



Worksheet 13.1

Fifteen summary facts

- 1 Plants are distributed according to abiotic factors such as temperature (e.g. grasses on the beach can survive hot temperatures because they have deep root systems), water (e.g. grasses can find water in dry sand because they have a long root systems), soil pH (e.g. grasses can live on a sand dune where the pH is 7.5), salinity (e.g. beach grasses are resistant to dryness caused by salt spray) and mineral nutrients (e.g. in the forest, a more diverse group of plants is found because there are more mineral nutrients available).
- 2 In order to study the distribution of plants living on the beach, in the foredune and in the forest, a sampling technique called the transect method can be used (page 424).
- 3 Animals are distributed according to abiotic factors such as temperature (e.g. rabbits can withstand high temperatures of the foredune by building deep burrows), water (e.g. blue herons need interdunal ponds for nesting), breeding sites (e.g. blue herons breed in interdunal wetlands), food supply (e.g. rabbits eats the grasses which grow where their burrows are) and territory (coyotes stay within the territory that they mark, usually in the forest). I
- 4 In order to study the distribution of animals, the quadrat sample method can be used (Figure 13.2, page 423)
- 5 The niche is the particular role an organism has in an ecosystem. The niche includes where an organism lives, spatial habitat (e.g. frogs live in mud burrows at edge of a pond), feeding activities (e.g. green frogs eat aquatic larva of mosquitoes) and interactions with other species. These interactions can be competitive (e.g. frogs and small fish compete for aquatic larva), herbivory (e.g. rabbits eat the grasses of the dunes), predation (e.g. blue herons eat the green frogs), parasitism (e.g. leeches suck the blood of a fish) or mutualism (e.g. lichens are a cooperative relationship between alga and fungus. A niche can be fundamental (the perfect situation). For example, the heron eats frogs and lays its eggs in the grasses of the pond. A niche can be realized. The realized niche is the reality that the organism must live with. For example, if the pond has dried up due to drought, the heron is in direct competition with the other birds for food and space. If competition is severe, the principle of competitive exclusion may apply. This states that no two species in a community can occupy the same niche (Figure 13.3, page 429).
- 6 Biomass is measured as dry mass of organic matter of living organisms. To obtain the dry mass of an animal, trap and weigh the animal. Use a chart to determine the biomass based on its size or weight. To obtain the dry mass of plants, choose one plot to sample. Measure the size of each plant species, then cut them down. Dry the plants in an oven at 90 °C. Use a chart to show the relationship between height and biomass. Sample other plots in the area and use this information to determine biomass of the plants.



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- 7 A pyramid of energy shows movement of energy through an ecosystem (Figure 13.6, page 434). *Gross production* is the total amount of energy trapped in organic matter produced by plants per area per time in kilojoules. *Net production* is the gross production minus the energy lost through respiration. *Biomass* is the dry weight of an organism measured in grams per square metre per year. The formula for calculation of net production is:
- $$\begin{array}{ccccccc} \text{gross production} & \text{minus} & \text{respiration} & \text{equals} & \text{net production} & & \\ \text{GP} & - & \text{R} & = & \text{NP} & & \end{array}$$
- 8 A pyramid of biomass has the same shape as the pyramid of energy because higher trophic levels have lower biomass per unit area. Each successive level of the ecosystem loses more and more biomass. A pyramid of numbers has a similar shape because the total biomass of food available at the top trophic level is small.
- 9 Communities of organisms do not fit perfectly into these pyramids. For example, Grizzly bears eat plants and insects and some mammals so they do not fit easily in one trophic level. An eagle is a tertiary consumer when it eats rattlesnakes but a secondary consumer when it eats rabbits. A food web gives a true picture of what is being eaten in an ecosystem.
- 10 Primary succession begins when plants slowly begin growing on a previously barren and lifeless area such as a volcanic island. Secondary succession is more rapid and takes place following an upheaval of the primary succession such as a recolonization after a forest fire (table, page 440) During primary succession, the plants affect the soil development by building humus, recycling minerals nutrients as they decay, and reducing erosion as their roots stabilize the soil. Soon, larger and more diverse organisms can populate the area as soil structure improves.
- 11 The biosphere is all the living parts of the Earth where organisms live. Biomes are divisions of the biosphere defined by their vegetation and community structure. Biomes are distributed according to weather patterns, altitude and latitude. A single mountain may have alpine tundra at the top, coniferous forest next, deciduous forest below, and at the lowest altitude maybe a tropical forest (Figure 13.9, page 442). A climograph plots the temperature and rainfall in particular regions (Figure 13.10, page 443). Rainfall and temperature determine the different characteristics of seven major biomes of our biosphere (chart on page 444)
- 12 Using the Simpson diversity index, the diversity of two different communities can be compared. This index takes into account the number of individuals of each species present and the number of species. If one species is dominant in an ecosystem, it is less diverse than an ecosystem with more evenly distributed organisms. The formula for the index and some practice calculations are found on page 446.
- 13 The introduction of alien species into an ecosystem can be deliberate, accidental or specifically intended for biological control. Kudzu was deliberately introduced to the US from Japan in 1876 to prevent soil erosion. Unfortunately, kudzu's thick growth crushes many other plants as it grows over them and significantly reduces diversity. Zebra mussels were accidentally released into North



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America in the 1980s. They were carried into the Great Lakes in the ballast waters of ships from Europe. These mussels have done significant damage by clogging up pipes and attaching themselves to ships. A successful example of biological control is the introduction of a moth, *Cactoblastic cactorum*, from the US into Australia. The moth was introduced to control the spread of the prickly pear cactus. The prickly pear cactus is under control and a balance exists between the two populations.

- 14 Biomagnification is a process by which a chemical substance becomes more concentrated at each trophic level. DDT is a pesticide that was introduced into the environment to kill insect pests. It was not known at the time that DDT would not break down and would persist for decades in the environment. It entered the water supply and was ingested by microscopic organisms. These were eaten by small fish, which in turn were ingested by larger fish. DDT was magnified in the fatty tissue of the fish. As the fish were eaten by birds, the magnification increased. The decline of predator birds was caused by DDT interfering with the production of the hard shells on the bird's eggs.
- 15 Other serious problems affecting the biosphere include excess UV radiation and the presence of CFCs (chlorofluorocarbons). CFCs released from propellants in aerosol sprays and refrigerants, and have been recognized as a cause of depletion of the ozone layer since 1985. CFCs destroy ozone molecules. The destruction of the ozone layer in the stratosphere allows more damaging UV radiation to reach the earth. Excess UV radiation causes damage to living tissues (e.g. skin cancer, mutation of DNA, sunburn and cataracts). Excess UV radiation also causes reduced biological productivity. Floating microscopic plants are especially susceptible.