



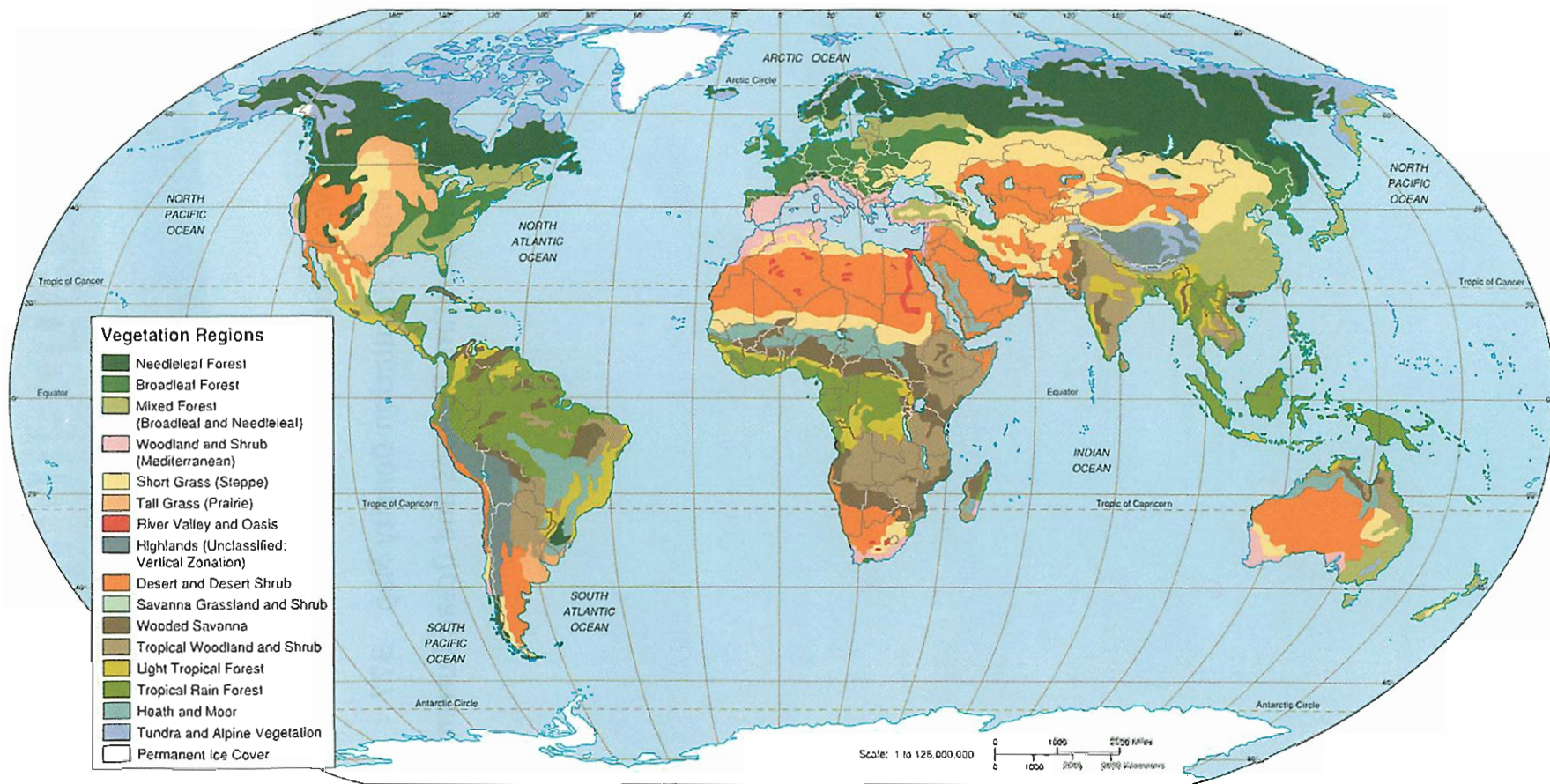
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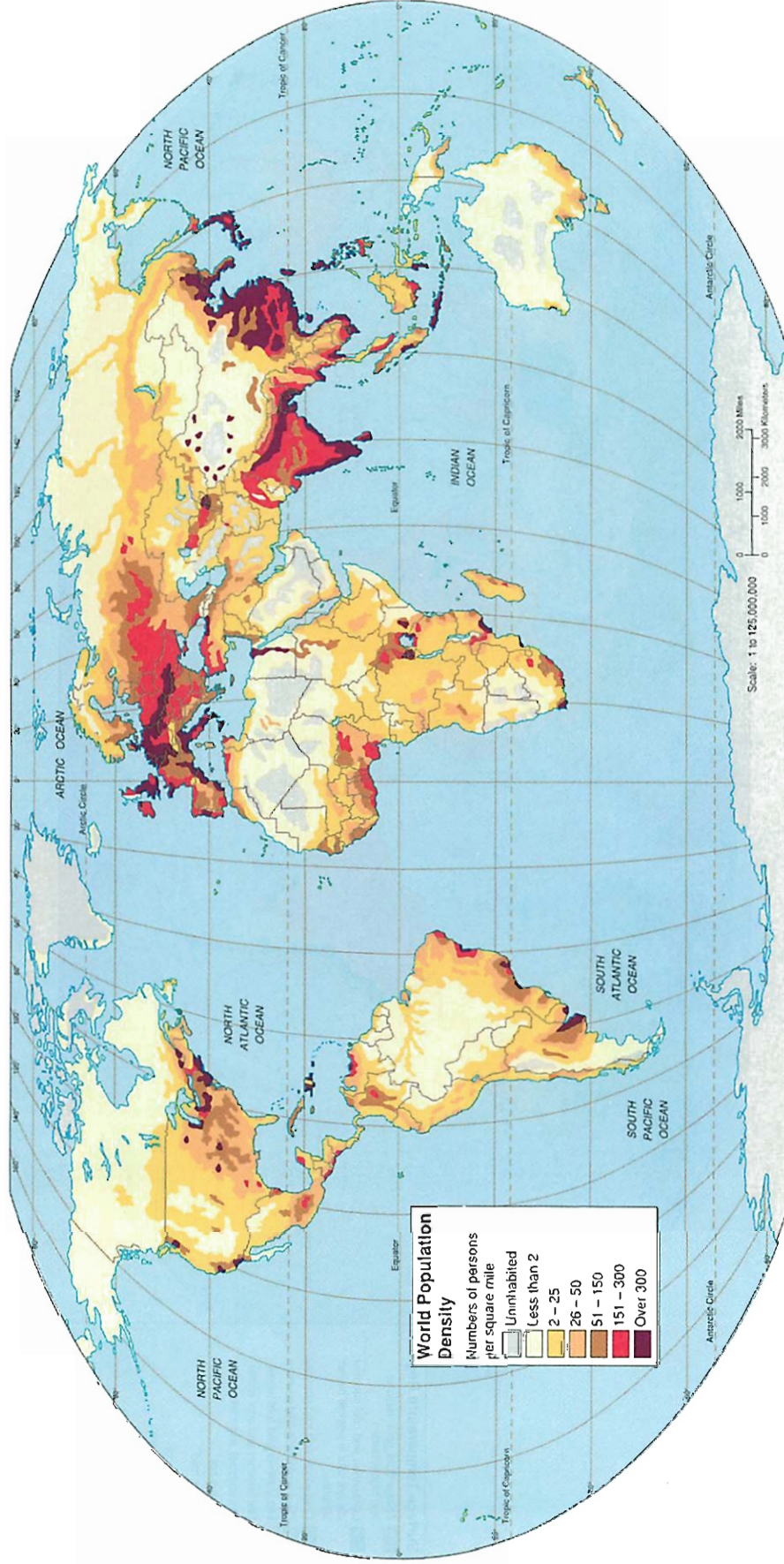
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Vegetation



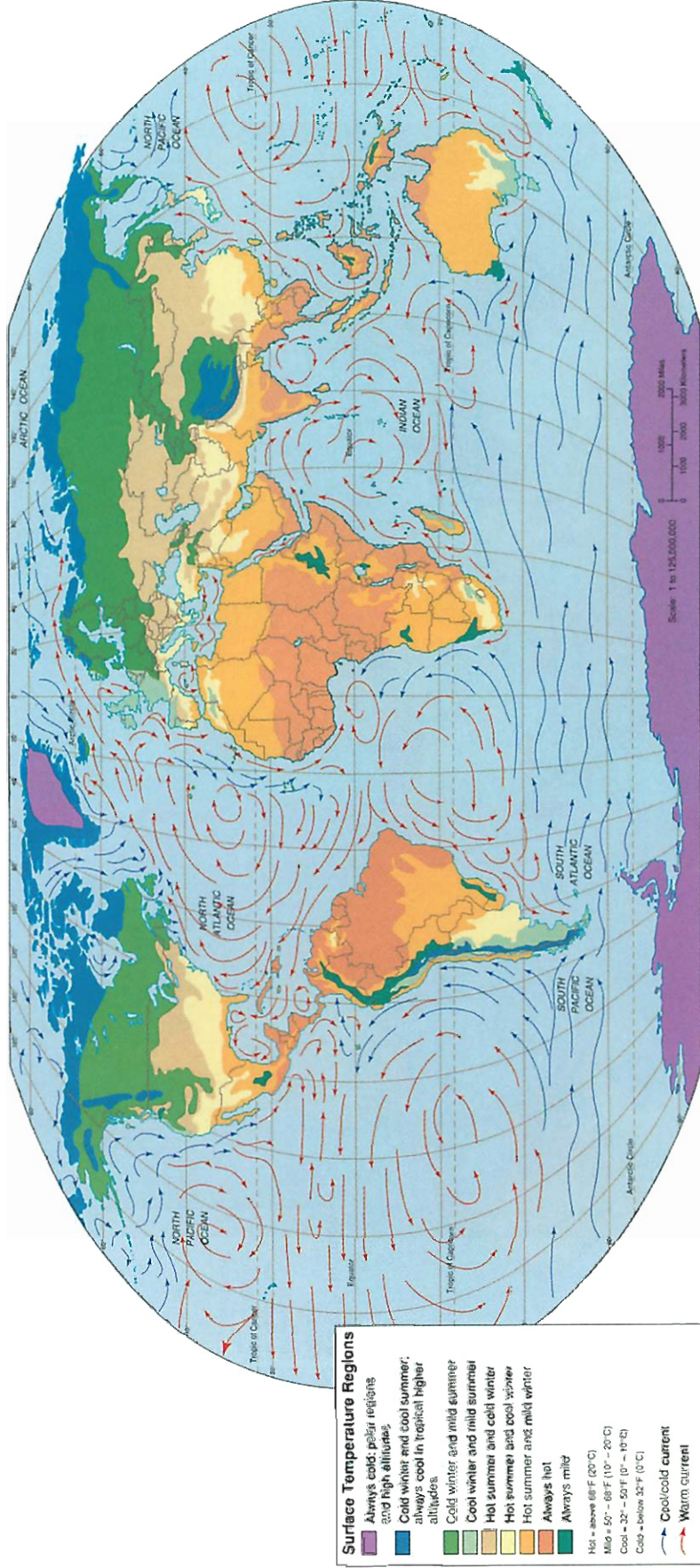
Vegetation is the most visible consequence of the distribution of temperature and precipitation. The global distribution of vegetation types and the global distribution of climate are closely related, but not all vegetation types are the consequence of temperature and precipitation or other climatic variables. Many types of vegetation, in many areas of the world, are the consequence of human activities, particularly the grazing of domesticated livestock, burning, and forest clearance.

World Population Density



No feature of human activity is more reflective of environmental conditions than where people live. In the areas of densest population, a mixture of natural and human factors have combined to allow maximum food production, maximum urbanization, and especially concentrated economic activity. Three such great concentrations appear on the map—East Asia, South Asia, and Europe—with a fourth lesser concentration in eastern North America (the “Megalopolis” region of the United States and Canada). The areas of future high density (in addition to those already existing) are likely to be in Middle and South America and Africa, where population growth rates are well above the world average. Population that is extremely dense or growing at an excessive rate when measured against a region’s habitability is one of the greatest indicators of environmental deterioration.

Temperature Regions and Ocean Currents



Along with precipitation, temperature is one of the two most important environmental variables, defining the climatic conditions so essential for the distribution of human activities and the human population. Ocean currents exert a significant influence over the climate of adjacent continents and are the most important mechanism for redistributing surplus heat from the equatorial region into middle and high latitudes.

Glossary

A

abundance The number of individuals of a species in an area.

acid precipitation Acidic rain, snow, or dry particles deposited from the air due to increased acids released by anthropogenic or natural resources.

acids Substances that release hydrogen atoms in water.

active solar systems Mechanical systems that use moving substances to collect and transfer solar energy.

acute effects A sudden onset of symptoms or effects of exposure to some factor.

acute poverty Insufficient income or access to resources needed to provide the basic necessities for life, such as food, shelter, sanitation, clean water, medical care, and education.

adaptation Physical changes that allow organisms to survive in a given environment.

adaptive management A management plan designed from the outset to “learn by doing” and to actively test hypotheses and adjust treatments as new information becomes available.

administrative law Executive orders, administrative rules and regulations, and enforcement decisions by administrative agencies and special administrative courts.

aerosols Minute particles or liquid droplets suspended in the air.

affluenza An addiction to spending and consuming beyond one’s needs.

agency rule-making The formal process of establishing rules and standards by administrative agencies.

albedo A description of a surface’s reflective properties.

allergens Substances that activate the immune system and cause an allergic response; may not be directly antigenic themselves but may make other materials antigenic.

allopatric speciation Species that arise from a common ancestor through geographic isolation or some other barrier to reproduction.

ambient air The air immediately around us.

amorphous silicon collectors Photovoltaic cells made from randomly assembled silicon molecules rather than silicon crystals. Amorphous collectors are less efficient but far cheaper than crystalline collectors.

analytical thinking A way of systematic analysis that asks, “How can I break this problem down into its constituent parts?”

anemia Low levels of hemoglobin due to iron deficiency or lack of red blood cells.

anthropocentric Believing that humans hold a special place in nature; being centered primarily on humans and human affairs.

antigens Substances that stimulate the production of, and react with, specific antibodies.

aquifers Porous, water-bearing layers of sand, gravel, and rock below the earth’s surface; reservoirs for groundwater.

arbitration A formal process of dispute resolution resulting in a legally binding decision that all parties must obey.

arithmetic growth A pattern of growth that increases at a constant amount per unit time, such as 1, 2, 3, 4 or 1, 3, 5, 7.

atmospheric deposition Sedimentation of solids, liquids, or gaseous materials from the air.

atom The smallest particle that exhibits the characteristics of an element.

atomic number The characteristic number of protons per atom of an element.

autotroph An organism that synthesizes food molecules from inorganic molecules by using an external energy source, such as light energy.

B

barrier islands Low, narrow, sandy islands that form offshore from a coastline.

bases Substances that readily bond with hydrogen ions in an aqueous solution.

Batesian mimicry Evolution by one species to resemble another species that is protected from predators by a venomous stinger, bad taste, or some other defensive adaptation.

benthic The bottom of a sea or lake.

binomials Scientific or Latin names that combine the genus and species, e.g., *Zea mays*.

bioaccumulation The selective absorption and concentration of molecules by cells.

biocentrism The belief that all creatures have rights and values; being centered on nature rather than humans.

biochemical oxygen demand (BOD) A standard test for measuring the amount of dissolved oxygen utilized by aquatic microorganisms.

biodegradable plastics Plastics that can be decomposed by microorganisms.

biodiversity The genetic, species, and ecological diversity of the organisms in a given area.

biofuel Fuel made from biomass.

biogeochemical cycles Movement of matter within or between ecosystems; caused by living organisms, geologic forces, or chemical reactions. The cycling of nitrogen, carbon, sulfur, oxygen, phosphorus, and water are examples.

biological community The populations of plants, animals, and microorganisms living and interacting in a certain area at a given time.

biological controls Use of natural predators, pathogens, or competitors to regulate pest populations.

biomagnification Increase in concentration of certain stable chemicals (for example, heavy metals or fat-soluble pesticides) in successively higher trophic levels of a food chain or web.

biomass The accumulated biological material produced by living organisms.

biomass fuel Organic material produced by plants, animals, or microorganisms that can be burned directly as a heat source or converted into a gaseous or liquid fuel.

biomass pyramid A metaphor or diagram that explains the relationship between the amounts of biomass at different trophic levels.

biomes Broad, regional types of ecosystems characterized by distinctive climate and soil conditions and distinctive kinds of biological community adapted to those conditions.

bioremediation Use of biological organisms to remove pollution or restore environmental quality.

biosphere The zone of air, land, and water at the surface of the earth that is occupied by organisms.

biosphere reserves World heritage sites identified by the IUCN as worthy for national park or wildlife refuge status because of high biological diversity or unique ecological features.

biotic potential The maximum reproductive rate of an organism, given unlimited resources and ideal environmental conditions.

birth control Any method used to reduce births, including celibacy, delayed marriage, contraception; devices or medications that prevent implantation of fertilized zygotes and induced abortions.

blind experiments A design in which researchers don’t know which subjects were given experimental treatment until after data have been gathered and analyzed.

bogs Areas of waterlogged soil that tend to be peaty; fed mainly by precipitation; low productivity; some bogs are acidic.

boreal forest A broad band of mixed coniferous and deciduous trees that stretches across northern North America (and Europe and Asia); its northernmost edge, the taiga, intergrades with the arctic tundra.

brownfields Abandoned or underused urban areas in which redevelopment is blocked by liability or financing issues related to toxic contamination.

C

cancer Invasive, out-of-control cell growth that results in malignant tumors.

capital Any form of wealth, resources, or knowledge available for use in the production of more wealth.

- carbohydrate** An organic compound consisting of a ring or chain of carbon atoms with hydrogen and oxygen attached; examples are sugars, starches, cellulose, and glycogen.
- carbon cycle** The circulation and reutilization of carbon atoms, especially via the processes of photosynthesis and respiration.
- carbon management** Projects to reduce carbon dioxide emissions from fossil fuel or to ameliorate their effects.
- carbon monoxide** Colorless, odorless, nonirritating but highly toxic gas produced by incomplete combustion of fuel, incineration of biomass or solid waste, or partially anaerobic decomposition of organic material.
- carbon neutral** Producing no net carbon dioxide emissions.
- carbon sink** Places of carbon accumulation, such as in large forests (organic compounds) or ocean sediments (calcium carbonate).
- carcinogens** Substances that cause cancer.
- carnivores** Organisms that mainly prey upon animals.
- carrying capacity** The maximum number of individuals of any species that can be supported by a particular ecosystem on a long-term basis.
- case law** Precedents from both civil and criminal court cases.
- cell** Minute compartments surrounded by semipermeable membranes within which the processes of life are carried out by all living organisms.
- cellular respiration** The process in which a cell breaks down sugar or other organic compounds to release energy used for cellular work; may be anaerobic or aerobic, depending on the availability of oxygen.
- chain reaction** A self-sustaining reaction in which the fission of nuclei produces subatomic particles that cause the fission of other nuclei.
- chaparral** A biological community characterized by thick growth of thorny, evergreen shrubs typical of a Mediterranean climate.
- chemical bond** The force that holds molecules together.
- chemical compounds** Molecules made up of two or more kinds of atoms held together by chemical bonds.
- chemical energy** Potential energy stored in chemical bonds of molecules.
- chemosynthesis** Extracting energy for life from inorganic chemicals, such as hydrogen sulfide, rather than from sunlight.
- chlorofluorocarbons** Chemical compounds with a carbon skeleton and one or more attached chlorine and fluorine atoms. Commonly used as refrigerants, solvents, fire retardants, and blowing agents.
- chloroplasts** Chlorophyll-containing organelles in eukaryotic organisms; sites of photosynthesis.
- chronic effects** Long-lasting results of exposure to a toxin; can be a permanent change caused by a single, acute exposure or a continuous, low-level exposure.
- citizen science** Projects in which trained volunteers work with scientific researchers to answer real-world questions.
- civil law** A body of laws regulating relations between individuals or between individuals and corporations concerning property rights, personal dignity and freedom, and personal injury.
- classical economics** Modern, Western economic theories of the effects of resource scarcity, monetary policy, and competition on supply and demand of goods and services in the market place. This is the basis for the capitalist market system.
- clear-cutting** Cutting every tree in a given area, regardless of species or size; an appropriate harvest method for some species; can be destructive if not carefully controlled.
- climate** A description of the long-term pattern of weather in a particular area.
- climax community** A long-lasting, self-sustaining community resulting from ecological succession that is resistant to disturbance.
- closed-canopy** A forest where tree crowns spread over 20 percent of the ground; has the potential for commercial timber harvests.
- closed system** A system in which there is no exchange of energy or matter with its surroundings.
- cloud forests** High mountain forests where temperatures are uniformly cool and fog or mist keeps vegetation wet all the time.
- coevolution** The process in which species exert selective pressure on each other and gradually evolve new features or behaviors as a result of those pressures.
- cogeneration** The simultaneous production of electricity and steam or hot water in the same plant.
- coliform bacteria** Bacteria that live in the intestines (including the colon) of humans and other animals; used as a measure of the presence of feces in water or soil.
- commensalism** A symbiotic relationship in which one member is benefited and the second is neither harmed nor benefited.
- common law** The body of court decisions that constitutes a working definition of individual rights and responsibilities where no formal statutes define these issues.
- communal resource management systems** Resources managed by a community for long-term sustainability.
- community-based planning** Involving community stakeholders in pluralistic, adaptive, inclusive, proactive planning.
- community ecology** The study of interactions of all populations living in the ecosystem of a given area.
- community (ecological) structure** The patterns of spatial distribution of individuals, species, and communities.
- competitive exclusion** A theory that no two populations of different species will occupy the same niche and compete for exactly the same resources in the same habitat for very long.
- complexity** The number of species at each trophic level and the number of trophic levels in a community.
- composting** The biological degradation of organic material under aerobic (oxygen-rich) conditions to produce compost, a nutrient-rich soil amendment and conditioner.
- compound** Substances composed of different kinds of atoms.
- confined animal-feeding operation** Feeding large numbers of livestock at a high density in pens or barns.
- conifer** A needle-bearing tree that produces seeds in cones.
- conservation medicine** Attempts to understand how changes we make in our environment threaten our health as well as that of natural communities on which we depend.
- conservation of matter** In any chemical reaction, matter changes form; it is neither created nor destroyed.
- conspicuous consumption** A term coined by economist and social critic Thorstein Veblen to describe buying things we don't want or need to impress others.
- constructed wetlands** Artificially constructed wetlands.
- consumers** Organisms that obtain energy and nutrients by feeding on other organisms or their remains. See also *heterotroph*.
- consumption** The fraction of withdrawn water that is lost in transmission or that is evaporated, absorbed, chemically transformed, or otherwise made unavailable for other purposes as a result of human use.
- contour plowing** Plowing along hill contours; reduces erosion.
- controlled studies** Comparisons made between two populations that are identical (as far as possible) in every factor except the one being studied.
- control rods** Neutron-absorbing material inserted into spaces between fuel assemblies in nuclear reactors to regulate fission reaction.
- convection currents** Rising or sinking air currents that stir the atmosphere and transport heat from one area to another. Convection currents also occur in water.
- conventional (criteria) pollutants** The seven substances (sulfur dioxide, carbon monoxide, particulates, hydrocarbons, nitrogen oxides, photochemical oxidants, and lead) identified by the Clean Air Act as the most serious threat of all pollutants to human health and welfare.
- convergent evolution** Species evolve from different origins but under similar environmental conditions to have similar traits.
- coral reefs** Prominent oceanic features composed of hard, limy skeletons produced by coral animals; usually formed along edges of shallow, submerged ocean banks or along shelves in warm, shallow, tropical seas.
- core** The dense, intensely hot mass of molten metal, mostly iron and nickel, thousands of kilometers in diameter at the earth's center.
- core habitat** A habitat patch large enough and with ecological characteristics suitable to support a critical mass of the species that make up a particular community.
- Coriolis effect** The tendency for air above the earth to appear to be deflected to the right (in the Northern Hemisphere) or the left (in the South) because of the earth's rotation.
- corridors** Strips of natural habitat that connect two adjacent nature preserves to allow migration of organisms from one place to another.
- cost-benefit analysis (CBA)** An evaluation of large-scale public projects by comparing the costs and benefits that accrue from them.
- cover crops** Plants, such as rye, alfalfa, or clover, that can be planted immediately after harvest to hold and protect the soil.
- creative thinking** Original, independent thinking that asks, "How might I approach this problem in new and inventive ways?"
- criminal law** A body of court decisions based on federal and state statutes concerning wrongs against persons or society.
- criteria pollutants** See *conventional pollutants*.
- critical factor** The single environmental factor closest to a tolerance limit for a given species at a given time.
- critical thinking** An ability to evaluate information and opinions in a systematic, purposeful, efficient manner.

crude birth rate The number of births in a year per 1000 (using the midyear population).

crude death rate The number of deaths per thousand persons in a given year; also called crude mortality rate.

crust The cool, lightweight, outermost layer of the earth's surface that floats on the soft, pliable underlying layers; similar to the "skin" on a bowl of warm pudding.

cultural eutrophication An increase in biological productivity and ecosystem succession caused by human activities.

D

debt-for-nature swaps Forgiveness of international debt in exchange for nature protection in developing countries.

deciduous Trees and shrubs that shed their leaves at the end of the growing season.

decomposer Fungus or bacterium that breaks complex organic material into smaller molecules.

deductive reasoning "Top down" reasoning in which we start with a general principle and derive a testable prediction about a specific case.

deforestation Removing trees from a forest.

delta Fan-shaped sediment deposit found at the mouth of a river.

demanufacturing Disassembly of products so components can be reused or recycled.

demographic transition A pattern of falling death rates and birth rates in response to improved living conditions; typically leads to rapid then stabilizing population growth.

demography The statistical study of human populations relating to growth rate, age structure, geographic distribution, etc., and their effects on social, economic, and environmental conditions.

density-dependent factors Either internal or external factors that affect growth rates of a population depending on the density of the organisms in the population.

dependency ratio The number of nonworking members compared with working members for a given population.

dependent variable Also known as the response variable; is one affected by other variables.

desalination (or desalination) Removal of salt from water by distillation, freezing, or ultrafiltration.

desertification Denuding and degrading a once fertile land, initiating a desert-producing cycle that feeds on itself and causes long-term changes in soil, climate, and biota of an area.

deserts Biomes characterized by low moisture levels and infrequent and unpredictable precipitation. Daily and seasonal temperatures fluctuate widely.

detritivore Organisms that consume organic litter, debris, and dung.

dieback A sudden population decline; also called a population crash.

disability-adjusted life years (DALYs) A health measure that assesses the total burden of disease by combining premature deaths and loss of a healthy life that result from illness or disability.

discharge The amount of water that passes a fixed point in a given amount of time; usually expressed as liters or cubic feet of water per second.

discount rate The amount we discount or reduce the value of a future payment. When you bor-

row money from the bank at 10 percent annual interest, you are in effect saying that having the money now is worth 10 percent more to you than having the same amount one year from now.

disease A deleterious change in the body's condition in response to destabilizing factors, such as nutrition, chemicals, or biological agents.

dissolved oxygen (DO) content Amount of oxygen dissolved in a given volume of water at a given temperature and atmospheric pressure; usually expressed in parts per million (ppm).

disturbance Any force that disrupts the established patterns and processes, such as species diversity and abundance, community structure, community properties, or species relationships.

disturbance-adapted species Species that depend on repeated disturbance for their survival and propagation.

divergent evolution Separation of a species into new types.

diversity The number of species present in a community (species richness), as well as the relative abundance of each species.

DNA Deoxyribonucleic acid; the long, double-helix molecule in the nucleus of cells that contains the genetic code and directs the development and functioning of all cells.

double-blind design Neither the subject (participant) nor the experimenter knows which participants are receiving the experimental or the control treatments until after data have been gathered and analyzed.

drip irrigation Uses pipe or tubing perforated with very small holes to deliver water one drop at a time directly to the soil around each plant.

dust domes High concentrations of dust and aerosols in the air over cities.

E

earthquakes Sudden, violent movement of the earth's crust.

ecological diseases Sudden, wide-spread epidemics among livestock and wild species.

ecological economics Application of ecological insights to economic analysis; incorporating ecological principles and priorities into economic accounting systems.

ecological footprint An estimate of our individual and collective environmental impacts. It is usually calculated and expressed as the area of bioproducer land required to support a particular lifestyle.

ecological niche The functional role and position of a species in its ecosystem, including what resources it uses, how and when it uses the resources, and how it interacts with other species.

ecological services Processes or materials, such as clean water, energy, climate regulation, and nutrient cycling, provided by ecosystems.

ecological succession The process by which organisms gradually occupy a site, alter its ecological conditions, and are eventually replaced by other organisms.

ecology The scientific study of relationships between organisms and their environment. It is concerned with the life histories, distribution, and behavior of individual species as well as the structure and function of natural systems at the level of populations, communities, and ecosystems.

economic development A rise in real income per person; usually associated with new technology that increases productivity or resources.

ecosystem A specific biological community and its physical environment interacting in an exchange of matter and energy.

ecosystem management An integration of ecological, economic, and social goals in a unified systems approach to resource management.

ecosystem restoration To reinstate an entire community of organisms to as near its natural condition as possible.

ecotones Boundaries between two types of ecological communities.

ecotourism A combination of adventure travel, cultural exploration, and nature appreciation in wild settings.

edge effects A change in species composition, physical conditions, or other ecological factors at the boundary between two ecosystems.

electron A negatively charged subatomic particle that orbits around the nucleus of an atom.

electronic waste (e-waste) Discarded electronic equipment, including TVs, cell phones, computers, etc.

element A substance that cannot be broken into simpler units by chemical means.

El Niño A climatic change marked by shifting of a large warm water pool from the western Pacific Ocean toward the east. Wind direction and precipitation patterns are changed over much of the Pacific and perhaps around the world.

emergent disease A new disease or one that has been absent for at least 20 years.

emergent properties Properties that make a system more than the sum of its parts.

emigration The movement of members from a population.

emission standards Regulations for restricting the amounts of air pollutants that can be released from specific point sources.

endangered species A species considered to be in imminent danger of extinction.

endemism A species that is restricted to a single region, country, or other area.

endocrine hormone disrupters Chemicals that interfere with the function of endocrine hormones such as estrogen, testosterone, thyroxine, adrenaline, or cortisone.

energy The capacity to do work, such as moving matter over a distance.

energy intensity The amount of energy needed to provide the goods and services consumed in an economy.

energy recovery The incineration of solid waste to produce useful energy.

entropy A measure of disorder and usefulness of energy in a system.

environment The circumstances or conditions that surround an organism or a group of organisms as well as the complex of social or cultural conditions that affect an individual or a community.

environmental ethics A search for moral values and ethical principles in human relations with the natural world.

environmental health The science of external factors that cause disease, including elements of the natural, social, cultural, and technological worlds in which we live.

environmental impact statement (EIS) An analysis of the effects of any major program or project planned by a federal agency; required by provisions in the National Environmental Policy Act of 1970.

environmental justice Fair access to a clean, healthy environment, regardless of class, race, income level, or other status.

environmental law Legal rules, decisions, and actions concerning environmental quality, natural resources, and ecological sustainability.

environmental literacy A basic understanding of ecological principles and the ways society affects, or responds to, environmental conditions.

environmental policy The official rules or regulations concerning the environment adopted, implemented, and enforced by some government agency.

environmental science The systematic, scientific study of our environment as well as our role in it.

epidemiology The study of the distribution and causes of disease and injuries in human populations.

epigenetics Effects (both positive and negative) expressed in future generations that are not caused by nuclear mutations and are not inherited by normal Mendelian genetics.

epiphyte A plant that grows on a substrate other than the soil, such as the surface of another organism.

estuaries Bays or drowned valleys where a river empties into the sea.

eutrophic Rivers and lakes rich in organic material (*eu* = well; *trophic* = nourished).

evolution A theory that explains how random changes in genetic material and competition for scarce resources cause species to change gradually.

evolutionary species concept A definition of species that depends on evolutionary relationships.

exotic organisms Alien species introduced by human agency into biological communities where they would not naturally occur.

explanatory variable An independent variable that helps explain the relationship to a dependent variable.

exponential growth Growth at a constant rate of increase per unit of time; can be expressed as a constant fraction or exponent. See also *geometric growth*.

externalizing costs Shifting expenses, monetary or otherwise, to someone other than the individuals or groups who use a resource.

extinction The irrevocable elimination of species; can be a normal process of the natural world as species outcompete or kill off others or as environmental conditions change.

F

family planning Controlling reproduction; planning the timing of birth and having only as many babies as are wanted and can be supported.

famines Acute food shortages characterized by large-scale loss of life, social disruption, and economic chaos.

fauna All of the animals present in a given region.

fecundity The physical ability to reproduce.

federal laws (statutes) Laws passed by the federal legislature and signed by the chief executive.

fens Wetlands fed mainly by groundwater.

feral A domestic animal that has taken up a wild existence.

fetal alcohol syndrome A tragic set of permanent physical, mental, and behavioral birth defects that result when mothers drink alcohol during pregnancy.

first law of thermodynamics States that energy is conserved; that is, it is neither created nor destroyed under normal conditions.

flood An overflow of water onto land that normally is dry.

floodplains Low lands along riverbanks, lakes, and coastlines subjected to periodic inundation.

flora All of the plants present in a given region.

food security The ability of individuals to obtain sufficient food on a day-to-day basis.

food web A complex, interlocking series of individual food chains in an ecosystem.

fossil fuels Petroleum, natural gas, and coal created by geologic forces from organic wastes and dead bodies of formerly living biological organisms.

fragmentation Disruption of habitat into small, isolated fragments.

freshwater ecosystems Ecosystems in which the fresh (nonsalty) water of streams, rivers, ponds, or lakes plays a defining role.

fuel assembly A bundle of hollow metal rods containing uranium oxide pellets; used to fuel a nuclear reactor.

fuel cells Mechanical devices that use hydrogen or hydrogen-containing fuel, such as methane, to produce an electric current. Fuel cells are clean, quiet, and highly efficient sources of electricity.

fugitive emissions Substances that enter the air without going through a smokestack, such as dust from soil erosion, strip mining, rock crushing, construction, and building demolition.

fungi Nonphotosynthetic, eukaryotic organisms with cell walls, filamentous bodies, and absorptive nutrition.

fungicide A chemical that kills fungi.

G

gamma rays Very short wavelength forms of the electromagnetic spectrum.

gap analysis A biogeographical technique of mapping biological diversity and endemic species to find gaps between protected areas that leave endangered habitats vulnerable to disruption.

gasohol A mixture of gasoline and ethanol.

gene A unit of heredity; a segment of DNA nucleus of the cell that contains information for the synthesis of a specific protein, such as an enzyme.

genetically modified organisms (GMOs) Organisms created by combining natural or synthetic genes using the techniques of molecular biology.

genetic engineering Laboratory manipulation of genetic material using molecular biology.

genuine progress index (GPI) An alternative to GNP or GDP for economic accounting that measures real progress in quality of life and sustainability.

geoengineering Attempts to deliberately alter global-scale ecological or geochemical processes to create more desirable environmental conditions.

geographic isolation Geographical changes that isolate populations of a species and prevent reproduction or gene exchange for a long enough time so that genetic drift changes the populations into distinct species.

geometric growth Growth that follows a geometric pattern of increase, such as 2, 4, 8, 16, etc. See also *exponential growth*.

geothermal energy Energy drawn from the internal heat of the earth, either through geysers, fumaroles, hot springs, or other natural geothermal features or through deep wells that pump heated groundwater.

GIS Geographical information systems that use computers to combine and analyze geographical data.

global environmentalism The extension of modern environmental concerns to global issues.

grasslands Biomes dominated by grasses and associated herbaceous plants.

greenhouse effect Trapping of heat by the earth's atmosphere, which is transparent to incoming visible light waves but absorbs outgoing long-wave infrared radiation.

greenhouse gas A gas that traps heat in the atmosphere.

green plans Integrated national environmental plans for reducing pollution and resource consumption while achieving sustainable development and environmental restoration.

green political parties Political organizations based on environmental protection, participatory democracy, grassroots organization, and sustainable development.

green pricing Plans in which consumers can voluntarily pay premium prices for renewable energy.

green revolution Dramatically increased agricultural production brought about by "miracle" strains of grain; usually requires high inputs of water, plant nutrients, and pesticides.

gross domestic product (GDP) The total economic activity within national boundaries.

gross national product (GNP) The sum total of all goods and services produced in a national economy. Gross domestic product (GDP) is used to distinguish economic activity within a country from that of offshore corporations.

groundwater Water held in gravel deposits or porous rock below the earth's surface; does not include water or crystallization held by chemical bonds in rocks or moisture in upper soil layers.

gully erosion Removal of layers of soil, creating channels or ravines too large to be removed by normal tillage operations.

H

habitat The place or set of environmental conditions in which a particular organism lives.

half-life The time required for one-half of a sample to decay or change into some other form.

hazardous waste Any discarded material containing substances known to be toxic, mutagenic, carcinogenic, or teratogenic to humans or other life-forms; ignitable, corrosive, explosive, or highly reactive alone or with other materials.

health A state of physical and emotional well-being; the absence of disease or ailment.

heap-leach extraction A technique for separating gold from extremely low-grade ores. Crushed ore is piled in huge heaps and sprayed with a dilute alkaline-cyanide solution, which percolates through the pile to extract the gold.

heat Total kinetic energy of atoms or molecules in a substance not associated with the bulk motion of the substance.

heat islands Areas of higher temperatures around cities.

herbicide A chemical that kills plants.

herbivores Organisms that eat only plants.

heterotroph An organism that is incapable of synthesizing its own food and, therefore, must feed upon organic compounds produced by other organisms.

high-level waste repository A place where intensely radioactive wastes can be buried and remain unexposed to groundwater and earthquakes for tens of thousands of years.

high-quality energy Intense, concentrated, and high-temperature energy that is considered high-quality because of its usefulness in carrying out work.

HIPPO Habitat destruction, Invasive species, Pollution, Population (human), and Overharvesting, the leading causes of extinction.

histogram A graph of frequency distributions.

holistic science The study of entire, integrated systems rather than isolated parts. Often takes a descriptive or an interpretive approach.

homeostasis A dynamic, steady state in a living system maintained through opposing, compensating adjustments.

hormesis Nonlinear effects of toxic materials.

human development index (HDI) A measure of quality of life using data for life expectancy, child survival, adult literacy, education, gender equity, access to clean water and sanitation, and income.

hydrologic cycle The natural process by which water is purified and made fresh through evaporation and precipitation. This cycle provides all the freshwater available for biological life.

hypothesis A conditional explanation that can be verified or falsified by observation or experimentation.

I

igneous rocks Crystalline minerals solidified from molten magma from deep in the earth's interior; basalt, rhyolite, andesite, lava, and granite are examples.

independent variable One that does not respond to other variables in a particular test.

indicators Species that have very specific environmental requirements and tolerance levels that make them good indicators of pollution or other environmental conditions.

indigenous people Natives or original inhabitants of an area, those who have lived in a particular place for a very long time.

inductive reasoning "Bottom-up" reasoning in which we study specific examples and try to discover patterns and derive general explanations from collected observations.

infiltration The process of water percolation into the soil and pores and hollows of permeable rocks.

inholdings Private lands within public parks, forests, or wildlife refuges.

insecticide A chemical that kills insects.

insolation Incoming solar radiation.

integrated gasification combined cycle (IGCC) A process in which a fuel (coal or biomass) is heated in the presence of high oxygen levels to produce a variety of gases, mostly hydrogen and carbon dioxide. Impurities, including CO₂, can easily be removed and the synthetic hydrogen gas, or syngas, is burned in a turbine to produce electricity. Superheated gas from the turbine is used to generate steam that produces more electricity, raising the efficiency of the system.

integrated pest management (IPM) An ecologically based pest-control strategy that relies on natural mortality factors, such as natural ene-

mies, weather, cultural control methods, and carefully applied doses of pesticides.

Intergovernmental Panel on Climate Change (IPCC) A large group of scientists from many nations and a wide variety of fields assembled by the United Nations Environment Program and World Meteorological Organization to assess the current state of knowledge about climate change.

internalizing costs Planning so that those who reap the benefits of resource use also bear all the external costs.

international treaties and conventions Agreements between nations on important issues.

interspecific competition In a community, competition for resources between members of different species.

intraspecific competition In a community, competition for resources among members of the same species.

invasive species Organisms that thrive in new territory where they are free of predators, diseases, or resource limitations that may have controlled their population in their native habitat.

ionizing radiation High-energy electromagnetic radiation or energetic subatomic particles released by nuclear decay.

ionosphere The lower part of the thermosphere.

ions Electrically charged atoms that have gained or lost electrons.

irruptive growth See *Malthusian growth*.

island biogeography The study of rates of colonization and extinction of species on islands or other isolated areas based on size, shape, and distance from other inhabited regions.

isotopes Forms of a single element that differ in atomic mass due to a different number of neutrons in the nucleus.

J

J curve A growth curve that depicts exponential growth; called a J curve because of its shape.

joule A unit of energy. One joule is the energy expended in 1 second by a current of 1 amp flowing through a resistance of 1 ohm.

K

K-selected species Organisms whose population growth is regulated by internal (or intrinsic) as well as external factors. Large animals, such as whales and elephants, as well as top predators, generally fall in this category. They have relatively few offspring and often stabilize their population size near the carrying capacity of their environment.

keystone species A species whose impacts on its community or ecosystem are much larger and more influential than would be expected from mere abundance. This could be a top predator, a plant that shelters or feeds other organisms, or an organism that plays a critical ecological role.

kinetic energy Energy contained in moving objects, such as a rock rolling down a hill, the wind blowing through the trees, or water flowing over a dam.

Kyoto Protocol An international treaty adopted in Kyoto, Japan, in 1997, in which 160 nations agreed to roll back CO₂, methane, and nitrous

oxide emissions to reduce the threat of global climate change.

L

landscape ecology The study of the reciprocal effects of spatial pattern on ecological processes.

landslides Mass wasting or mass movement of rock or soil downhill. Often triggered by seismic events or heavy rainfall.

La Niña The opposite of El Niño.

latent heat Stored energy in a form that is not sensible (detectable by ordinary senses).

LD50 A chemical dose lethal to 50 percent of a test population.

legal standing The right to take part in legal proceedings.

life expectancy The average age that a newborn infant can expect to attain in a particular time and place.

life span The longest period of life reached by a type of organism.

limiting factors Chemical or physical factors that limit the existence, growth, abundance, or distribution of an organism.

limits to growth A belief that the world has a fixed carrying capacity for humans.

lobbying Using personal contacts, public pressure, or political action to persuade legislators to vote in a particular manner.

logarithmic scale One that uses logarithms as units in a sequence that progresses by a factor of 10 in each step.

logical thinking A rational way of thought that asks, "How can orderly, deductive reasoning help me think clearly?"

logistic growth Growth rates regulated by internal and external factors that establish an equilibrium with environmental resources. See also *S curve*.

LULUs Locally Unwanted Land Uses, such as toxic waste dumps, incinerators, smelters, airports, freeways, and other sources of environmental, economic, or social degradation.

M

magma Molten rock from deep in the earth's interior; called lava when it spews from volcanic vents.

malnourishment A nutritional imbalance caused by lack of specific dietary components or inability to absorb or utilize essential nutrients.

Malthusian growth A population explosion followed by a population crash; also called irruptive growth.

Man and Biosphere (MAB) program A design for nature preserves that divides protected areas into zones with different purposes. A highly protected core is surrounded by a buffer zone and peripheral regions in which multiple-use resource harvesting is permitted.

mangrove forests Diverse groups of salt-tolerant trees and other plants that grow in intertidal zones of tropical coastlines.

manipulative experiment Altering a particular factor for a test or experiment while holding all others (as much as possible) constant.

mantle A hot, pliable layer of rock that surrounds the earth's core and underlies the cool outer crust.

marasmus A widespread human protein deficiency disease caused by a diet low in calories and protein or imbalanced in essential amino acids.

marginal costs The cost to produce one additional unit of a good or service.

marshes Wetlands without trees; in North America, this type of land is characterized by cattails and rushes.

mass burn The incineration of unsorted solid waste.

matter Anything that takes up space and has mass.

mean Average.

megacities See *megapolis*.

megapolis Also known as a megacity or supercity; megapolis indicates an urban area with more than 10 million inhabitants.

megawatt (MW) Unit of electrical power equal to 1,000 kilowatts or 1 million watts.

mesosphere The atmospheric layer above the stratosphere and below the thermosphere; the middle layer; temperatures are usually very low.

metamorphic rocks Igneous and sedimentary rocks modified by heat, pressure, and chemical reactions.

methane hydrate Small bubbles or individual molecules of methane (natural gas) trapped in a crystalline matrix of frozen water.

microlending Small loans made to poor people who otherwise don't have access to capital.

midocean ridges Mountain ranges on the ocean floor where magma wells up through cracks and creates new crust.

Milankovitch cycles Periodic variations in tilt, eccentricity, and wobble in the earth's orbit; Milutin Milankovitch suggested these are responsible for cyclic weather changes.

millennium assessment A set of ambitious environmental and human development goals established by the United Nations in 2000.

mineral A naturally occurring, inorganic, crystalline solid with definite chemical composition, a specific internal crystal structure, and characteristic physical properties.

minimills Mills that use scrap metal as their starting material.

minimum viable population The number of individuals needed for long-term survival of rare and endangered species.

modern environmentalism A fusion of conservation of natural resources and preservation of nature with concerns about pollution, environmental health, and social justice.

molecules Combinations of two or more atoms.

monitored, retrievable storage Holding wastes in underground mines or secure surface facilities, such as dry casks, where they can be watched and repackaged, if necessary.

monoculture forestry Intensive planting of a single species; an efficient wood production approach, but one that encourages pests and disease infestations and conflicts with wildlife habitat or recreation uses.

morals A set of ethical principles that guides our actions and relationships.

morbidity Illness or disease.

more-developed countries (MDC) Industrialized nations characterized by high per capita incomes, low birth and death rates, low population growth rates, and high levels of industrialization and urbanization.

mortality Death rate in a population, such as number of deaths per thousand people per year.

Müllerian (or Muellerian) mimicry Evolution of two species, both of which are unpalatable and

have poisonous stingers or some other defense mechanism, to resemble each other.

mutagens Agents, such as chemicals or radiation, that damage or alter genetic material (DNA) in cells.

mutation A change, either spontaneous or by external factors, in the genetic material of a cell; mutations in the gametes (sex cells) can be inherited by future generations of organisms.

mutualism A symbiotic relationship between individuals of two different species in which both species benefit from the association.

N

National Environmental Policy Act (NEPA) The law that established the Council on Environmental Quality and that requires environmental impact statements for all federal projects with significant environmental impacts.

natural experiment Observation of natural events to deduce causal relationships.

natural increase Crude death rate subtracted from crude birth rate.

natural resource economics Economics that takes natural resources into account as valuable assets.

natural resources Goods and services supplied by the environment.

natural selection The mechanism for evolutionary change in which environmental pressures cause certain genetic combinations in a population to become more abundant; genetic combinations best adapted for present environmental conditions tend to become predominant.

negative feedbacks Factors that result from a process and, in turn, reduce that same process.

neo-classical economics The branch of economics that attempts to apply the principles of modern science to economic analysis in a mathematically rigorous, noncontextual, abstract, predictive manner.

net energy yield Total useful energy produced during the lifetime of an entire energy system minus the energy used, lost, or wasted in making useful energy available.

net primary productivity The amount of biomass produced by photosynthesis and stored in a community after respiration, emigration, and other factors that reduce biomass.

neurotoxins Toxic substances, such as lead or mercury, that specifically poison nerve cells.

neutron A subatomic particle, found in the nucleus of the atom, that has no electromagnetic charge.

NIMBY Not-In-My-Back-Yard; the position of those opposed to LULUs.

nitrogen cycle The circulation and reutilization of nitrogen in both inorganic and organic phases.

nitrogen-fixing bacteria Bacteria that convert nitrogen from the atmosphere or soil solution into ammonia that can then be converted to plant nutrients by nitrite- and nitrate-forming bacteria.

nitrogen oxides Highly reactive gases formed when nitrogen in fuel or combustion air is heated to over 650°C (1,200°F) in the presence of oxygen or when bacteria in soil or water oxidize nitrogen-containing compounds.

noncriteria pollutants See *unconventional pollutants*.

nongovernmental organizations (NGOs) Pressure and research groups, advisory agencies, political

parties, professional societies, and other groups concerned about environmental quality, resource use, and many other issues.

nonpoint sources Scattered, diffuse sources of pollutants, such as runoff from farm fields, golf courses, and construction sites.

nonrenewable resources Minerals, fossil fuels, and other materials present in essentially fixed amounts (within human time scales) in our environment.

normal distribution A bell-shaped curve or Gaussian distribution of measurements or data.

nuclear fission The radioactive decay process in which isotopes split apart to create two smaller atoms.

nuclear fusion A process in which two smaller atomic nuclei fuse into one larger nucleus and release energy; the source of power in a hydrogen bomb.

nucleic acids Large organic molecules made of nucleotides that function in the transmission of hereditary traits, in protein synthesis, and in control of cellular activities.

nucleus The center of the atom; occupied by protons and neutrons. In cells, the organelle that contains the chromosomes (DNA).

O

obese Pathologically overweight, having a body mass greater than 30 kg/m², or roughly 30 pounds above normal for an average person.

oil shales Fine-grained sedimentary rock rich in solid organic material called kerogen. When heated, the kerogen liquefies to produce a fluid petroleum fuel.

old-growth forests Forests free from disturbance for long enough (generally 150 to 200 years) to have mature trees, physical conditions, species diversity, and other characteristics of equilibrium ecosystems.

oligotrophic Condition of rivers and lakes that have clear water and low biological productivity (*oligo* = little; *trophic* = nourished); are usually clear, cold, infertile headwater lakes and streams.

omnivores Organisms that eat both plants and animals.

open access system A commonly held resource for which there are no management rules.

open canopy A forest where tree crowns cover less than 20 percent of the ground; also called woodland.

open system A system that exchanges energy and matter with its environment.

organic compounds Complex molecules organized around skeletons of carbon atoms arranged in rings or chains; includes biomolecules, molecules synthesized by living organisms.

overgrazing Allowing domestic livestock to eat so much plant material that it degrades the biological community.

overharvesting Harvesting so much of a resource that it threatens its existence.

overnutrition Receiving too many calories.

oxygen sag Oxygen decline downstream from a pollution source that introduces materials with high biological oxygen demands.

ozone A highly reactive molecule containing three oxygen atoms; a dangerous pollutant in ambient air. In the stratosphere, however, ozone forms an ultraviolet absorbing shield that protects us from mutagenic radiation.

P

paradigms Overarching models of the world that shape our worldviews and guide our interpretation of how things are.

parasite An organism that lives in or on another organism, deriving nourishment at the expense of its host, usually without killing it.

parasitism A relationship in which one organism feeds on another without immediately killing it.

parsimony A principle that says where two equally plausible explanations for a phenomenon are possible, we should choose the simpler one (also known as Ockham's razor).

particulate material Atmospheric aerosols, such as dust, ash, soot, lint, smoke, pollen, spores, algal cells, and other suspended materials; originally applied only to solid particles but now extended to droplets of liquid.

passive solar absorption The use of natural materials or absorptive structures without moving parts to gather and hold heat; the simplest and oldest use of solar energy.

pastoralists People who live by herding domestic animals.

pathogens Organisms that produce disease in host organisms, disease being an alteration of one or more metabolic functions in response to the presence of the organisms.

peat Deposits of moist, acidic, semidecayed organic matter.

pelagic Zones in the vertical water column of a water body.

perennial species Plants that grow for more than two years.

permafrost A permanently frozen layer of soil that underlies the arctic tundra.

permanent retrievable storage Placing waste storage containers in a secure location where they can be inspected periodically and retrieved, if necessary, for repacking or for transfer if a better means of disposal or reuse is developed.

persistent organic pollutants (POPs) Chemical compounds that persist in the environment and retain biological activity for a long time.

pest Any organism that reduces the availability, quality, or value of a useful resource.

pesticide Any chemical that kills, controls, drives away, or modifies the behavior of a pest.

pH A value that indicates the acidity or alkalinity of a solution on a scale of 0 to 14, based on the proportion of H⁺ ions present.

phosphorus cycle The movement of phosphorus atoms from rocks through the biosphere and hydrosphere and back to rocks.

photochemical oxidants Products of secondary atmospheric reactions. See also *smog*.

photodegradable plastics Plastics that break down when exposed to sunlight or to a specific wavelength of light.

photosynthesis The biochemical process by which green plants and some bacteria capture light energy and use it to produce chemical bonds. Carbon dioxide and water are consumed while oxygen and simple sugars are produced.

photovoltaic cell An energy-conversion device that captures solar energy and directly converts it to electrical current.

phylogenetic species concept A definition of species that depends on genetic similarities (or differences).

phytoplankton Microscopic, free-floating, autotrophic organisms that function as producers in aquatic ecosystems.

pioneer species In primary succession on a terrestrial site, the plants, lichens, and microbes that first colonize the site.

plankton Primarily microscopic organisms that occupy the upper water layers in both freshwater and marine ecosystems.

plasma A hot, electrically neutral gas of ions and free electrons.

poaching Hunting wildlife illegally.

point sources Specific locations of highly concentrated pollution discharge, such as factories, power plants, sewage treatment plants, underground coal mines, and oil wells.

policy A societal plan or statement of intentions intended to accomplish some social or economic goal.

policy cycle The process by which problems are identified and acted upon in the public arena.

pollution To make foul, unclear, dirty; any physical, chemical, or biological change that adversely affects the health, survival, or activities of living organisms or that alters the environment in undesirable ways.

pollution charges Fees assessed per unit of pollution based on the "polluter pays" principle.

population All members of a species that live in the same area at the same time.

population crash A sudden population decline caused by predation, waste accumulation, or resource depletion; also called a dieback.

population explosion Growth of a population at exponential rates to a size that exceeds environmental carrying capacity; usually followed by a population crash.

population momentum A potential for increased population growth as young members reach reproductive age.

positive feedbacks Factors that result from a process and, in turn, increase that same process.

potential energy Stored energy that is latent but available for use. A rock poised at the top of a hill or water stored behind a dam are examples of potential energy.

power The rate of energy delivery; measured in horsepower or watts.

precautionary principle The rule that we should leave a margin of safety for unexpected developments. This principle implies that we should strive to prevent harm to human health and the environment even if risks are not fully understood.

predator An organism that feeds directly on other organisms in order to survive; live-feeders, such as herbivores and carnivores.

predator-mediated competition A situation in which the effects of a predator dominate population dynamics.

preservation A philosophy that emphasizes the fundamental right of living organisms to exist and to pursue their own ends.

primary pollutants Chemicals released directly into the air in a harmful form.

primary producers Photosynthesizing organisms.

primary productivity Synthesis of organic materials (biomass) by green plants using the energy captured in photosynthesis.

primary standards Regulations of the 1970 Clean Air Act; intended to protect human health.

primary succession Ecological succession that begins in an area where no biotic community previously existed.

primary treatment A process that removes solids from sewage before it is discharged or treated further.

principle of competitive exclusion A result of natural selection whereby two similar species in a community occupy different ecological niches, thereby reducing competition for food.

probability The likelihood that a situation, a condition, or an event will occur.

producer An organism that synthesizes food molecules from inorganic compounds by using an external energy source; most producers are photosynthetic.

productivity The amount of biomass (biological material) produced in a given area during a given period of time.

prokaryotic Cells that do not have a membrane-bounded nucleus or membrane-bounded organelles.

pronatalist pressures Influences that encourage people to have children.

prospective study A study in which experimental and control groups are identified before exposure to some factor. The groups are then monitored and compared for a specific time after the exposure to determine any effects the factor may have.

proteins Chains of amino acids linked by peptide bonds.

proton A positively charged subatomic particle found in the nucleus of an atom.

proven-in-place reserves Energy sources that have been thoroughly mapped and are likely to be economically recoverable with available technology.

pull factors Conditions that draw people from the country into the city.

push factors Conditions that force people out of the country and into the city.

R

r-selected species Organisms whose population growth is regulated mainly by external factors. They tend to have rapid reproduction and high mortality of offspring. Given optimum environmental conditions, they can grow exponentially. Many "weedy" or pioneer species fit in this category.

radioactive decay A change in the nuclei of radioactive isotopes that spontaneously emit high-energy electromagnetic radiation and/or subatomic particles while gradually changing into another isotope or different element.

rainforest A forest with high humidity, constant temperature, and abundant rainfall (generally over 380 cm [150 in.] per year); can be tropical or temperate.

rain shadow Dry area on the downwind side of a mountain.

random sample A subset of a collection of items or observations chosen at random.

rangeland Grasslands and open woodlands suitable for livestock grazing.

rational choice Public decision making based on reason, logic, and science-based management.

reasoned judgment Thoughtful decisions based on careful, logical examination of available evidence.

recharge zones Areas where water infiltrates into an aquifer.

reclamation Chemical, biological, or physical cleanup and reconstruction of severely contaminated or degraded sites to return them to

something like their original topography and vegetation.

recycling Reprocessing of discarded materials into new, useful products; not the same as reuse of materials for their original purpose, but the terms are often used interchangeably.

reduced tillage systems Farming methods that preserve soil and save energy and water through reduced cultivation: includes minimum till, conserve-till, and no-till systems.

reflective thinking A thoughtful, contemplative analysis that asks, "What does this all mean?"

reformer A device that strips hydrogen from fuels such as natural gas, methanol, ammonia, gasoline, or vegetable oil so they can be used in a fuel cell.

refuse-derived fuel Processing of solid waste to remove metal, glass, and other unburnable materials; organic residue is shredded, formed into pellets, and dried to make fuel for power plants.

regenerative farming Farming techniques and land stewardship that restore the health and productivity of the soil by rotating crops, planting ground cover, protecting the surface with crop residue, and reducing synthetic chemical inputs and mechanical compaction.

regulations Rules established by administrative agencies; regulations can be more important than statutory law in the day-to-day management of resources.

rehabilitation Rebuilding basic structure or function in an ecological system without necessarily achieving complete restoration to its original condition.

relative humidity At any given temperature, a comparison of the actual water content of the air with the amount of water that could be held at saturation.

relevé A rapid assessment of vegetation types and biodiversity in an area.

remediation Cleaning up chemical contaminants from a polluted area.

renewable resources Resources normally replaced or replenished by natural processes; resources not depleted by moderate use; examples include solar energy, biological resources such as forests and fisheries, biological organisms, and some biogeochemical cycles.

renewable water supplies Annual freshwater surface runoff plus annual infiltration into underground freshwater aquifers that are accessible for human use.

replacement rate The number of children per couple needed to maintain a stable population. Because of early deaths, infertility, and nonreproducing individuals, this is usually about 2.1 children per couple.

replication Repeating studies or tests.

reproducibility Making an observation or obtaining a particular result consistently.

residence time The length of time a component, such as an individual water molecule, spends in a particular compartment or location before it moves on through a particular process or cycle.

resilience The ability of a community or ecosystem to recover from disturbances.

resource partitioning In a biological community, various populations sharing environmental resources through specialization, thereby reducing direct competition. See also *ecological niche*.

resources In economic terms, anything with potential use in creating wealth or giving satisfaction.

restoration ecology Seeks to repair or reconstruct ecosystems damaged by human actions.

retrospective study A study that looks back in history at a group of people (or other organisms) who suffer from some condition to try to identify something in their past life that the whole group shares but that is not found in the histories of a control group as near as possible to those being studied but who do not suffer from the same condition.

riders Amendments attached to bills in conference committee, often completely unrelated to the bill to which they are added.

rill erosion The removing of thin layers of soil as little rivulets of running water gather and cut small channels in the soil.

risk The probability that something undesirable will happen as a consequence of exposure to a hazard.

risk assessment Evaluation of the short-term and long-term risks associated with a particular activity or hazard; usually compared with benefits in a cost-benefit analysis.

rock A solid, cohesive aggregate of one or more crystalline minerals.

rock cycle The process whereby rocks are broken down by chemical and physical forces; sediments are moved by wind, water, and gravity; sedimented and reformed into rock; and then crushed, folded, melted, and recrystallized into new forms.

rotational grazing Confining grazing animals in a small area for a short time to force them to eat weedy species as well as the more desirable grasses and forbes.

runoff The excess of precipitation over evaporation; the main source of surface water and, in broad terms, the water available for human use.

S

salinity The amount of dissolved salts (especially sodium chloride) in a given volume of water.

salinization A process in which mineral salts accumulate in the soil, killing plants; occurs when soils in dry climates are irrigated profusely.

saltwater intrusion The movement of saltwater into freshwater aquifers in coastal areas where groundwater is withdrawn faster than it is replenished.

sample To analyze a small but representative portion of a population to estimate the characteristics of the entire class.

sanitary landfills Landfills in which garbage and municipal waste are buried every day under enough soil or fill to eliminate odors, vermin, and litter.

savannas An open prairie or grassland with scattered groves of trees.

scientific consensus A general agreement among informed scholars.

scientific method A systematic, precise, objective study of a problem. Generally this requires observation, hypothesis development and testing, data gathering, and interpretation.

scientific theory An explanation or idea accepted by a substantial number of scientists.

S curve A curve that depicts logistic growth; called an S curve because of its shape.

sea-grass beds Large expanses of rooted, submerged, or emergent aquatic vegetation, such as eel grass or salt grass.

secondary pollutants Chemicals modified to a hazardous form after entering the air or that are formed by chemical reactions as components of the air mix and interact.

secondary succession Succession on a site where an existing community has been disrupted.

secondary treatment Bacterial decomposition of suspended particulates and dissolved organic compounds that remain after primary sewage treatment.

second law of thermodynamics States that, with each successive energy transfer or transformation in a system, less energy is available to do work.

secure landfills Solid waste disposal sites lined and capped with an impermeable barrier to prevent leakage or leaching.

sedimentary rocks Rocks composed of accumulated, compacted mineral fragments, such as sand or clay; examples include shale, sandstone, breccia, and conglomerates.

sedimentation The deposition of organic materials or minerals by chemical, physical, or biological processes.

selection pressure Limited resources or adverse environmental conditions that tend to favor certain adaptations in a population. Over many generations, this can lead to genetic change, or evolution.

selective cutting Harvesting only mature trees of certain species and size; usually more expensive than clear-cutting but less disruptive for wildlife and often better for forest regeneration.

shade-grown coffee and cocoa Plants grown under a canopy of taller trees, which provides habitat for birds and other wildlife.

sheet erosion Peeling off thin layers of soil from the land surface; accomplished primarily by wind and water.

shelterwood harvesting Mature trees are removed from the forest in a series of two or more cuts, leaving young trees and some mature trees as a seed source for future regeneration.

sick building syndrome A cluster of allergies and other illnesses caused by sensitivity to molds, synthetic chemicals, or other harmful compounds trapped in insufficiently ventilated buildings.

significant numbers Meaningful data that can be measured accurately and reproducibly.

sinkholes A large surface crater caused by the collapse of an underground channel or cavern; often triggered by groundwater withdrawal.

sludge A semisolid mixture of organic and inorganic materials that settles out of wastewater at a sewage treatment plant.

smart growth The efficient use of land resources and existing urban infrastructure that encourages in-fill development, provides a variety of affordable housing and transportation choices, and seeks to maintain a unique sense of place by respecting local cultural and natural features.

smelting Roasting ore to release metals from mineral compounds.

smog The combination of smoke and fog in the stagnant air of London; now often applied to photochemical pollution.

social justice Equitable access to resources and the benefits derived from them; a system that recognizes inalienable rights and adheres to what is fair, honest, and moral.

soil A complex mixture of weathered rock material, partially decomposed organic molecules, and a host of living organisms.

- soil creep** The slow, downhill movement of soil due to erosion.
- soil horizons** Horizontal layers that reveal a soil's history, characteristics, and usefulness.
- Southern Oscillation** The combination of El Niño and La Niña cycles.
- southern pine forest** United States coniferous forest ecosystem characterized by a warm, moist climate.
- speciation** Evolution of new species.
- species** All the organisms genetically similar enough to breed and produce live, fertile offspring in nature.
- species diversity** The number and relative abundance of species present in a community.
- specific heat** The amount of heat energy needed to change the temperature of a body. Water has a specific heat of 1, which is higher than most substances.
- sprawl** Unlimited, unplanned growth of urban areas that consumes open space and wastes resources.
- stability** In ecological terms, a dynamic equilibrium among the physical and biological factors in an ecosystem or a community; relative homeostasis.
- stable runoff** The fraction of water available year-round; usually more important than total runoff when determining human uses.
- state shift** An abrupt response to a disturbance that causes a persistent change in a system to a new set of conditions and relationships.
- statistics** Mathematical analysis of the collection, organization, and interpretation of numerical data.
- statutory law** Rules passed by a state or national legislature.
- steady-state economy** Characterized by low birth and death rates, use of renewable energy sources, recycling of materials, and emphasis on durability, efficiency, and stability.
- stewardship** A philosophy that holds that humans have a unique responsibility to manage, care for, and improve nature.
- Strategic Lawsuits against Public Participation (SLAPP)** Lawsuits that have no merit but are brought merely to intimidate and harass private citizens who act in the public interest.
- strategic metals and minerals** Materials a country cannot produce itself but that it uses for essential materials or processes.
- stratosphere** The zone in the atmosphere extending from the tropopause to about 50 km (30 mi) above the earth's surface; temperatures are stable or rise slightly with altitude; has very little water vapor but is rich in ozone.
- stress** Physical, chemical, or emotional factors that place a strain on an animal. Plants also experience physiological stress under adverse environmental conditions.
- strip-cutting** Harvesting trees in strips narrow enough to minimize edge effects and to allow natural regeneration of the forest.
- strip-farming** Planting different kinds of crops in alternating strips along land contours; when one crop is harvested, the other crop remains to protect the soil and prevent water from running straight down a hill.
- strip-mining** Extracting shallow mineral deposits (especially coal) by scraping off surface layers with giant earth-moving equipment; creates a huge open pit; an alternative to underground or deep open-pit mines.
- Student Environmental Action Coalition (SEAC)** A grassroots coalition of student and youth environmental groups, working together to protect our planet and our future.
- subduction (subducted)** Where the edge of one tectonic plate dives beneath the edge of another.
- subsidence** Settling of the ground surface caused by the collapse of porous formations that result from withdrawal of large amounts of groundwater, oil, or other underground materials.
- subsoil** A layer of soil beneath the topsoil that has lower organic content and higher concentrations of fine mineral particles; often contains soluble compounds and clay particles carried down by percolating water.
- sulfur cycle** The chemical and physical reactions by which sulfur moves into or out of storage and through the environment.
- sulfur dioxide** A colorless, corrosive gas directly damaging to both plants and animals.
- Superfund** A fund established by Congress to pay for containment, cleanup, or remediation of abandoned toxic waste sites. The fund is financed by fees paid by toxic waste generators and by cost recovery from cleanup projects.
- surface mining** Some minerals are also mined from surface pits. See also *strip-mining*.
- surface soil** The A horizon in a soil profile; the soil just below the litter layer.
- surface tension** The tendency for a surface of water molecules to hold together, producing a surface that resists breaking.
- sustainability** Ecological, social, and economic systems that can last over the long term.
- sustainable agriculture (regenerative farming)** Ecologically sound, economically viable, socially just agricultural system. Stewardship, soil conservation, and integrated pest management are essential for sustainability.
- sustainable development** A real increase in well-being and standard of life for the average person that can be maintained over the long term without degrading the environment or compromising the ability of future generations to meet their own needs.
- sustained yield** Utilization of a renewable resource at a rate that does not impair or damage its ability to be fully renewed on a long-term basis.
- swamps** Wetlands with trees, such as the extensive swamp forests of the southern United States.
- symbiosis** The intimate living together of members of two species; includes mutualism, commensalism, and, in some classifications, parasitism.
- sympatric speciation** A gradual change (generally through genetic drift) so that offspring are genetically distinct from their ancestors even though they live in the same place.
- synergism** When an injury caused by exposure to two environmental factors together is greater than the sum of exposure to each factor individually.
- synergistic effects** The combination of several processes or factors is greater than the sum of their individual effects.
- systems** Networks of interdependent components and processes.
- taking** The unconstitutional confiscation of private property.
- tar sands** Geologic deposits composed of sand and shale particles coated with bitumen, a viscous mixture of long-chain hydrocarbons.
- tectonic plates** Huge blocks of the earth's crust that slide around slowly, pulling apart to open new ocean basins or crashing ponderously into each other to create new, larger landmasses.
- telemetry** Locating or studying organisms at a distance using radio signals or other electronic media.
- temperate rainforest** The cool, dense, rainy forest of the northern Pacific coast; enshrouded in fog much of the time; dominated by large conifers.
- temperature** A measure of the speed of motion of a typical atom or molecule in a substance.
- temperature inversions** Atmospheric conditions in which a layer of warm air lies on top of cooler air and blocks normal convection currents. This can trap pollutants and degrade air quality.
- teratogens** Chemicals or other factors that specifically cause abnormalities during embryonic growth and development.
- terracing** Shaping the land to create level shelves of earth to hold water and soil; requires extensive hand labor or expensive machinery, but it enables farmers to farm very steep hillsides.
- tertiary treatment** The removal of inorganic minerals and plant nutrients after primary and secondary treatment of sewage.
- thermal pollution** Artificially raising or lowering of the temperature of a water body in a way that adversely affects the biota or water quality.
- thermocline** In water, a distinctive temperature transition zone that separates an upper layer that is mixed by the wind (the epilimnion) and a colder deep layer that is not mixed (the hypolimnion).
- thermodynamics** The branch of physics that deals with transfers and conversions of energy.
- thermohaline ocean conveyor** A large-scale oceanic circulation system in which warm water flows from equatorial zones to higher latitudes where it cools, evaporates, and becomes saltier and more dense, which causes it to sink and flow back toward the equator in deep ocean currents.
- thorn scrub** A dry, open woodland or shrubland characterized by sparse, spiny shrubs.
- threatened species** While still abundant in parts of its territorial range, this species has declined significantly in total numbers and may be on the verge of extinction in certain regions or localities.
- throughput** The flow of energy and/or matter into and out of a system.
- tide pools** Small pools of water left behind by falling tides.
- tolerance limits** See *limiting factors*.
- topsoil** The first true layer of soil; layer in which organic material is mixed with mineral particles; thickness ranges from a meter or more under virgin prairie to zero in some deserts.
- total fertility rate** The number of children born to an average woman in a population during her entire reproductive life.
- total growth rate** The net rate of population growth resulting from births, deaths, immigration, and emigration.
- total maximum daily loads (TMDL)** The amount of particular pollutant that a water body can receive from both point and nonpoint sources and still meet water quality standards.
- Toxic Release Inventory** A program created by the Superfund Amendments and Reauthorization Act of 1984 that requires manufacturing

facilities and waste handling and disposal sites to report annually on releases of more than 300 toxic materials. You can find out from the EPA whether any of these sites are in your neighborhood and what toxins they release.

toxins Poisonous chemicals that react with specific cellular components to kill cells or to alter growth or development in undesirable ways; often harmful, even in dilute concentrations.

tradable permits Pollution quotas or variances that can be bought or sold.

“Tragedy of the Commons” An inexorable process of degradation of communal resources due to selfish self-interest of “free riders” who use or destroy more than their fair share of common property. See *open access system*.

transpiration The evaporation of water from plant surfaces, especially through stomates.

trophic level Step in the movement of energy through an ecosystem; an organism’s feeding status in an ecosystem.

tropical rainforests Forests near the equator in which rainfall is abundant—more than 200 cm (80 in.) per year—and temperatures are warm to hot year-round.

tropical seasonal forests Semievergreen or partly deciduous forests tending toward open woodlands and grassy savannas dotted with scattered, drought-resistant trees.

tropopause The boundary between the troposphere and the stratosphere.

troposphere The layer of air nearest to the earth’s surface; both temperature and pressure usually decrease with increasing altitude.

tsunami Far-reaching waves caused by earthquakes or undersea landslides.

tundra Treeless arctic or alpine biome characterized by cold, dark winters; a short growing season; and potential for frost any month of the year; vegetation includes low-growing perennial plants, mosses, and lichens.

U

unconventional pollutants Toxic or hazardous substances, such as asbestos, benzene, beryllium, mercury, polychlorinated biphenyls, and vinyl chloride, not listed in the original Clean Air Act

because they were not released in large quantities; also called noncriteria pollutants.

urban agglomerations Urban areas where several cities or towns have coalesced.

utilitarian conservation The philosophy that resources should be used for the greatest good for the greatest number for the longest time.

V

values An estimation of the worth of things; a set of ethical beliefs and preferences that determines our sense of right and wrong.

vertical stratification The vertical distribution of specific subcommunities within a community.

vertical zonation Vegetation zones determined by climate changes brought about by altitude changes.

volatile organic compounds Organic chemicals that evaporate readily and exist as gases in the air.

volcanoes Vents in the earth’s surface through which molten lava (magma), gases, and ash escape to create mountains.

vulnerable species Naturally rare organisms or species whose numbers have been so reduced by human activities that they are susceptible to actions that could push them into threatened or endangered status.

W

warm front A long, wedge-shaped boundary caused when a warmer advancing air mass slides over neighboring cooler air parcels.

waste stream The steady flow of varied wastes, from domestic garbage and yard wastes to industrial, commercial, and construction refuse.

water cycle The recycling and reutilization of water on earth, including atmospheric, surface, and underground phases and biological and nonbiological components.

waterlogging Water saturation of soil that fills all air spaces and causes plant roots to die from lack of oxygen; a result of overirrigation.

water scarcity Having less than 1,000 m³ (264,000 gal) of clean fresh water available per person per year.

watershed The land surface and groundwater aquifers drained by a particular river system.

water stress Countries that consume more than 10 percent of renewable water supplies.

water table The top layer of the zone of saturation; undulates according to the surface topography and subsurface structure.

watt One joule per second.

weather The physical conditions of the atmosphere (moisture, temperature, pressure, and wind).

weathering Changes in rocks brought about by exposure to air, water, changing temperatures, and reactive chemical agents.

wetlands Ecosystems of several types in which rooted vegetation is surrounded by standing water during part of the year. See also *swamps*, *marshes*, *bogs*, *fens*.

wind farms Large numbers of windmills concentrated in a single area; usually owned by a utility or large-scale energy producer.

withdrawal A description of the total amount of water taken from a lake, a river, or an aquifer.

woodland A forest where tree crowns cover less than 20 percent of the ground; also called open canopy forest.

work The application of force through a distance; requires energy input.

world conservation strategy A proposal for maintaining essential ecological processes, preserving genetic diversity, and ensuring that utilization of species and ecosystems is sustainable.

X

X ray Very short wavelength in the electromagnetic spectrum; can penetrate soft tissue; although it is useful in medical diagnosis, it also damages tissue and causes mutations.

Z

zero population growth (ZPG) A condition in which births and immigration in a population just balance deaths and emigration.

zone of aeration Upper soil layers that hold both air and water.

zone of saturation Lower soil layers where all spaces are filled with water.



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