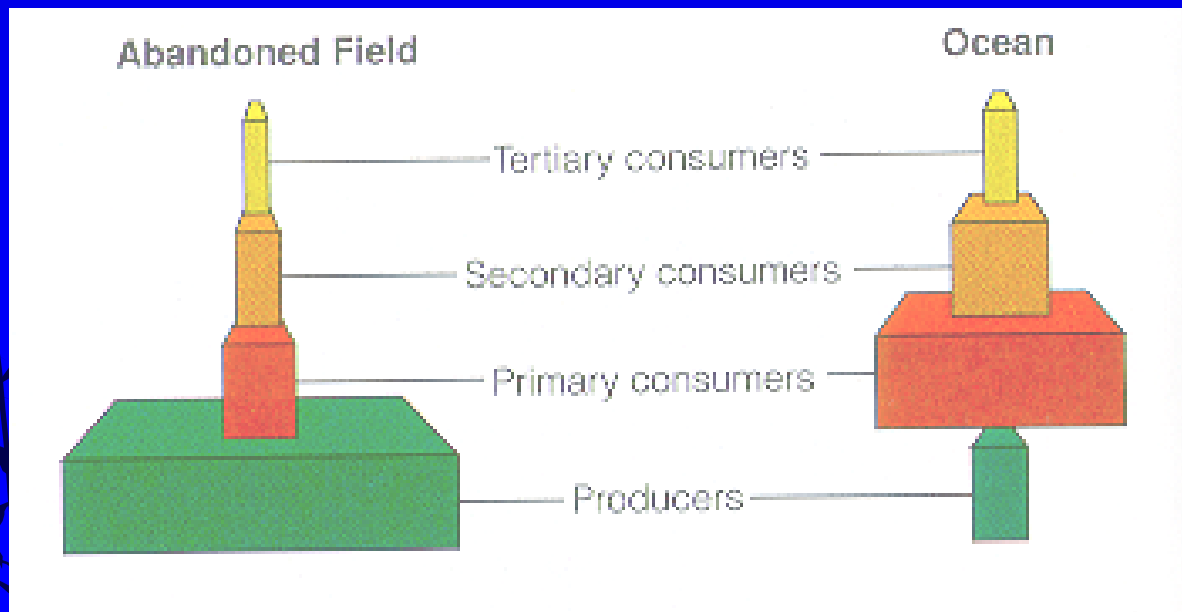


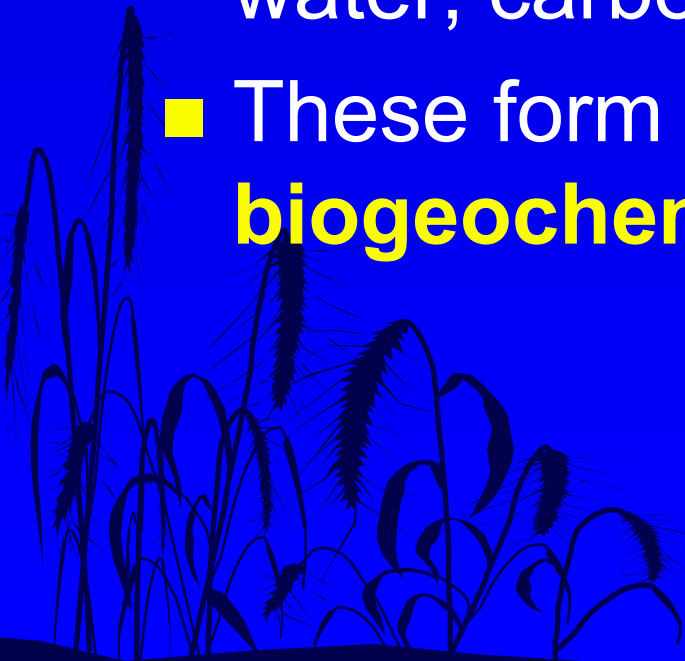
# Materials Cycle Within Ecosystems

- Ecologists also construct pyramids of numbers and **biomass** (the dry weight of organisms)
- Only the energy pyramid must be “right side up!”



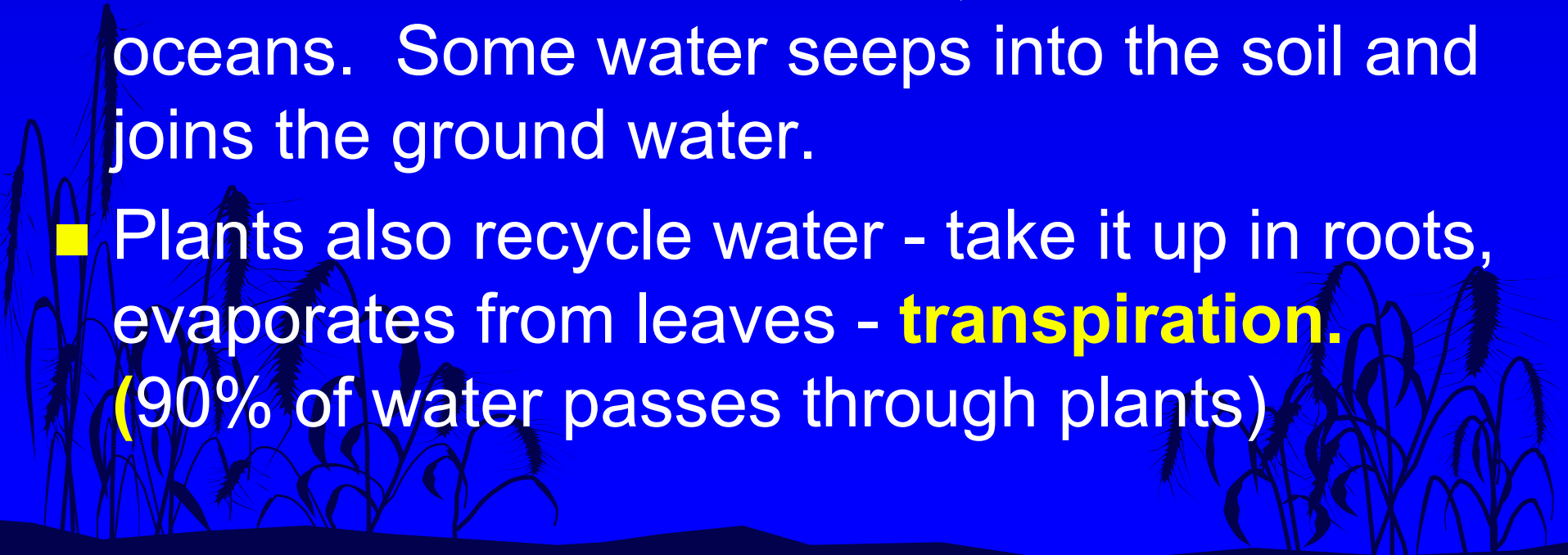
# Materials Cycle Within Ecosystems

- Unlike energy which flows through the ecosystem in one direction, the physical components cycle constantly.
- Four substances particularly important: water, carbon, nitrogen, phosphorous.
- These form closed circles - **biogeochemical cycles.**

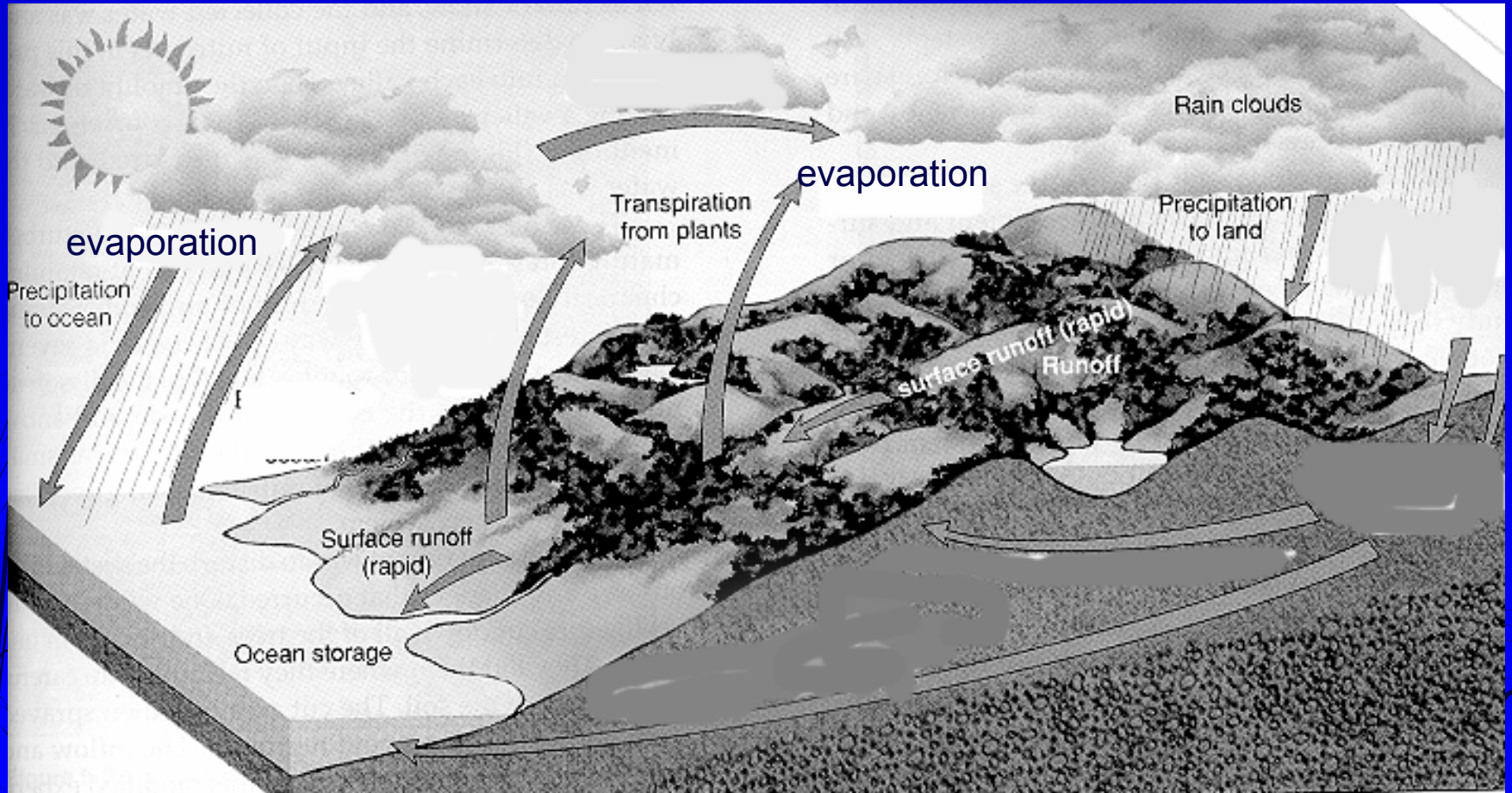


# WATER CYCLE

- In the water cycle, water falls to the surface as **precipitation**. Some water returns to the atmosphere through **evaporation**.
- Water also collects in lakes, rivers and oceans. Some water seeps into the soil and joins the ground water.
- Plants also recycle water - take it up in roots, evaporates from leaves - **transpiration**.  
(90% of water passes through plants)

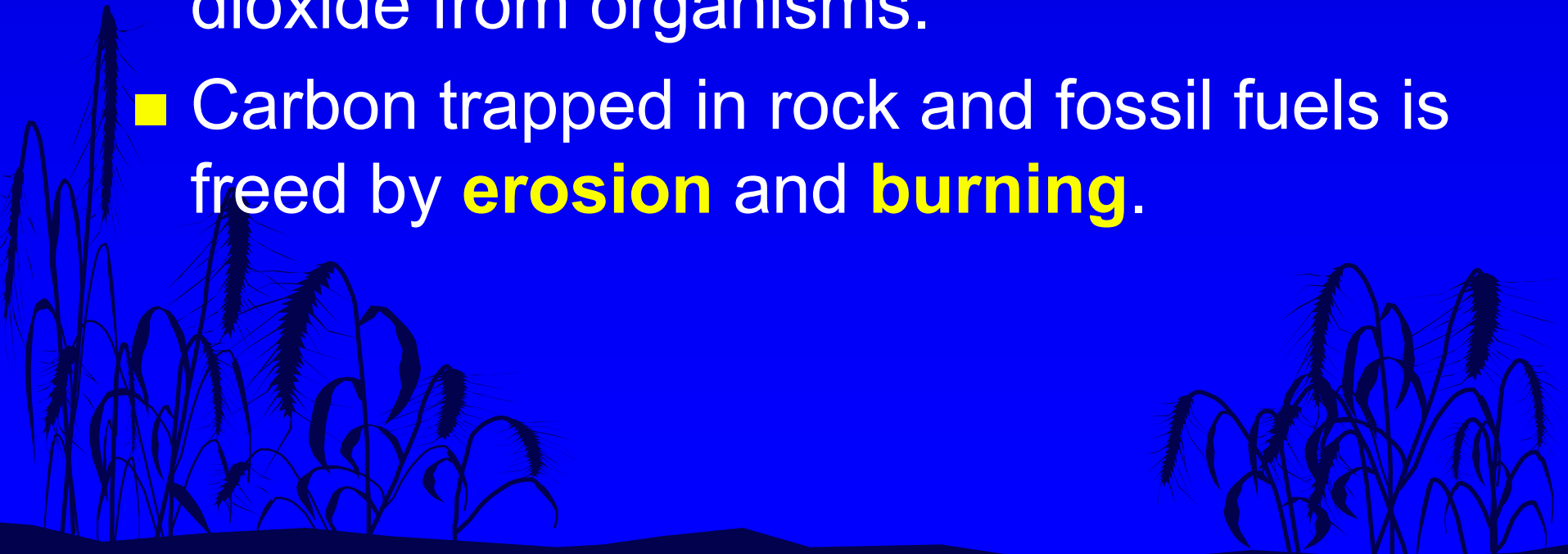


# WATER CYCLE



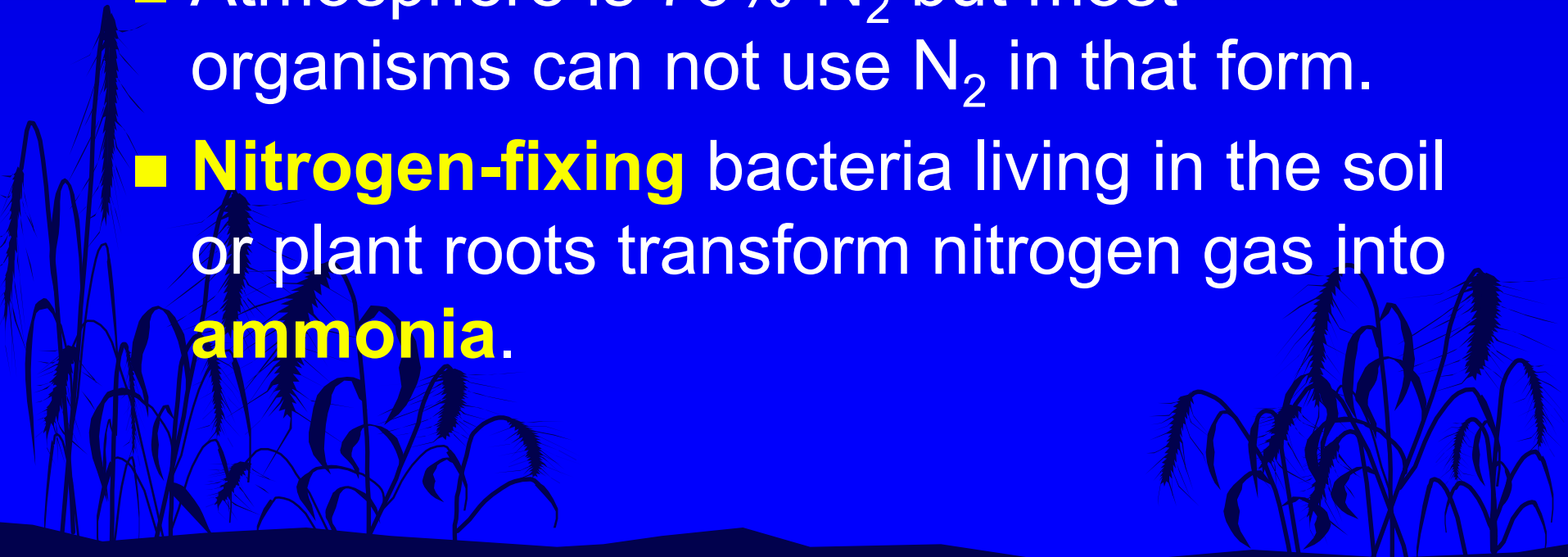
# CARBON CYCLE

- Carbon enters the living portion of the carbon cycle through **photosynthesis**. **Cellular respiration** releases carbon dioxide from organisms.
- Carbon trapped in rock and fossil fuels is freed by **erosion** and **burning**.

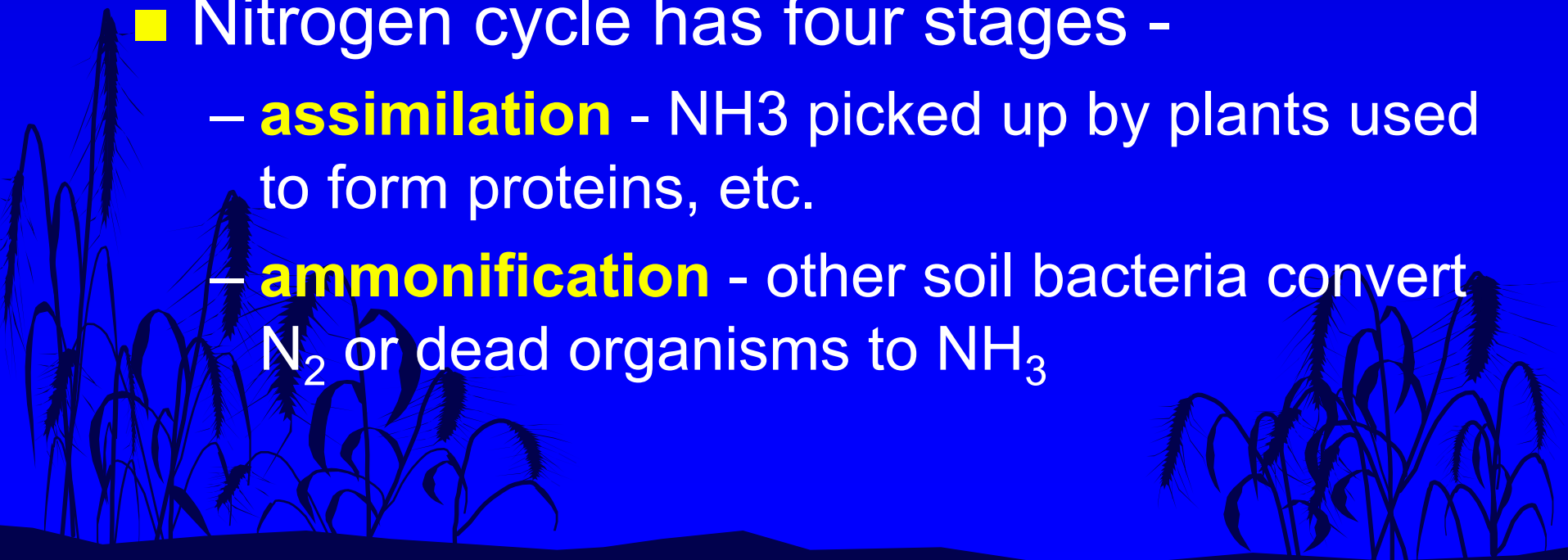


# NITROGEN CYCLE

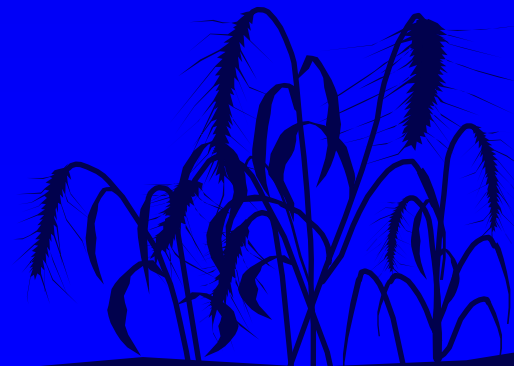
- Organisms contain large amounts of  $N_2$  because both proteins and amino acids contain  $N_2$ .
- Atmosphere is 79%  $N_2$  but most organisms can not use  $N_2$  in that form.
- **Nitrogen-fixing** bacteria living in the soil or plant roots transform nitrogen gas into **ammonia**.

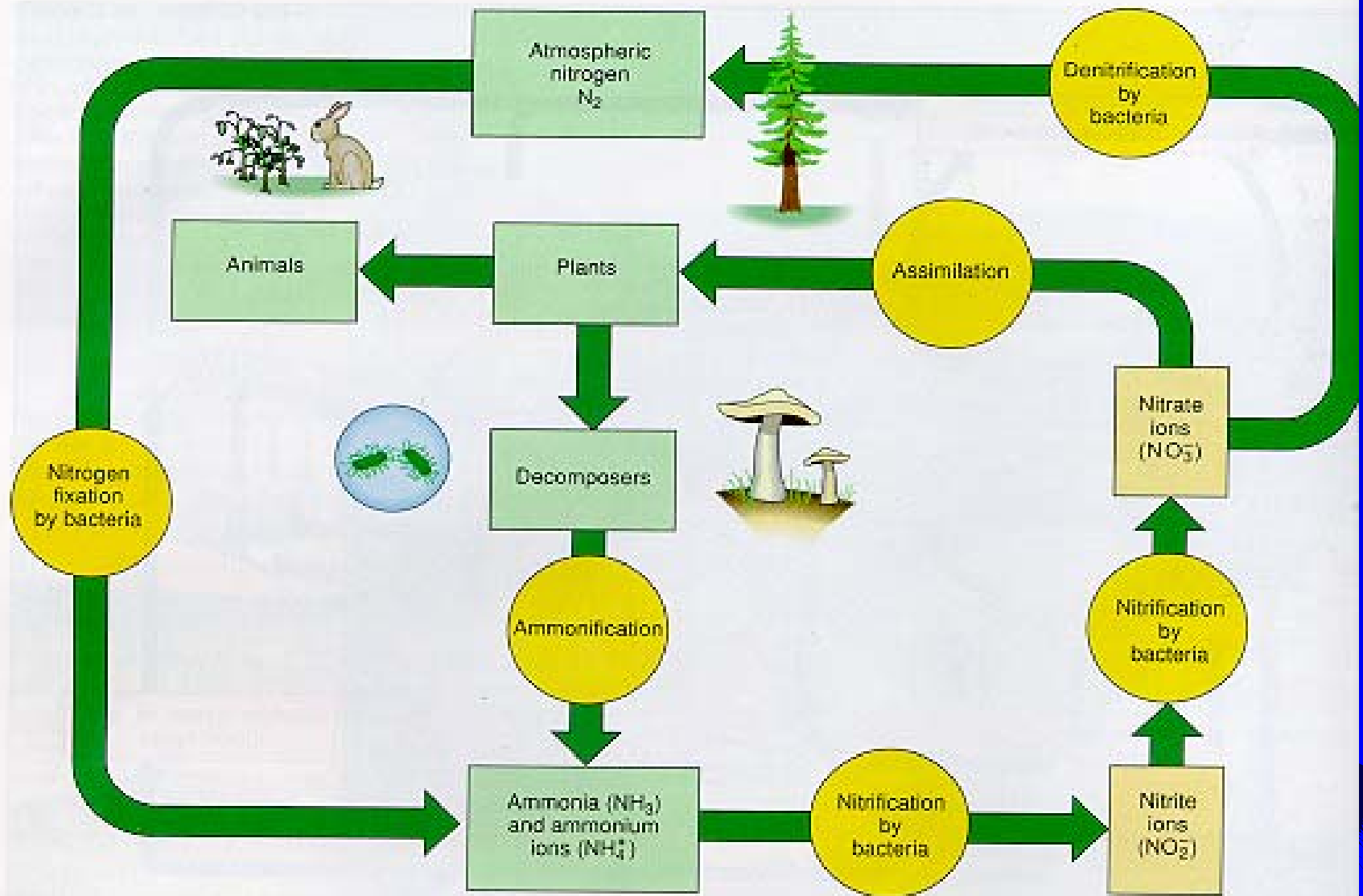


- Plants lacking these bacteria take up ammonia and nitrate from the soil. Animals get nitrogen by eating plants or other animals.
- Nitrogen cycle has four stages -
  - **assimilation** -  $\text{NH}_3$  picked up by plants used to form proteins, etc.
  - **ammonification** - other soil bacteria convert  $\text{N}_2$  or dead organisms to  $\text{NH}_3$



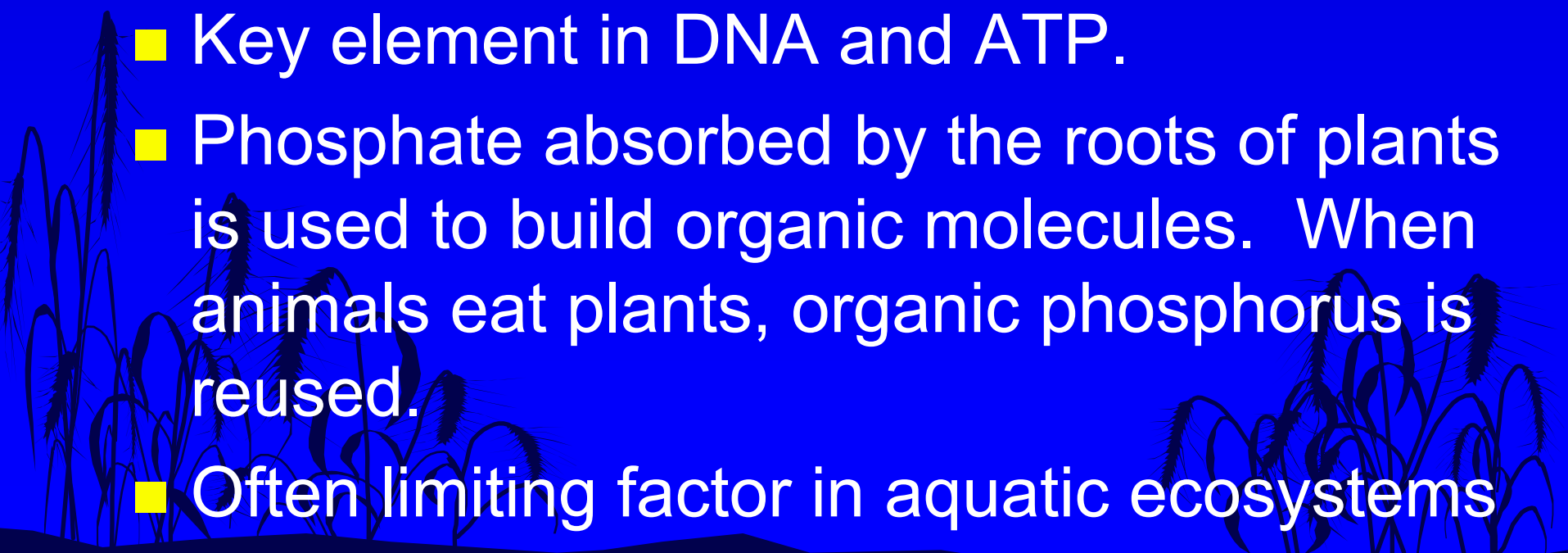
- **nitrification** -  $\text{NH}_3$  in soil converted to  $\text{NO}_3$  and  $\text{NO}_2$  by yet other soil bacteria
- **denitrification** - still other bacteria convert  $\text{NO}_3$  back to  $\text{N}_2$  to return it to the air.
- The growth of plants is often limited by the amount of  $\text{NH}_3$  and  $\text{NO}_3$  in the soil  
∴ fertilizer or compost is added!

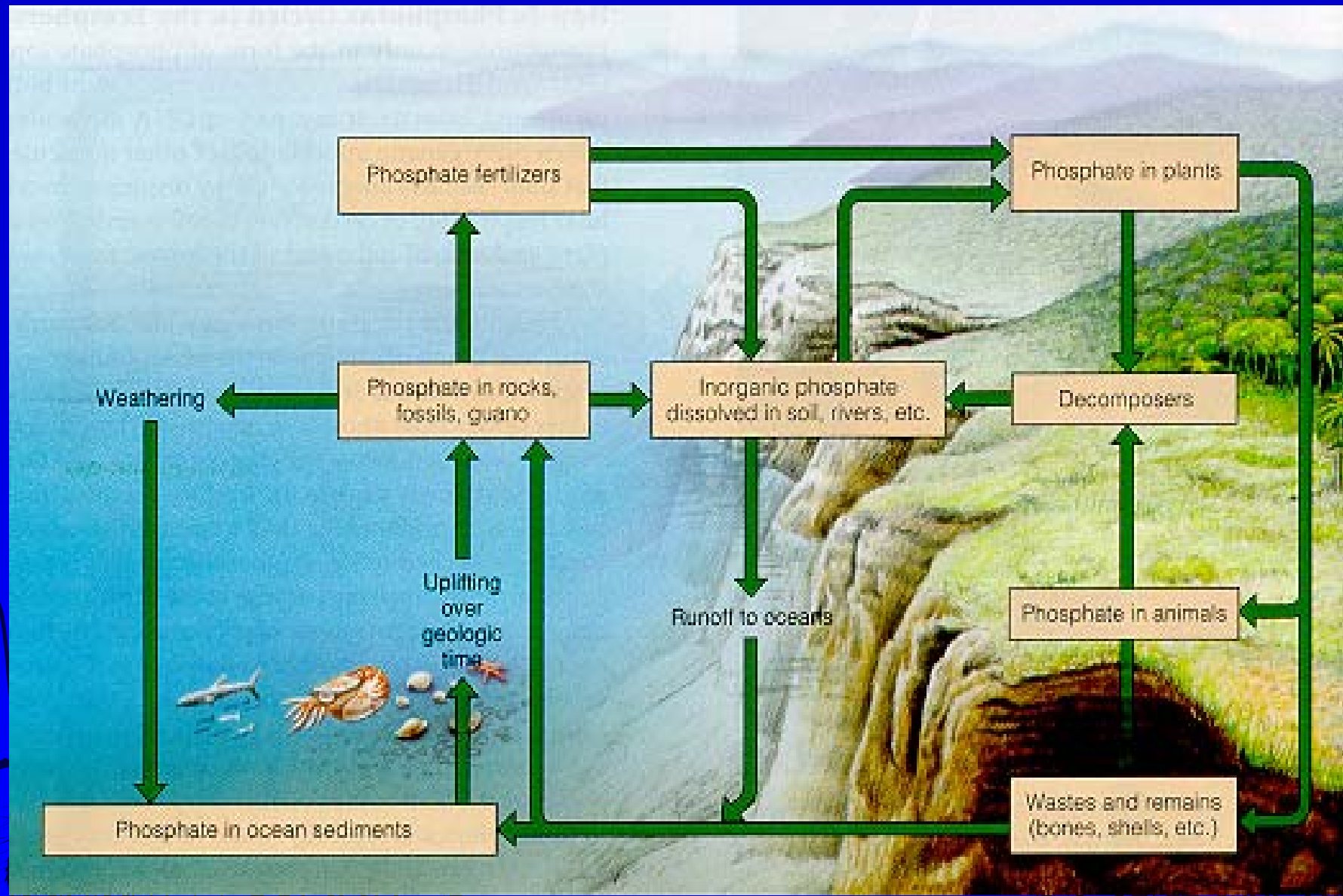




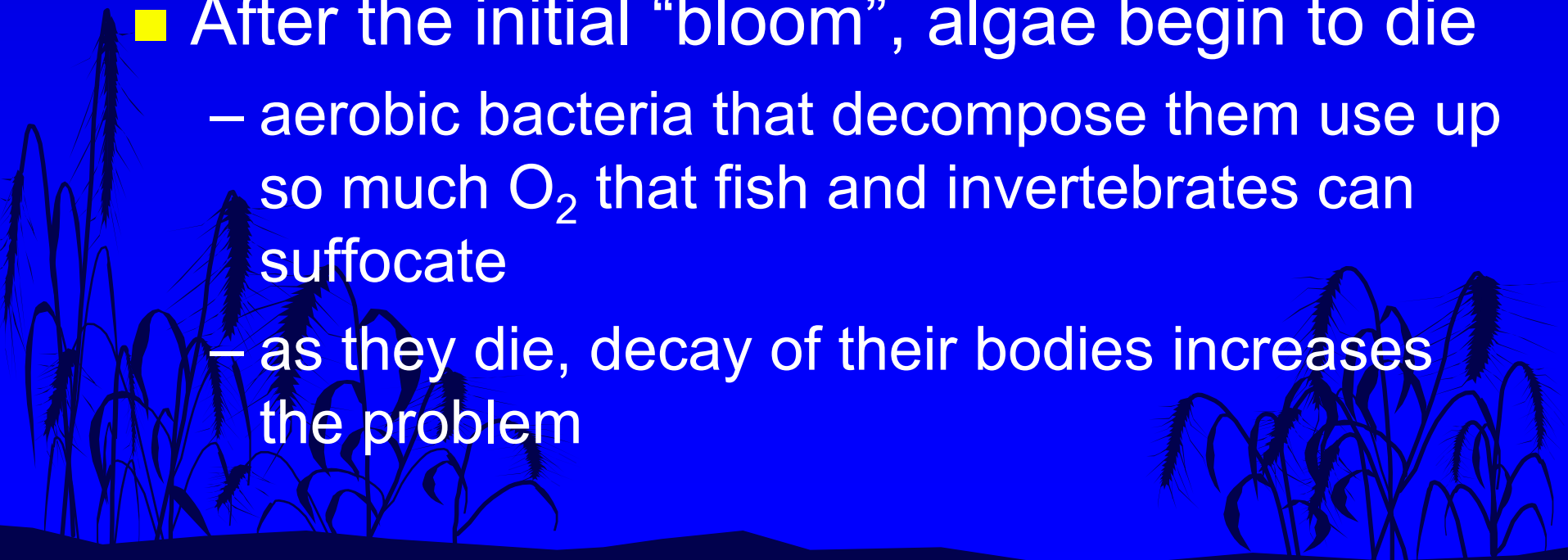
**Figure 5-27** Simplified conceptual model of the nitrogen cycle in a terrestrial ecosystem. Nitrogen reservoirs are shown as boxes, and processes changing one form of nitrogen to another are shown in ovals.

# PHOSPHOROUS CYCLE

- Phosphorous, an essential element of all living organisms, is usually present in soil and rock as calcium phosphate.
  - Key element in DNA and ATP.
  - Phosphate absorbed by the roots of plants is used to build organic molecules. When animals eat plants, organic phosphorus is reused.
  - Often limiting factor in aquatic ecosystems
- 



- Phosphorous added to lakes as a result of human activities (detergents/fertilizers) can cause **algal bloom** - rapid multiplication of the algae population.
- After the initial “bloom”, algae begin to die
  - aerobic bacteria that decompose them use up so much  $O_2$  that fish and invertebrates can suffocate
  - as they die, decay of their bodies increases the problem



**Any one for a swim?**

