Unit #2 Assessment Statements

Ecology, Ecosystems, Productivity, Cycles

• A species is a group of organisms that share common characteristics and that interbreed to produce fertile offspring.

• A habitat is the environment in which a species normally lives.

• A niche describes the particular set of abiotic and biotic conditions and resources to which an organism or population responds.

• The fundamental niche describes the full range of conditions and resources in which a species could survive and reproduce. The realized niche describes the actual conditions and resources in which a species exists due to biotic interactions.

• The non-living, physical factors that influence the organisms and ecosystem—such as temperature, sunlight, pH, salinity, and precipitation—are termed abiotic factors.

• The interactions between the organisms—such as predation, herbivory, parasitism, mutualism, disease, and competition—are termed biotic factors.

• Interactions should be understood in terms of the influences each species has on the population dynamics of others, and upon the carrying capacity of the others’ environment.

• Sampling strategies may be used to measure biotic and abiotic factors and their change in space, along an environmental gradient, over time, through succession, or before and after a human impact (for example, as part of an Environmental Impact Assessment—we will study this in a later unit).

• Measurements should be repeated to increase reliability of data. The number of repetitions required depends on the factor being measured.

• Methods for estimating the biomass and energy of trophic levels in a community include measurement of dry mass, controlled combustion and extrapolation from samples. Data from these methods can be used to construct ecological pyramids.

• The study of an ecosystem requires that it be named and located; for example, Deinikerwald in Baar, Switzerland—a mixed deciduous–coniferous managed woodland.

• An ecosystem is a community and the physical environment with which it interacts.

• Respiration and photosynthesis can be described as processes with inputs, outputs and transformations of energy and matter.

• Respiration is the conversion of organic matter into carbon dioxide and water in all living organisms, releasing energy. Aerobic respiration can be represented by the following word equation.

glucose+oxygen carbon dioxide + water

• During respiration, large amounts of energy are dissipated as heat, increasing the entropy in the ecosystem while enabling organisms to maintain relatively low entropy and so high organization.

• Primary producers in most ecosystems convert light energy into chemical energy in the process of photosynthesis.

• The photosynthesis reaction is can be represented by the following word equation.

carbon dioxide + water glucose + oxygen

• Photosynthesis produces the raw material for producing biomass.

• The trophic level is the position that an organism occupies in a food chain, or the position of a group of organisms in a community that occupy the same position in food chains.

• Producers (autotrophs) are typically plants or algae that produce their own food using photosynthesis and form the first trophic level in a food chain. Exceptions include chemosynthetic organisms that produce food without sunlight.

• Feeding relationships involve producers, consumers and decomposers. These can be modelled using food chains, food webs and ecological pyramids.

• Ecological pyramids include pyramids of numbers, biomass and productivity and are quantitative models that are usually measured for a given area and time.

• In accordance with the second law of thermodynamics, there is a tendency for numbers and quantities of biomass and energy to decrease along food chains; therefore, the pyramids become narrower towards the apex.

• Bioaccumulation is the build-up of persistent or non-biodegradable pollutants within an organism or trophic level because they cannot be broken down.

• Biomagnification is the increase in concentration of persistent or nonbiodegradable pollutants along a food chain.

• Toxins such as DDT and mercury accumulate along food chains due to the decrease of biomass and energy.

• Pyramids of numbers can sometimes display different patterns; for example, when individuals at lower trophic levels are relatively large (inverted pyramids).

• A pyramid of biomass represents the standing stock or storage of each trophic level, measured in units such as grams of biomass per square meter (g m–2) or Joules per square meter (J m-2) (units of biomass or energy).

• Pyramids of biomass can show greater quantities at higher trophic levels because they represent the biomass present at a fixed point in time, although seasonal variations may be marked.

• Pyramids of productivity refer to the flow of energy through a trophic level, indicating the rate at which that stock/storage is being generated.

• Pyramids of productivity y for entire ecosystems over a year always show a decrease along the food chain.

• As solar radiation (insolation) enters the Earth’s atmosphere, some energy becomes unavailable for ecosystems as this energy is absorbed by inorganic matter or reflected back into the atmosphere.

• Pathways of radiation through the atmosphere involve a loss of radiation through reflection and absorption as shown in figure 4.



• Pathways of energy through an ecosystem include:

– conversion of light energy to chemical energy

– transfer of chemical energy from one trophic level to another with

varying efficiencies

– overall conversion of ultraviolet and visible light to heat energy by an

ecosystem

– re-radiation of heat energy to the atmosphere.

• The conversion of energy into biomass for a given period of time is measured as productivity.

• Net primary productivity (NPP) is calculated by subtracting respiratory losses (R) from gross primary productivity (GPP).

NPP = GPP – R

• Gross secondary productivity (GSP) is the total energy or biomass assimilated by consumers and is calculated by subtracting the mass of fecal loss from the mass of food consumed.

GSP = food eaten – fecal loss

• Net secondary productivity (NSP) is calculated by subtracting respiratory losses

(R) from GSP.

NSP = GSP – R

• Maximum sustainable yields are equivalent to the net primary or net secondary of a system.

• Matter also flows through ecosystems linking them together. This flow of matter involves transfers and transformations.

• The carbon and nitrogen cycles are used to illustrate this flow of matter using flow diagrams. These cycles contain storages (sometimes referred to as sinks) and flows, which move matter between storages.

• Storages in the carbon cycle include organisms and forests (both organic), or the atmosphere, soil, fossil fuels and oceans (all inorganic).

• Flows in the carbon cycle include consumption (feeding), death and decomposition, photosynthesis, respiration, dissolving and fossilization.

• Storages in the nitrogen cycle include organisms (organic), soil, fossil fuels, atmosphere and water bodies (all inorganic).

• Flows in the nitrogen cycle include nitrogen fixation by bacteria and lightning, absorption, assimilation, consumption (feeding), excretion, death and decomposition, and denitrification by bacteria in water-logged soils.

• Human activities such as burning fossil fuels, deforestation, urbanization and agriculture impact energy flows as well as the carbon and nitrogen cycles.