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Aa: Lava with a rough, clinkery surface. When molten it is less gaseous and flows more slowly than pahoehoe. The geologic terms (without diacritics) are used by volcanologists around the world. The Hawaiian word 'ā'a means "staring as eyes" or glowing.

Abiotic: Nonliving material components of the environment such as air, rocks, soil, water.

Abstract: A short summary of a document that can stand by itself to explain the document.

Acute toxicant: A poison that kills quickly, usually with one dose.

Acarine: Referring to a member of the order Acarina, containing small to minute arachnids or spider-like animals.

Adaptive radiation: The evolution of different forms from one species of animal or plant. Divergent evolution. Hawai'i has many superlative examples.

Adaptive shift: Change from a behavior or habit characteristic of the ancestral group of plants or animals to a strikingly different pattern. Hawaiian examples are predaceous caterpillars, nectar-eating finches, flightless birds, flightless insects.

Ahupua'a: Hawaiian word for a unit of land, ideally extending from the mountainside into the sea to the offshore reefs.

Algae: Simple plants with chlorophyll that live in aquatic environments or moist situations on land. May be single-celled or multicellular (filamentous, ribbon-like, or plate-like).

Alien: Non-native. Brought into an area by humans, deliberately or by accident. Synonyms include introduced, non-native, exotic, and adventive.

Allele: Forms of a gene. (See heterozygous, homozygous.)

Allelopathy: Chemical inhibition of other plants by secretions from roots or above-ground parts of plants, including leaf litter.

Alluvium: Sedimentary material deposited on land surface by streams.

Amphibian: Member of the vertebrate animal class Amphibia, containing frogs, toads, newts, salamanders. None of the amphibians found in the Hawaiian Islands are native.

Anchialine pools: Land-locked bodies of water with no surface connection to the ocean, yet with measureable salinity (0.5-30 parts per thousand) and tidal fluctuations. Larger areas are habitat for rare Hawaiian shrimps and endangered waterbirds. Anchialine pools are recent geological features and subject to obliteration by lava flows and accumulation of organic and mineral deposits, and to damage by humans.

Andesite: A lava generally lighter in color than basalt and richer in silicon and sodium.

Annelid: Member of the invertebrate phylum Annelida, comprised of segmented worms (earthworms). Hawai'i has no native earthworms.

Annual: A plant that completes its life cycle in one year, during which time germinates, flowers, produces seeds, and dies.
**Anticoagulant:** A substance that prevents the formation of blood clots. Can be used to reduce populations of alien mammals.

**Aquifer:** A geological formation that transmits water in sufficient quantity to supply needs for development for human use.

**Arachnid:** Class of arthropods containing terrestrial animals such as spiders, mites, scorpions, and ticks.

**Archipelago:** A group of many scattered islands in a sea or other expanse of water.

**Arthropod:** Member of the animal phylum Arthropoda including spiders, scorpions, mites, ticks, shrimps, barnacles, crabs, insects, centipedes, and millipedes.

**Artificial classification:** The arrangement of organisms into a series of groups based on one or a few characters for ease of identification or for a specific purpose. For example, birds are often arranged by habitat and habitat (seabirds, waterbirds, birds of prey, and so forth). (Compare with natural classification.)

**Artificial selection:** Differential survival or reproduction of animals or plants with certain genetic composition, resulting from actions of humans.

**Avian malaria:** A parasitic infection of the blood caused by a protozoan. It infects a wide range of birds in Hawai‘i, has probably contributed to the extinction of some native species, and limits the distribution of other species to higher and drier forests. It is transmitted by mosquitoes and was first reported in Hawai‘i in 1947.

**Avian pox:** A virus-caused disease that affects the mouth or upper respiratory tract of birds or causes lesions on legs, feet, eyelids, and so forth. It can result in death but often is mild and self limiting. Pox is transmitted by vectors such as mosquitoes or mites or directly by contact between individuals. It can also be transmitted by infected objects. First reported in Hawai‘i in 1893.

**Bacteria:** Diverse group of microorganisms, all of which consist of a single cell without a distinct nuclear membrane and with a unique cell wall. Usually classified by shape and chemical reaction.

**Bagasse:** Plant residue left after extraction of a plant product for human use. (For example, sugar cane bagasse is the residue after extraction of juice for sugar. It is sometimes used for fuel.)

**Balanced genetic polymorphism:** A stable equilibrium of two or more alleles (genetic alternatives) in a breeding population at such frequencies that the most common allele does not exceed 99%. Several mechanisms for maintaining the balance exist, including heterosis (favoring of individuals with mixed alleles), compulsory cross fertilization among individuals of different types, and opposing selection pressures.

**Basalt, basaltic:** A dark, heavy lava rock, rich in iron and magnesium and comparatively poor in silicon. The common lava rock of Hawai‘i.

**Biennial:** A plant that requires two growing seasons to complete its lifecycle. During the first year, food reserves are accumulated, to be used during the second year for flower and seed production.

**Binomial:** A two-part Latinized name for organisms. The first part is the generic name (see genus) and the second is the specific name (see species). The binomial system of nomenclature was devised by Carolus von Linnaeus and is often called the Linnaean system.

**Biological control:** Reduction or elimination of pest animals or weeds by introduction of natural enemies such as predators, parasites, and diseases.
Biological diversity: Variety of natural communities, species, or genotypes in a given area. At the species level, the numbers of individuals of each species as well as the number of species is important in determining diversity. An area with 50 individuals of one species and 50 of another is said to be more diverse than an area with 99 individuals of one species and one of another. Biological diversity can also be considered within communities and in a given geographical area. The last is thought to be the most important, because some communities are naturally more diverse than others. An indication of genetic diversity is the number of different populations that exist.

Biomass: Total weight of living material in an area. Often applied to organisms, populations, or communities.

Biome: A large, naturally occurring assemblage of plant and animal species adapted to conditions in which they occur. Examples of biomes are tropical rain forest, temperate grassland, tundra, and deciduous forest.

Biosphere: Region of the earth's surface, ocean, and air inhabited by living organisms.

Biota, biotic: Flora (plants) and fauna (animals) considered together.

Bird: Member of class Aves, two-legged vertebrates with feathers, wings, scaly legs, and beaks. Birds, like mammals, amphibians, reptiles, and fishes are all animals. It is incorrect to say "birds and animals." Birds are animals!

Bog: Wetland that is acidic, nitrogen-poor, rich in plant residues, and in Hawai'i has a characteristic flora of sedges, heaths, sphagnum moss, and stunted woody plants (trees and shrubs).

Bottleneck: Reduction of an animal or plant population to a small number of individuals such that considerable genetic variation from the original population is not represented. When the small population increases, it is said to have gone through population and genetic bottlenecks.

Bounty: A payment given (usually by governments) to encourage destruction of harmful animals. Evidence is required to substantiate destruction. Usually not effective at the population level, although it may work for individual destructive animals, because evidence can be fabricated and obtained from animals and areas not of concern. As with hunting, reduction of animals below a readily obtained level is not facilitated; perpetuation of populations to continue bounties often occurs.

Brackish: Marine waters and estuaries that are mixohaline (0.5-30 parts per thousand of ocean salt). (Seawater has 35 parts per thousand.) (See saline.)

Bryophyte: Member of the plant division Bryophyta, including mosses and liverworts. These simple plants have no vascular tissue and usually grow in damp habitats. (See vascular plant.)

Bunchgrass: Tussock-forming grasses with spaces between clumps, as opposed to mat-forming grasses. Examples of bunchgrasses in Hawai'i are Deschampsia australis, Panicum tenuifolium, and Trisetum glomeratum.

Candidate: Refers to plants and animals under consideration for addition to the list of Federally Endangered or Threatened wildlife or plants in the United States. Candidate taxa receive no substantive or procedural protection under the Endangered Species Act, but Federal agencies and other planners are urged to consider Candidate species in environmental planning under the National Environmental Policy Act and other statutes.
Most of Hawai'i's rare plants are Candidates rather than listed Endangered or Threatened taxa.

**Canopy:** That portion of vegetation that first intercepts solar radiation, or portion that is seen when viewed from above all vegetation. Usually applied to tallest woody species in an area. (See **understory**.)

**Captive breeding (captive propagation):** Referring to a program in which plants or animals have been removed from their natural environment to establish an artificial population for the purpose of reproduction of the organisms. This management procedure is often undertaken when population sizes in the wild are small and threats to the natural habitat are great. (See **in situ**.)

**Carrying capacity:** The number of organisms of a given species that can survive in an area through the least favorable period that occurs over a long period without deterioration of the ecosystem. The term can also be used to refer to the number of species (a measure of biological diversity) that an area can support over a long period. A third use is in a recreational context—the number of human an area can tolerate in the worst circumstances without ecosystem deterioration or deterioration in the quality of the recreational experience of concern.

**Category 1 taxa:** Candidate taxa for which there is substantial information to support the biological appropriateness of listing a species as Federally Endangered or Threatened. Development and publication of proposed rules for these taxa is anticipated.

**Category 2 taxa:** Candidate taxa for which conclusive data on biological vulnerability and threats are not currently available. Listings for these taxa is not supported at this time.

**Category 3 taxa:** Those which are no longer being considered for listing as taxa that are Federally Endangered or Threatened.

**Channelization:** Modification of a natural stream channel through replacing or reinforcing banks or stream bed, filling or blocking the channel, or changing the length of a channel.

**Chemical control:** Use of pesticides to reduce or remove individuals or populations of animals or plants.

**Chromosome:** Threadlike structure, several to many of which are found in the nuclei of plant and animal cells. Chromosomes carry genes that determine individual characters of an organism.

**Circumtropical:** Found around the world in the tropical zone.

**Class:** Category used in classifying organisms that consists of closely related orders. Similar animal classes are grouped into a phylum, and plant classes (sometimes) into a division. (See **natural classification**.)

**Climax community:** A relatively persistent, self-reproducing natural ecological community achieved after other communities have existed in the same place. The biological diversity of the climax community can be lower than that of other communities preceding it, but the climax community is more "stable" by one or more measures.

**Clonal reproduction:** Formation of genetically identical individuals from a single "parent" individual.

**Club-moss:** Primitive vascular plant in the group Lycopoda or Lycophtyina related to ferns. *Wawaeirole* or *Lycopodium* is a genus found in Hawai'i.

**Coadapted genetic system:** Mutually harmonious set of alleles that are inherited intact and that confer fitness (reproductive advantage) to the
individual. The alleles that comprise such a system are usually inherited together.

Community: A naturally occurring assemblage of plants and animals living and interacting in a defined area. The same groups of species also occur elsewhere, and the community is usually named for dominant plants or animals or major physical components.

Community mosaic: A group of different communities that are located near one another in a particular area.

Conifer, coniferous: Member of the plant subdivision Gymnospermae (naked seed) that has reproductive organs in cones, with fertilization usually achieved by wind-borne pollination. (See flowering plant, seed plant.)

Conservation District: One of four districts provided for in Hawai'i's 1961 Land Use Law and in 1963 and 1965 amendments. The Conservation District includes national and state parks, lands with a slope of 20% or more, lands in existing forestry and water reserves, and marine waters and offshore islands. The District is administered by the Hawai'i State Department of Land and Natural Resources, and boundaries can be changed by the Land Use Commission through petition and public hearings.

Conservation easement: A legal arrangement between landowner and non-owner that entitles the landowner to retain title to the land and the non-owner to manage the land for conservation of natural resources.

Conservation education: Planned effort to teach others about protecting, managing, and caring for natural resources. Emphasis is less on nature study than on ecological processes, politics, real-world problems and decisions. Focuses on renewable natural resources (plants and animals) and on key manageable resources (soil, water, air). Sometimes used synonymously with environmental education.

Coral: Member of a group of sedentary, colonial marine invertebrates in the phylum Coelenterata. The skeleton of true coral animals is almost pure calcium carbonate and in the Tropics in large part forms the coral reefs of oceans. Other marine organisms such as coralline algae also participate in the building of coral reefs.

Coralline algae: Algae that participate in the formation of coral reefs. (See algae, coral.)

Cretaceous: The final geologic period of the Mesozoic era. It extended from about 136 million years ago to 65 million years ago. Reptiles reached their peak and Flowering plants first appeared during this period. There was widespread extinction at the end of the Cretaceous, and dinosaurs and other groups disappeared.

Critical habitat: Specific areas within the geographic range occupied by a species at the time of listing by the Federal government as Endangered or Threatened, within which are found physical or biological features necessary for conservation of the species, and specific areas outside the occupied area, upon determination that those areas are also essential for conservation of the species (legal definition). Critical habitat is not often designated for many reasons, including the time required for the process and the difficulty of definition. (See habitat.)

Critically imperilled: Refers to communities with 1-5 occurrences in Hawai'i or species with fewer than 1,000 individuals. (Term used by The Nature Conservancy of Hawaii). (See imperilled.)
Crustacean: Invertebrate of the class Crustacea (phylum Arthropoda), including shrimps, crabs, lobsters, barnacles, and fish lice.

Cultivar: A cultivated variety (genetic strain) of a domesticated crop plant.

Cultural control: Making the environment less favorable for problem species or pests. In Hawai‘i, maintaining large tracts of intact native forest could be considered ecological or cultural control for some alien species that require avenues of ingress provided by humans or feral animals.

Cytogenetics: The study of inheritance in relation to the structure and function of cells.

Deciduous: Plants that shed all leaves at the end of each growing season, usually autumn in temperate regions and at the beginning of a dry season in the Tropics. Seasonal leaf fall helps the plant retain water that would otherwise be lost by evapotranspiration through plant tissue.

Destabilization: Major reorganization of polygenic balances in a population of plants or animals, leading to speciation.

Dicotyledon: One of two classes or subclasses of flowering plants, distinguished by having two seed leaves (cotyledons) within the seeds, reticulate (netted) venation in leaves, and flower parts in multiples of four or five. (See monocotyledon.)

Division: Highest category used in classification of plants, containing similar classes.

DNA: Deoxyribonucleic acid. The genetic material of most living organisms, which is a major component of chromosomes within cell nuclei. DNA plays a major role in determining hereditary characteristics by controlling protein synthesis in cells. (See gene.)

Ecological zone: Generally, in terrestrial environments in Hawai‘i: elevational bands, areas with similar moisture, or some combination of these. Five broad ecological zones may be recognized on the basis of elevation. They are: coastal (sea level to the extent of the salt spray); lowland (sea level to 3,000 ft); montane (3,000-6,000 ft); subalpine (6,000-9,000 ft); and alpine (over 9,000 ft). According to moisture alone, three zones can be recognized: dry (receiving less than 50 in. of annual rain or with soil dry most of the time); mesic (receiving between 50-100 in. or soil staying moist most of the time); and wet (receiving more than 100 in. per year or with prevailing wet soil conditions. The character or physiognomy (external aspect) of the natural vegetation can also be used to define broad ecological zones. In Hawai‘i we have desert (little to no vegetation), herbland, grassland, shrubland, forest, and mixed vegetation.

Ecosystem: The complex of interacting living (biotic) and non-living (abiotic) components of a particular environment.

Edge: Zone between two different kinds of vegetation where one influences the other biologically or physically. Different species of animals may depend on the edge zone or be most abundant there. "Edge" is also used to describe visual junction of two distinct communities.

Emergent vegetation: Plants with support tissue that grow in freshwater or marine wetland areas, rooted under the water but emerging from water into the air. Examples are bulrushes and some sedges.

Eminent domain: A right of government to take private property for public use by virtue of superior dominion of the sovereign power over all lands in its jurisdiction, provided that compensation is made.
Endangered: A species, subspecies, variety, or population in immediate danger of extinction throughout all or part of its geographic range, and (if capitalized herein) formally recognized as such by the U.S. Government and protected by law. (Some taxa are considered endangered by other governments or organizations.)

Endemic: Peculiar to a particular area and nowhere else. Evolved in a particular area and found only there. Localized endemics are those with geographic ranges of less than 20,000 mi². Hawai‘i’s land area is only 6,500 mi², and many Hawaiian taxa are single-island endemics.

Entomology: The study of insects. Entomologists are scientists who study insects.

Environmental Assessment (EA): Document required by Federal agencies when proposed minor activities are environmentally controversial, affect public health and safety, affect properties listed on the National Register of Historic Places, violate Federal, state, or local law for environmental protection, establish a precedent, affect unique geologic characteristics, or impact a Federally listed Endangered or Threatened species. The purpose of the proposed action, alternatives, impacts of the alternatives, and a list of persons or agencies contacted must be given in the EA. Public review and a finding of no significant impact (FONSI) must be accomplished to proceed with the proposed action. The State of Hawai‘i has equivalent documents.

Environmental education: Planned teaching about all aspects of environment including preservation, threats, benefits, and dangers to humans. Technically includes conservation education but sometimes is used synonymously with it. Environmental education sometimes emphasizes nature study and teaching of nature appreciation to children, rather than ecological processes, issues, and education of adults.

Environmental Impact Statement (EIS): A document prepared by a Federal agency or an entity receiving Federal support, in which anticipated environmental effects of a planned course of action are evaluated. Required by the National Environmental Policy Act of 1969. Public and agency comments are solicited and specific legal requirements for content and advertising must be met.

Epiphyte: A plant that grows on another plant but is not parasitic on it and not rooted in the ground.

Estuary: A semi-enclosed body of water along a coast, open to the sea and subject to tides, and displaying a mixture of sea water diluted by fresh water from land drainage. Some Hawaiian fishponds and anchialine pools behave like small estuaries and are very productive of aquatic life.

Evapotranspiration: Loss of water from the soil resulting from evaporation and emission of water vapor through plant leaves and other parts.

Evolution: Gradual process by which plants and animals arose from earliest and most primitive organisms. The process of evolution continues today but is now influenced by humans in many obvious and subtle ways (for example, air and water pollution, reduction and fragmentation of habitat of organisms). (See natural selection, genetics, speciation, adaptive radiation, artificial selection.)

Ex situ: A conservation method involving removal of organisms or living parts (such as eggs, seeds, sperm) from their original environment, usually in an effort to ensure population survival.
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**Founder effect:** Combination of genetic drift and natural selection resulting in a new genetic direction for a small population or individual in a new environment. Descendants of an individual or small population may diverge from the ancestral population because of natural selection that is different in the new area, or because the small population contains a different frequency of genotypes (or lacks some) than the ancestral population, or because of both natural selection and drift. (See genetics.)

**Founding event:** Establishment of an individual or small population in a new area for that species.

**Founding individual:** One individual of a species successfully invading a new area previously unoccupied by the species.

**Fungus, fungi:** A simple plant without chlorophyll. Sometimes considered a member of the kingdom Protista or a separate kingdom Fungi rather than a member of the plant kingdom.

**Gallinaceous:** Of or pertaining to the order Galliformes, including pheasants, turkeys, quail, grouse, and the domestic fowl. Chicken-like bird.

**Gastropod:** Member of invertebrate phylum Mollusca (mollusks), class Gastropoda ("stomach-toothed"). Includes freshwater, terrestrial, and marine snails, slugs, limpets (topihi), "tree snails."

**Gene:** The functional and structural unit of inheritance. Each gene is composed of DNA, located in a particular part of a chromosome, and contains all information necessary to perform a function or help control a characteristic of an organism.

**Gene pool:** The total of all genetic information encoded within all genes of a breeding population.

**Genetics:** The study of heredity and variation, including the chemical nature of the genes and the ways in which they can replicate and be transmitted.

**Genetic drift:** Random fluctuation in gene frequencies in a small population, sometimes accompanied or followed by rapid natural selection. (See Sewall Wright effect, founder effect.)

**Genetic engineering:** The techniques involved in altering the characters of an organism by inserting DNA from another organism into its genes. For example, the human gene for insulin production has been incorporated into bacterial DNA; the genetically engineered bacteria are then used in commercial production of insulin. Also known as "recombinant" DNA technology.

**Genetic recombination:** The rearrangement of genes that occurs when reproductive cells (gametes) are formed and combined to form a new individual. Recombination produces offspring that have a combination of characteristics that differ from their parents.

**Genetic shift:** Change from one balance in genetic variability to another, resulting in adaptation to new ecological conditions. Evolution has produced many such shifts in Hawai'i, in which the new group differs strikingly from the ancestral group. (See adaptive shift, genetic drift.)

**Genome:** A single, complete chromosome set within an organism. (In higher animals and vascular plants two genomes (diploid) are contained within body cells, whereas reproductive cells (gametes) contain one genome (haploid)).

**Genotype:** The genetic composition of an organism.

**Genus, genera:** A category used in classification of organisms, which consists of a number of similar or closely related species. (See natural classification.)
Groundwater table: The upper surface of groundwater (water in the zone of saturation where all openings in the soil and rocks are filled with water).

Habitat: The specific place where plants or animals live. Includes biotic and abiotic factors needed to define an organism’s requirements but is often designated by physical characteristics or a dominant plant type.

Herb, herbaceous: A plant without woody tissue. Often used to refer to broad-leaved, non-woody plants, that is, non grasses and sedges (monocotyledons).

Herbal: An illustrated book about plants, especially in relation to their medicinal value.

Herbarium: A collection of dried plant specimens mounted on paper, labeled, and systematically arranged for use as references. (See voucher specimen, type.)

Heterozygous: An organism having two different alleles (alternative forms of a gene) controlling a particular feature. (See homozygous.)

High island: An island with more than coastal and lowland vegetation zones. Also, one high enough to cause precipitation through cooling of air in highlands. Usually the eight “main” Hawaiian islands are considered high islands even though Kaho‘olawe, Lana‘i, and Ni‘ihau are in “rain shadows” behind Maui, Moloka‘i, and Kaua‘i and do not receive much rain. High islands and low islands are also sometimes distinguished by volcanic vs. coral substrates.

Homozygous: An organism having two identical alleles (alternative forms of a gene) controlling a particular feature. (See heterozygous.)

Honeycreeper: Member of a subfamily of birds that is endemic to the Hawaiian Islands. The only group of such high taxonomic rank to be restricted to Pacific areas in the Tropics. Honeycreepers provide perhaps the best example of avian adaptive radiation in the world. Over half of the surviving species are considered Endangered, and many are confined to higher elevations where mosquitoes, which transmit avian malaria, are absent or scarce. Logging, feral ungulates, and cattle-grazing threaten the upper-elevation forests where honeycreepers live. Honeycreepers include such species as the palila, Maui parrotbill, apapane, common 'amakihi, and 'i'iwi.

Host testing: Determination of which species of plant or animal a particular proposed biological control agent attacks. As a rule, agents include insects and pathogens.

Hot spot: An area that initiates volcano formation but is located in the middle of a shifting plate (see plate tectonics) rather than at plate boundaries. The "hot spot of the Pacific" over which the Hawaiian Islands have formed is a good example.

Hydroid: Small invertebrate found in fresh, brackish, and salt water, belonging to the class Hydrozoa in the phylum Coelenterata. Hydroids characteristically show "alternation of generations"—that is, they usually have two basic body forms in their life cycle: an attached, asexually reproducing, polyp stage in which many hydroids form a branching colony resembling a minute plant, and a free-swimming, sexually reproducing, medusa stage. Hydroids are carnivorous; like corals, jellyfish, and Portuguese man-of-war, they stun and capture their food with nematocysts (stinging cells) in contractile tentacles.
Imperilled: Referring to communities with 6-20 occurrences in Hawai'i or species with 1,000-3,000 individuals. (Term used by The Nature Conservancy of Hawaii.) (See critically imperilled.)

Inbreeding: A mating system involving breeding of closely related individuals, the most extreme form of which is self-fertilization.

Inbreeding depression: Reduction of fitness or vigor resulting from deleterious, recessive alleles from consistent inbreeding. Recessive alleles or traits are those which are masked or overridden by alternative dominant alleles or traits when both are present in the same genotype.

Indigenous: A species occurring naturally in an area but also in other areas. (See alien, endemic, native.)

Industrial melanism: The increase of melanic (dark) forms of an animal in areas darkened by industrial pollution. Examples are British moths (Biston betularia and 80 other species) that increased in polluted regions because they were less easily seen by birds against a dark background.

Insect: Member of a class of arthropods that usually has three pairs of legs, a waterproof cuticle (to resist desiccation), and wings. Breathing occurs through trachea, a network of tubes. Examples are cockroaches, crickets, flies, and beetles. Hawai'i has countless endemic (many of them undescribed) as well as alien insects; a major problem today lies in controlling the aliens—many of which are pests—without harming the forms that are native to the Islands. A current example of the problem is the proposed tri-fly eradication project, in which the U.S. Department of Agriculture proposes to spray large areas in Hawai'i with insecticide.

In situ: Conservation of plants and animals in their natural environment. (See ex situ.)

Integrated pest management: Use of chemical, manual, cultural or ecological control in a planned sequence to reduce problem plants or animals.

Intertidal zone: Area above the low-tide and below the high-tide marks of a body of water.

Invertebrate: Animal without backbone. Examples are insects, snails, spiders, clams, corals, various worms, wana (sea urchins), crabs, sponges, hydroids, lobsters, octopuses, sea cucumbers. (See mollusks, arthropods, annelids, crustaceans.)

Irruptive: Undergoing a sudden increase in numbers, especially when natural ecological balances and checks are disturbed.

Karyotype: The number and structure of the chromosomes in the nucleus of a cell.

Kingdom: The highest category into which organisms are classified. Traditionally, two kingdoms have been recognized—Plant and Animal; other more recently recognized kingdoms are Fungi, Prokaryota and Eukaryota, and Protista (all animals and plants of simple organization). (See natural classification.)

Kipuka: Hawaiian word for an "island" of land (older lava flow with vegetation) surrounded by a more recent lava flow (often without vegetation).

Larva, larvae: The juvenile stage in the life cycle of most invertebrates, amphibians, and fishes. Larvae hatch from the egg, are unlike the adult in form, and usually cannot reproduce sexually. Larvae can feed themselves, and most eventually go through transformation (metamorphosis) to the adult form.
Legume, leguminous: Member of the Leguminosae or Fabaceae (pea) family. Legumes (leguminous plants) have characteristic seed pods that split into two halves, exposing one or more seeds when ripe. Legumes are nitrogen fixing and can be important modifiers of nutrient cycles in Hawaiian ecosystems.

Liana: A climbing, twining, woody plant. Lianas in Hawai‘i include the endemic ‘ie‘ie and the alien banana poka.

Lichen: A group consisting of a symbiotic (mutually beneficial) relationship between a fungus and a green or blue-green alga (plural algae). The cells of the alga are distributed within the body of the fungus. The alga photosynthesizes (produces organic material from carbon dioxide and water in the presence of sunlight) and passes most of the food produced to the fungus; the fungus protects the algal cells.

Life form: As used herein, plant categories including information on size, life span, and woodiness. For example, categories in common use include herb, annual, perennial, herbaceous perennial, woody perennial, shrub, tree, and liana. Many other uses of the term "life form" also exist for plants.

Limiting factor: Any environmental factor whose presence, absence, or abundance is the main reason that distribution, numbers, or condition of a group of animals or plants is restricted or reduced.

Listing: Process of officially adding a taxon to the Federally Endangered or Threatened species list through a series of steps, including: systematic and biological review and evaluation of threats by the U.S. Secretaries of the Interior and Commerce; publication in the Federal Register; notification of the governor of the state or states in which the species occurs; public comment for 90 days (sometimes with public hearings); and publication of the facts upon which regulations are based in the Federal Register.

Liverwort: Class of bryophyte plants (Hepaticae) that occur in moist situations and as epiphytes on other plants. Reproduction is by spores in leafless stalks bearing capsules.

Low island: An island without upland vegetation zones. Also defined by coral rather than volcanic origin or structure. (See high island.)

Magma: Molten material of the mantle layer. When magma emerges from the earth it is called lava.

Mammal: A class of vertebrates with mammary glands and hair. Includes humans, whales and porpoises, dogs, pigs, rodents or rat-like animals, and others. Hawai‘i has two native land mammals, the Hawaiian bat and the Hawaiian monk seal. Mammals are only one kind of animal; the terms animal and mammal are not synonymous.

Mantle: Semi-liquid layer between earth’s core and crust. (See magma.)

Manual control: Reduction or removal of alien plants by hand or with simple, non-mechanical tools.

Marsh: Wetland characterized by sedges and grasses.

Mesic: Relatively moist and benign. Receiving between 50-75 in. of annual rain or with prevailing moist soil conditions. Intermediate between wet and dry conditions. Sometimes referred to as "moist."

Minimum viable population (MVP): Threshold number for the individuals of a given population of a species that will assure that it will persist for a given interval in its natural environment. The term intuitively involves genetic and population processes. It was first used in response to the
directive by Congress to maintain "viable populations" of vertebrates on U.S. Forest Service lands. Estimates of MVP depend upon density and distribution of individuals, breeding habits, age ratios in the population, and other factors. The concept is of practical importance because at a certain level, numbers of many animals and plants seem to decline at a rapid rate and conservation in natural areas becomes very difficult. It is also important because MVPs of some species (for example, a mobile bird such as the 'o'uu, may require very large protected areas. Smaller areas will not protect large enough numbers to prevent extinction. There is no MVP number applicable to all species. (See also critical habitat, critically imperilled, imperilled.)

Molecular biology: Study of the biochemical aspects of life, especially DNA, RNA (ribonucleic acid), and protein.

Mollusk: The animal phylum which includes gastropods (snails), bivalves (clams), cephalopods (octopus, cuttlefish, and squid), and others. Mollusks are found in terrestrial, freshwater, and marine environments. A scientist who studies mollusks including their soft body parts is a malacologist; a conchologist studies only the shells of mollusks.

Monocotyledon: One of two classes or subclasses of seed plants. Distinguished by having one seed leaf (cotyledon) within the seed, parallel veins in leaves, and flower parts in threes or multiples of three. (See dicotyledon, flowering plant.)

Monograph: A written account devoted to one major subject. In biology, often a taxonomic study of a particular genus or family.

Morphology, morphological: The study of the form and structure of organisms, especially external form.

Moss: A class of plants within the bryophytes with erect or prostrate leafy stems, which give rise to leafless stalks that bear capsules in which spores form. Found in damp and also dry places. (See liverwort.)

Multiple use: Usually, more than one use of a geographic area at a given time, but sometimes different uses at different times, which can be continued without conflict or harm to the productivity of the land. Sometimes, a variety of land uses (for example, grazing, hunting, mining, timber harvest) can be accommodated in one area. In other cases (for example wilderness), one use precludes other uses, and single use is necessary. Multiple use can be considered "multiple abuse" in cases where the land will not sustain all human demands placed on it or where one very important use is precluded by less important uses.

Mutation: Any change in the original genetic information encoded in a gene. The creation of a new allelic form of a gene.

Mutualism, mutualistic: An interaction between two species in which both species benefit. Often used synonymously with "symbiosis."

Mycology: The scientific study of fungi.

Mycorrhizae: The mutually beneficial association of the roots of a seed plant with the filamentous body of a fungus or a higher kind of bacteria. (See legume, mutualism.)

Myriapod: A member of a group of terrestrial arthropods usually found in damp conditions. Includes centipedes, millipedes, and others.

Native: Naturally occurring in an area. Not brought in by humans. Includes endemic (found naturally only in that area) and indigenous (found naturally in that area but also in other areas).
Glossary

Natural area: An area set aside for preservation of a representative sample of natural communities for educational, scientific, and future needs. These may also be called reserves, preserves, or sanctuaries by different agencies, organizations, or persons, and in different countries.

Natural classification: The arrangement of organisms into a series of groups based on resemblances which reflect evolutionary relationships. The small group is commonly the species and the arrangement is hierarchical. (See kingdom, division, phylum, class, order, family, genus.)

Natural regulation: Referring to populations of animals or plants limited by natural ecological factors (such as nutrition and food supply, weather, predators, disease) rather than by human manipulation or management.

Natural selection: Differential mortality or survival of animals or plants with differing genotypes. Natural selection is caused by naturally occurring biotic or abiotic factors. A collection of biologically "fit" (productive) individuals of selected genotypes results. Opposite of artificial selection, where humans influence the resulting genotypes. (See sexual selection, fitness, evolution.)

Naturalized: Referring to a non-native species established as if it were a native species in an area. A plant or animal that is reproducing and maintaining a population without human help, even though it was introduced from elsewhere.

Nematode: Member of a phylum of invertebrates called Nematoda, the roundworms. Some are microscopic and free-living but many are much larger and parasitic.

Niche: The status or role of an organism in its environment. An organism's niche is defined by the types of food it consumes, its predators, temperature tolerances, time of activity, and so forth. Physical factors alone have been used to define the niche of an organism because this can often be more easily done than by including biological factors also. However, this can be misleading.

Nitrogen cycle: One of the major chemical cycles in the environment. Nitrates in the soil are taken up by plant roots and may pass along food chains to animals. Decomposing bacteria convert nitrogen-containing compounds in plant and animal wastes and in dead organisms back to nitrates that are released into the soil and can again be taken up by plants. Nitrogen-fixing algae and bacteria are also involved, and lightning can cause atmospheric nitrogen and oxygen to combine. Oxides of nitrogen can enter the soil and form nitrates. Denitrifying bacteria in the soil can also return nitrogen to the atmosphere.

Nitrogen-fixing: A chemical process in which atmospheric nitrogen is assimilated into organic compounds in living organisms. Certain algae and bacteria, some of the latter in association with cells in the roots of plants, are able to fix nitrogen and increase soil fertility in the process.

Northwestern Hawaiian Islands: The islands from Nihoa to Kure Atoll. The "Leeward Islands." Excludes the eight "main" Hawaiian Islands and their adjacent islets. (See low islands.)

Noxious: An undesirable species harmful to domestic livestock, detrimental to their habitat or range (land producing natural or naturalized forage for them) or harmful to commercial forestry interests. Usually, a plant is defined as noxious by state agricultural or forestry interests, and native species are sometimes included (for example, the endemic dodder,
Some species that are considered out of control or that are harmful in natural areas but not agricultural areas are not included on noxious plant lists.

**Nutrient cycle:** The pathway of a nutrient or element through plants, animals, soil, air, and water in organic and inorganic forms, through an ecosystem.

**Oceanic island:** An island well out into the ocean and often lacking certain naturally occurring groups of species (for example, mammals, reptiles, amphibians) found on the nearest continental area. Oceanic islands are usually of basaltic (volcanic) or limestone origin. They are also places where evolution adds new taxa more rapidly than they are added by immigration.

**‘Ohi'a dieback:** A naturally occurring decline in the vitality of a similar-aged stand of 'ohi'a trees (cohort senescence), triggered by a fluctuating site factor (such as drought, flooding of root systems, seismic vibrations, or a combination of factors), sometimes followed by weak disease agents that may hasten the process of death.

**Order:** Category used in classification of organisms that consists of one or several related families. (See natural classification.)

**Orographic:** Related to mountains. Moisture-laden air that crosses mountains is cooled and cannot hold as much moisture; orographic rainfall or precipitation occurs as a result.

**Pacific Basin:** Area occupied by the Pacific Ocean, including "the majority of the world's islands, the deepest seas, the highest islands, many volcanic chains (several of them currently active), and, along its fringes, some of the world's highest mountains." The Pacific Ocean covers about one-third of the earth's surface and extends from the West Coast of America about 14,000 mi westward, to the islands of Asia, and from the Aleutian Islands southward 1,300 mi to Antarctica.

**Pacific Plate:** One of the crustal slabs near the earth's surface (see plate tectonics). A hot spot in the Pacific plate has allowed formation of the Hawaiian Islands.

**Pahoehoe:** Lava with a smooth or ropy appearing surface. When molten it is more gaseous and moves more rapidly than aa.

**Pathogen:** Any disease-causing microorganism. Includes viruses and many bacteria, fungi, protozoans.

**Perennial:** A plant that lives for a number of years. Woody perennials have a form above ground that continues to grow each year. Herbaceous (non-woody) perennials have above-ground forms that may die and be replaced by new shoots from underground each year.

**Permian:** The last geological period in the Palaeozoic era. It extended from about 280 million years ago to about 225 million years ago. During the period, amphibians and reptiles were dominant land animals, and coniferous plants and their relatives became dominant.

**Phenology:** Study of periodic biological phenomena (such as migration, flowering, fruiting, breeding) in relation to climate, day length changes, and other environmental factors.

**Phylogeny, phylogenetic:** The evolutionary history of an organism or group of related organisms.

**Phylum:** Category used in animal classification that consists of one or several closely related classes. Examples of phyla are Porifera (sponges), Arthropoda (insects and relatives), Nematoda (roundworms), Mollusca
(clams, snails, and cephalopods), Echinodermata (sea urchins, sea cucumbers, starfishes, and others), Coelenterata (jellyfish, corals, hydroids), Annelida (segmented worms), and Chordata (including vertebrates).

**Plankton, planktonic**: Minute organisms that float with currents in a sea or lake. An important food source for many animals, including corals, hydroids, whales.

**Plate tectonics**: Geological theory that the surface of the earth is comprised of a number of shifting slabs averaging 50 mi in thickness. These plates move relative to one another above a deeper, hotter zone. Most of the volcanoes of the world are located near the boundaries of the shifting plates, and many are arranged in linear chains. (See hot spot, Pacific Plate.)

**Pleiotropic**: Gene producing more than one visible effect.

**Polygenic**: Pertaining to a group of genes influencing a quantitative character (such as height in humans).

**Polynomial**: Scientific name for plant or animal, consisting of three or more words (usually the third is subspecies, variety, or form description). (See binomial, natural classification.)

**Population**: A group of individuals of the same species within a community or the total number of individuals of a given species or other taxon within a defined geographic area. Knowledge of certain characteristics of a population such as density (numbers per unit area), sex and age ratios, birth and death rates, and movement into and out of an area are needed to understand the health or "well-being" of the population. These characteristics vary and some idea of the natural variation is essential if one is to interpret when a population is expanding or contracting abnormally, as a result of changes induced by humans.

**Preadaptation**: Capability of a taxon to survive conditions not previously encountered. As a result of inherent population variability, some species are "preadapted" for survival in new environments.

**Preserve design**: Science and art of defining size, shape, and diversity of a natural area to save it for future generations of humans and other species. Considerations in design include threats to the area, social and economic factors, adjacent land uses, minimum viable population sizes of the native plants and animals within, ecological succession, genetics and dispersability of the species involved, and manageability of the area. In Hawai'i, it is particularly important to set objectives and evaluate resources for management of preserves at an early stage. "Paper parks," those that receive legal protection but not active management, are usually destined for long-term failure as preserves because of alien species and changing land use in adjacent areas. Responsible use of limited land is another reason for good preserve design.

**Prodrumus**: Precursor of a more complete work.

**Progenitor**: Ancestral form. Form from which a particular plant or animal taxon is descended and derived.

**Propagule**: Any part of an organism or stage in the life cycle that can reproduce the species and thus establish a new population.

**Protected or "P" subzone**: Land use subcategory within the Conservation District category in Hawai'i. Established under Department of Land and Natural Resources Regulation 4 to "protect valuable resources in such designated areas as restricted watersheds, fish, plant, and wildlife sanctuaries, significant historic, archaeological, geological and volcanological
features and sites, and other designated unique areas. Permitted uses do not allow physical facilities (except government development where public benefit outweighs impact), but do allow habitat improvement, site restoration, vegetation protection (including noxious plant removal), and control of animals and plants including fishing and hunting [ed. emphasis].”

**Protective mimicry**: The resemblance of one animal to another that has evolved as a means of protection. For example, a harmless insect may closely resemble the 'warning colors' of a distasteful insect. Predators learn to avoid the harmless one after contact with the distasteful. A group of harmful animals (such as bee, hornet, and wasp) may also resemble each other so that a predator will avoid all.

**Protozoa**: A phylum composed of unicellular or acellular organisms, usually microscopic. They are very widely distributed, and some are parasites and cause diseases such as avian malaria. Considered simple animals of the kingdom Protista.

**Quantitative characters**: Adaptively important characters of plants and animals controlled by many genes. An example is size of an animal. (See polygenic.)

**Rabies**: Acute disease caused by a virus that affects the nervous systems of mammals and is usually transmitted by their bites. Hawai'i is--so far--free of the disease.

**Rain forest**: On a worldwide basis, a broad vegetation type in the Tropics with high rainfall (40-400+ in. per year) and high average temperature. Rain forests near the equator lack pronounced cold or dry spells, but seasonality increases away from the equator. Two-thirds of the world's rain forests are the wetter, richer, equatorial type. A few thousand years ago the rain forest belt covered 14% of the earth's surface; it may now occur on 7% but contain over 50% of the earth's species. Tropical rain forests are now being destroyed more rapidly than any other vegetation type. It is predicted that one-fifth of the world's remaining rain forest will be destroyed or severely degraded by the year 2000.

**Random drift**: Change in genotype frequency of small populations due to loss or multiplication of some genotypes at random.

**Raptor**: A bird of prey (such as eagle, vulture, hawk, owl).

**Recovery plan**: A document developed by a recovery team, or on contract, to plan for removal of a species from Federal Endangered or Threatened status by making the species a self-sustaining member of an ecosystem. Plans are reviewed and approved by the Director of the U.S. Fish and Wildlife Service (Department of the Interior). Different tasks in the recovery plan are assigned to different agencies to complete, but often funding is not available.

**Recovery team**: A group of individuals appointed by the Director of the U.S. Fish and Wildlife Service (Department of the Interior) to plan and effectuate the removal of taxa from Endangered or Threatened status by making the species self-sustaining members of ecosystems. Usually a team is composed of professionals from different agencies with responsibilities for the species of concern. In Hawai'i, teams have usually been used only to draft recovery plans.

**Reef**: Mass of limestone formed by marine organisms in tropical or subtropical areas. Coelenterate coral animals are usually the most important reef formers, but coralline algae (simple plants) can also be important.
Refugium, refugia: An area that has remained unchanged while surrounding areas have changed markedly. A refugium serves as a refuge for species requiring specific habitats.

Relict: A remaining species of a group that was once widespread or diverse.

Reptile: Member of the class Reptilia in the subphylum Vertebrata. Lung-breathing animals without diaphragms, having skin covered with horny scales. Includes turtles and tortoises, crocodiles, lizards, snakes, and formerly included dinosaurs. Only three marine turtles and the sea snake are native reptiles in Hawai‘i.

Reservoir: An artificial lake where water is collected and kept in quantity for human use.

Rift zone: A highly fractured belt on the flank of a volcano along which most eruptions take place.

Saline: General term for waters containing various dissolved salts. "Saline" is sometimes used for inland waters and "haline" for coastal waters where salts are roughly in the same proportion as in sea water. (See brackish.) The salinity of a pool can be expressed as xx parts per thousand (xx/o0).

Sampling error: Variation among samples taken from a population. For example, if a sample of five flies is taken from a population of 1,000, it is very likely that not all of the variation encompassed in the large group will be encompassed in the small. Thus, many samples of five (or larger) might have to be taken to get a good idea of what the large population is like.

Sand: The weathered remains of various materials. Calcareous (white) sand contains the remains of mollusks, coralline algae, reef-building corals, echinoderms, and other animals. Olivine (green) sand is the weathered remains of basaltic ash. Black sand is the remains of basaltic lava.

Seabird: Species of bird whose normal habitat and food source is the sea, whether coastal, offshore, or pelagic (at sea).

Seamount: Undersea volcano.

Secondary sexual characteristic: External feature of a sexually mature individual which, although not directly involved in the mating act, is significantly involved in reproductive behavior and peculiar to a sex. Development of these features is controlled by sex hormones (androgens or estrogens). Examples are deer antlers (males), human facial hair (males), and human breasts (females).

Sedge: Grass-like monocotyledon plant in the family Cyperaceae.

Sedimentary rock: Rock formed when mineral matter settles out of water (or air) and is compressed and cemented together by precipitating minerals. Lithified dunes, sandstone, and emerged marine limestone (coral reef) sedimentary rocks are examples of types found in Hawai‘i; only on O‘ahu is this type of rock found in any large amount (for example, ‘Ewa Plain, Lualualei Valley).

Seed plants: Members of the plant division Spermatophyta, which reproduce by seeds. Includes trees, shrubs, grasses, and herbs. Flowering plants and coniferous plants and their allies are included.

Sewall Wright effect: Non-adaptive differentiation resulting from chance change in the relative frequency of two alleles (gene forms) in a population, followed by random fixation of one allele in a small isolated population.

Sexual selection: Means by which secondary sexual characteristics have evolved. Females choose to mate with males with best displays, or males
compete for females, or vice versa. The genes for characters and behaviors are thus inherited, emphasized and sometimes exaggerated with time. (See also natural selection, artificial selection, fitness, evolution, speciation.)

Shorebird: Bird of the suborder Charadrii, including plovers, stilts, sandpipers, curlews, turnstones, and related birds.

Shoreline management area (SMA): Legal term perminine lands extending not less than one hundred yards inland from the shoreline, including undeveloped lands surrounding bodies of surface water subject to tidal influence and the waters themselves. Designation beyond this is left to the discretion of each county.

Silversword alliance: Twenty-eight species of closely related (mostly interfertile) plants in three endemic genera (Argyroxyphium, Dubautia, and Wilkesia), probably descended from a single colonization of North American tarweeds (see founding effect). An excellent example of adaptive radiation in Hawai'i.

Silviculture: The science and art of cultivating forest crops for economic purposes. In Hawai'i, the term is usually applied to artificial forests or alien trees rather than native forests or native trees.

Social insects: Insects that cooperate in care of the young, have reproductive division of labor (some non-breeding members which perform other functions), and whose offspring assist parents at some stage in the life cycle. Includes ants, termites, and more organized bees and wasps.

Speciation: The development of one or more species from an existing species. Divergence from the parent population often becomes so great that interbreeding between populations cannot physically, behaviorally, or geographically occur.

Species: Basic category for classifying living things. A group of similar individuals that can usually breed among themselves and produce fertile offspring. Similar or related species are grouped into a genus. (See natural classification, speciation.)

Specific gravity: The ratio of the density of a substance to the density of another substance (often pure water) taken as a standard, when both substances are weighed in air.

Strand: Land bordering a body of water. Strand vegetation in Hawai'i is that growing near the ocean.

Stratigraphy: Geology of the origin, composition, and distribution of strata (sheetlike layers of sedimentary rock deposited over time). (See sedimentary rock.)

Subtropical: Regions bordering on the Tropics zone.

Succession: The sequence of communities that develops in an area from initial colonization until a stable mature community is achieved. Succession is influenced by climate, changes caused by colonizing organisms, initial substrate, size of the area, availability of species at different stages, and so forth. Primary succession is the gradual transformation of bare rock or another sterile substrate into a soil which supports a living ecological community. Secondary succession is a series of changes in community composition after disturbance, involving gradual and regular replacement of species and returning to the "climax" or steady state. (See climax community.)

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Sustained yield: Achievement and maintenance for the long term of regular production of a renewable resource (such as timber, pigs, or pheasants).
A balance between increment or production and killing or harvesting of animals or plants. In Hawai‘i, sustained yield management of alien animals (especially ungulates) in natural areas cannot be accomplished without damage to the ecosystems in which they occur. The aliens did not evolve with the ecosystems and their presence results in sustained disturbance to them.

Swamp: Wetland characterized by woody plants (trees and/or shrubs).

Systematics: The study of the diversity of organisms and their natural relationships. Sometimes a synonym for “taxonomy.” The term “biosystematics” describes the experimental study of diversity, especially at the species level, through breeding experiments, biochemical work, and cytological (cellular) comparisons.

Talus: Accumulation of rock debris at the base of a cliff. A talus slope is one formed from rock debris.

Taxon, taxa: Any group of individual organisms recognized as a formal unit (such as species, subspecies, family) and genetically related to a common ancestor.

Taxonomic key: An arrangement of important characteristics of plants or animals that is designed to facilitate identification and to allow separation of one similar form from another. Important characteristics are usually arranged in a dichotomous (paired) and hierarchical (inclusive) sequence so that one member of a pair and subsequent choices dependent upon it are eliminated with each choice.

Taxonomy: The study of the theory, practice, and rules of classification of living and extinct organisms. Modern taxonomy relies on evidence from a number of fields to name, describe, and classify organisms. (See natural classification, systematics.)

Temperature inversion layer: Warm, dry stratum or layer caused by large-scale subsidence of an extensive air mass and heating of the descending air by compression. The result is termed an inversion because warm air overlies cool air, whereas normally, air is cooler with increasing altitude. Precipitation below the inversion layer results because the cooler air below holds less moisture than the warmer air aloft.

Tertiary: The older of the two geologic periods in the Cenozoic era, which began about 65 million years ago, after the Cretaceous period, and extended to the beginning of the Quaternary period about 2 million years ago. The Tertiary was characterized by the rise of mammals and development of flowering plants.

Thermal stratification: Occurrence of different zones of increasing or decreasing temperature with altitude or depth. Lakes often exhibit thermal stratification.

Threatened: A species, subspecies, or population likely to become Endangered throughout all or a significant part of its range, and (if capitalized herein) recognized as such by the U.S. Government.

Trade wind: A wind blowing almost continuously in one direction, especially one blowing toward the equator from the northeast, north of the equator, and from the southeast south of the equator.

Transported landscapes: Areas modified by immigrant people in such a way that they resemble the land from which they came. Physical, biological, and cultural changes are included.

Trophic level: The position that an organism occupies in a food chain. For example, green plants are primary producers because they obtain energy
directly from sunlight. **Primary and secondary consumers** and *decomposers* are other examples of trophic levels.

**Tropics, tropical:** That portion of the globe between the Tropics of Cancer and Capricorn, 23.5° N and 23.5° S of the equator. Hawai‘i, at a general latitude of 20°, is the only U.S. State in the Tropics, although Puerto Rico and the Pacific Trust Territory are also tropical.

**Tuff cone:** Consolidated volcanic ash in the shape of a cone.

**Type:** The actual specimen used for naming and describing a species or subspecific taxon. Also, a taxon representative of a larger group. For example, the *genus Solanum* (*potato*) is the type genus of the larger group (family) Solanaceae. (See **voucher specimen**.)

**Understory:** Trees and other woody plants growing beneath upper layers of larger woody growth. (See **canopy**.)

**Ungulate:** A mammal with hoofed feet. Examples are pigs, goats, cattle, deer, horses. Native Hawaiian plants were not exposed to ungulates during their evolution and lack thorns, chemicals, protective growth habits, and other defenses against them, as a rule.

**Vascular plant:** A plant with organized tissue for conduction of nutrients, water, and other substances to different parts of the plant. Includes seed plants and fern-like plants, but not *algae*, *fungi*, or *lichens*.

**Vector:** An organism, usually an *insect*, which passively transmits disease-causing microorganisms from one animal or plant to another or from animal to human.

**Vertebrate:** Member of the subphylum Vertebrata (phylum Chordata). Animals with backbones, including *fishes*, *amphibians*, *reptiles*, *birds*, and *mammals*.

**Virus:** A particle too small to be filtered or to be seen by a light microscope but one that can reproduce within a living cell. Outside its host cell, a virus is inert. Viruses have cores of *DNA* and a protein coat. Viruses are parasites of animals, plants, and some *bacteria*. Viral diseases include *rabies*, the *common cold*, avian *pox*, and *herpes*.

**Voucher specimen:** Plant or animal collected and preserved in herbarium or museum, with information as to date of collection, location, collector, and so forth. Purpose of specimen is to allow anyone to verify taxon referred to in a study, anytime in the future.

**Waterbird:** Swimming or wading bird. Includes *waterfowl*, rails, herons, shorebirds, and so forth.

**Waterfowl:** Swimming birds such as ducks, geese, and swans. Also sometimes includes gallinules and coots (rail-like birds).

**Watershed:** An entire region drained by a waterway or which contributes water to the flow.

**Wetland:** Transition zone between terrestrial and aquatic ecosystems, characteristically saturated with or covered by water, at least periodically. Soil development and plant and animal communities are determined by the influence of water.

**Wilderness:** Undeveloped natural area retaining primeval character and influence without permanent improvements or human habitations. Protected and managed to preserve natural conditions. Usually at least 5,000 acres or of practical size for use in unimpaired condition.

**Zoning:** Demarcation of a planning area by ordinance into zones, and establishment of regulations to govern use of the land.
General Sources for Definitions


1Often adapted by the editors.