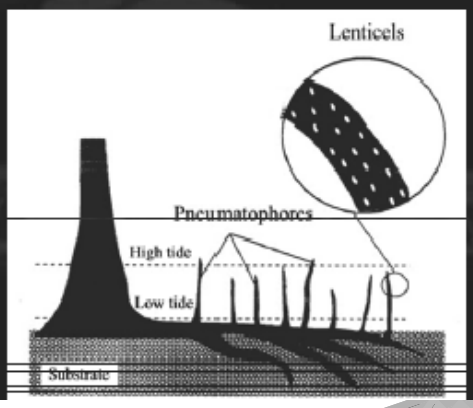


Lenticels



Pneumatophores

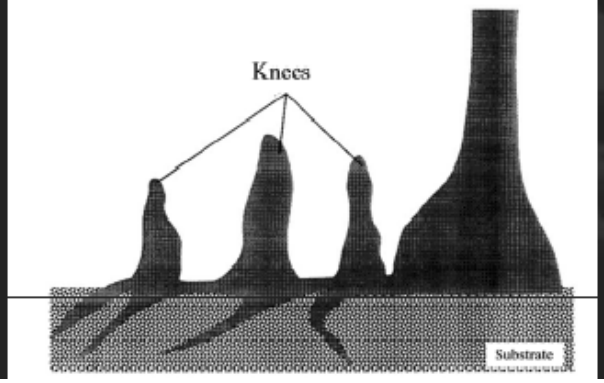
- Pneumatophores are spongy root projections usually 20 – 30 cm (8 – 12 in.) high and 1 cm (0.4 in.) in diameter that assist in oxygen transfer to the roots during low tides. There are often thousands of pneumatophores associated with one plant.



Pneumatophores

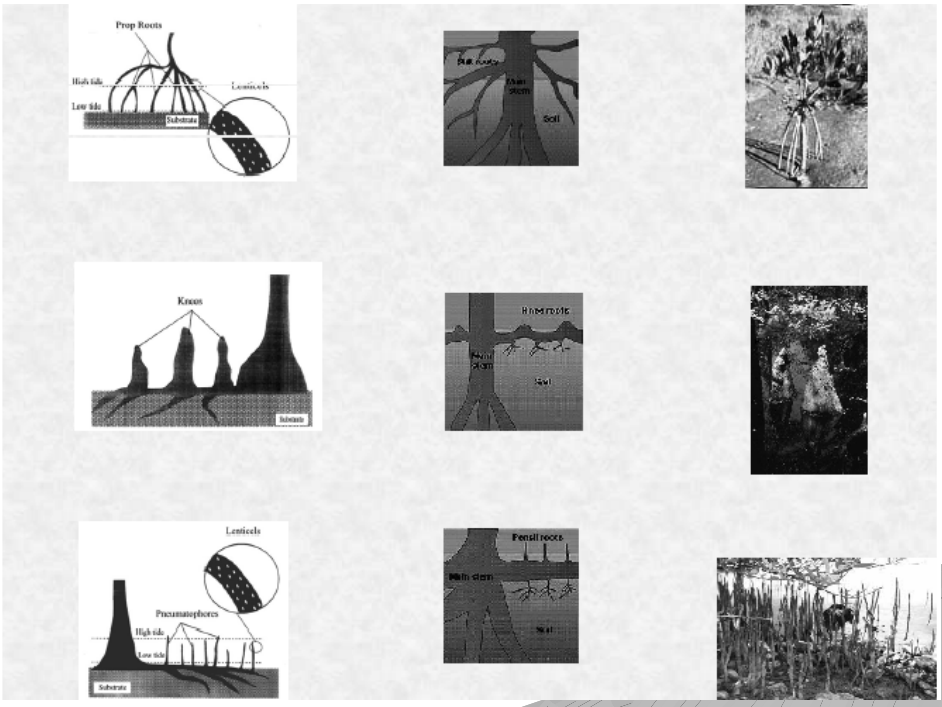
Knee Roots

- Knees are similar to pneumatophores in that they originate from the plant roots. However they are much larger and much less numerous. It is thought that they improve gas exchange, however this is currently only a theory.



“Knee” Roots

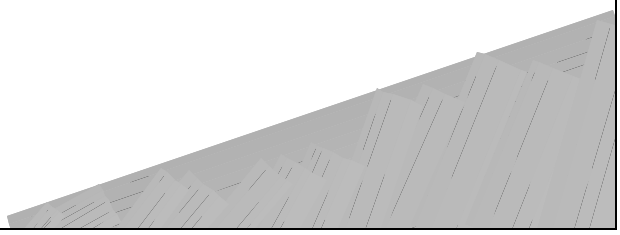
Root Adaptations



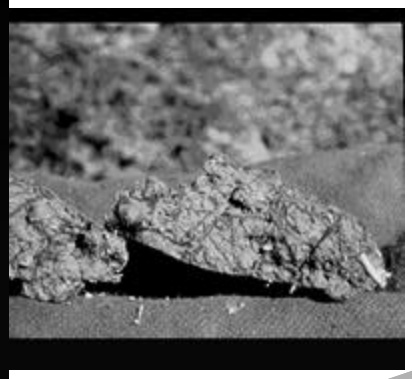
Plank Roots

Pressurized Gas Flow

- Air moves into internal gas spaces of aerial leaves
- Forced down to roots by gradient of temperature and water vapor pressure

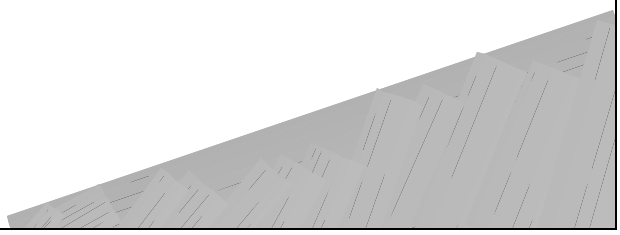


Oxidized Rhizosphere



Physiological Adaptations

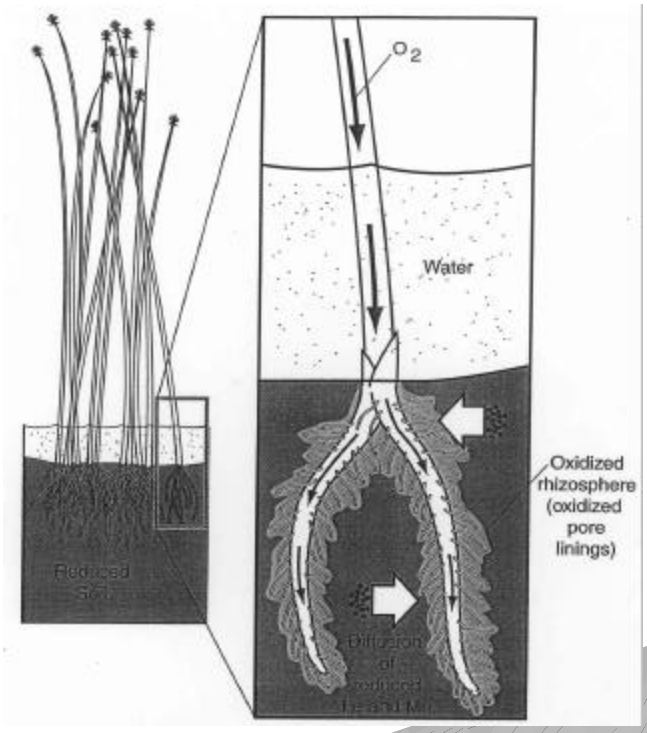
- Nutrient Absorption
- Anaerobic Respiration
- Malate Production



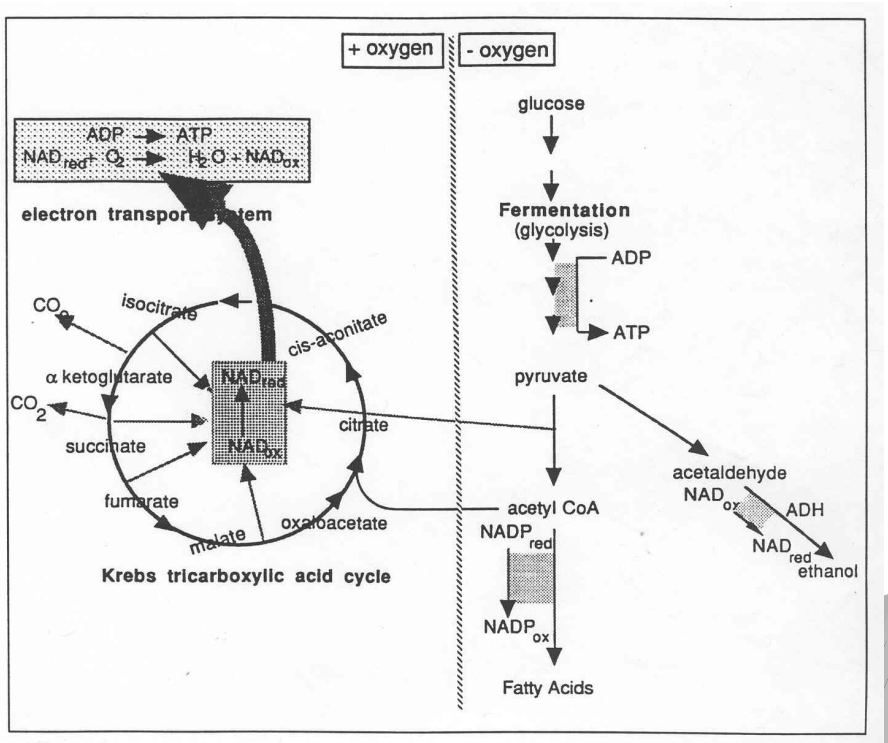
Nutrient Absorption

- Normal metabolism in roots
- Nitrogen – some wetland plants absorb ammonium
- Iron/Manganese – oxidized rhizospheres protect
- Sulfur – detoxification mechanisms

Rhizosphere Oxygenation

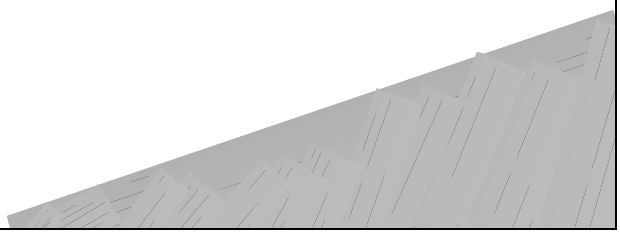


Anaerobic Respiration



Whole Plant Strategies

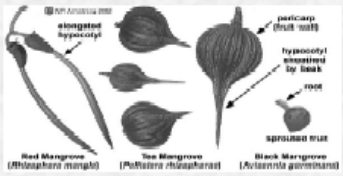
- Dormancy during flooding
- Seed Production in non-flooded season
- Buoyant Seeds
- Vivipary



Whole Plant Strategies

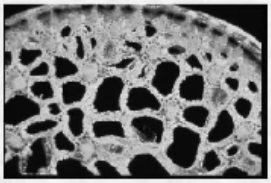
Floating Seeds

Vivipary



Rigid Stems

Arenchyma



Buttressed Trunks

Shallow Roots

Floatation

Vivipary

Adaptations to salt - plant

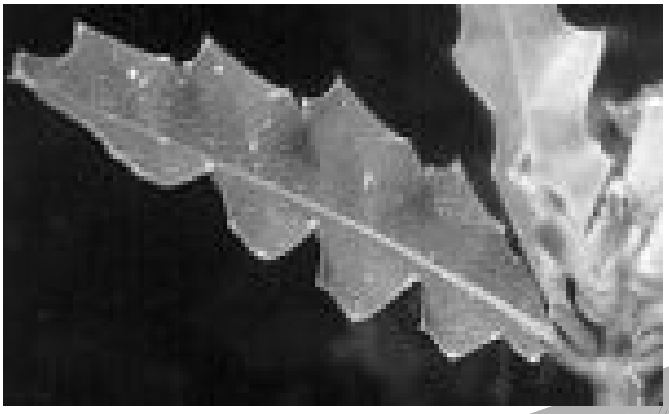
Some: salt gland - eliminates excess salt, maintains water balance. E.g., *Spartina alterniflora*

Vascular marsh plants either:

- **Succulent**: have high water concentration
  To reduce water loss, have: few stomata, reduced leaf area, photosynthetic stems.
  Rid salts by shedding leaves
- Other **halophytes** (salt dwellers): rid salts by
  a) salt-secreting glands;
  b) thin cuticles & many stomata → high transpiration

Salt Adaptations

- Barrier Cells in roots
- Secretory Cells



Changes in Photosynthesis

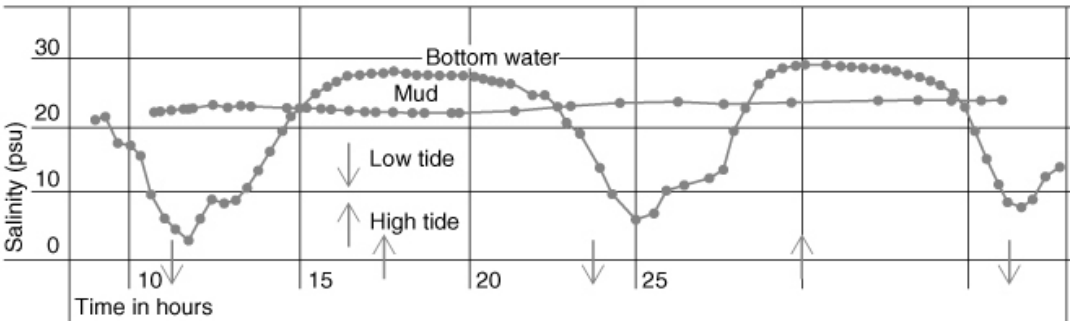
- C_3 Biochemical Pathway
  - Phosphoglyceric Acid
  - Much more common
- C_4 Biochemical Pathway
  - Oxaloacetic Acid
  - Arid/wetter
  - Use CO_2 More Effectively

Animals

- Anoxia
  - Specialized organs for gas exchange
  - Mechanism to improve oxygen gradient
  - Better circulation system
  - Decrease activity during oxygen stress
  - Shifts metabolic pathways
- Salt
  - Move
  - Control internal osmotic concentrations

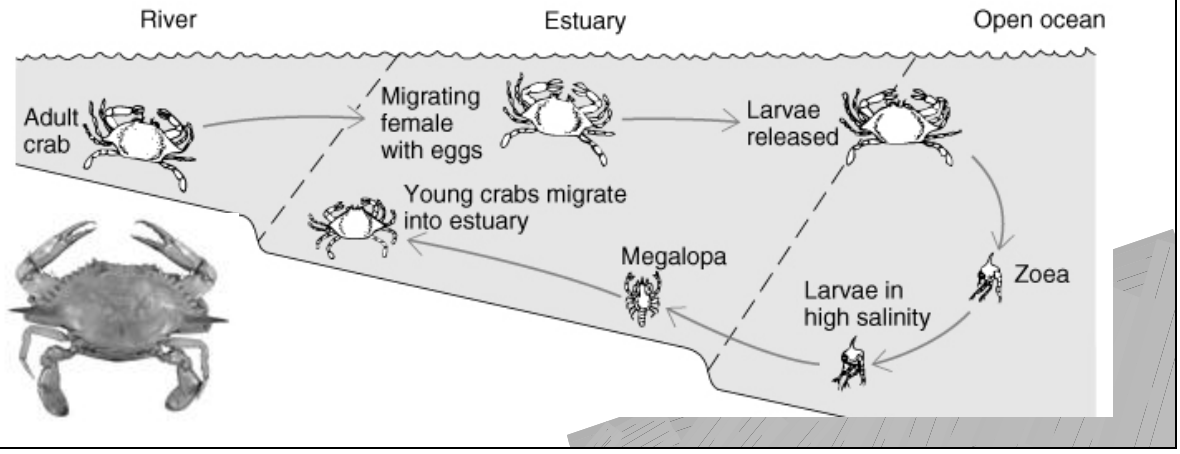
Salinity adaptations - faunal

- Behavioral: burrow, close up



Salinity adaptations - larvae

- Many larvae cannot osmoregulate
- Many estuarine inverts - pelagic larvae
- E.g., *Callinectes sapidus, Eriocheir sinensis* are catadromous



Wetland Delineation

Purpose
- Jurisdictional
- Scientific

- Definition

  U.S. Army Corps of Engineers:

  inundated or saturated by surface or ground water at frequency /duration sufficient to support vegetation adapted to saturated soil conditions.

- Diagnostic Characteristics
  - Vegetation
  - Soils
  - Hydrology

Vegetation Indicator Status Categories

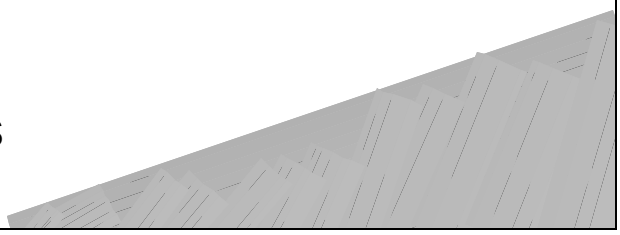
Category	**Symbol**	**Likelihood of Occurring in Wetland**
Obligate Wetland	OBL	>99%
Facultative Wetland	FACW	>67% to 99%
Facultative	FAC	33% to 66%
Facultative Upland	FACU	1% to < 33%
Obligate Upland	UPL	<1%

Wetland Soil Indicators

- NRCS Hydric Soil
- Field Indicators
  - Organic Soils
  - Mineral Soils
    - Gleyed
    - Chroma 1 with or without mottles
    - Chroma 2 with mottles
  - Sulfidic Material
  - Sandy Soils
    - High organic content at surface
    - Streaked

Hydrology Indicators

- Recorded Data
  - U.S. Corps of Engineers
  - USGS
  - State / Local Agencies
- Field Data
  - Soil Saturation
  - Watermarks
  - Drift Lines
  - Sediment Deposits



Delineation Method

- Preliminary Data
  - USGS Quadranlge Maps
  - NWI Maps
  - Soil Survey
  - Stream Gage
  - EISs
  - State Wetland Determinations
  - Local Wetland Inventories
  - Aerial Photographs
- In-Field Data (transects)
  - Visual Changes
  - Chose Representative Points
  - Characterize Each Change
    - Vegetation
    - Soils
    - Hydrology