

APPENDIX A

ANSWERS TO REVIEW QUESTIONS

Chapter 1 Principles of Pest Management

- (1) Many factors—such as crop value, pest biology, degree of damage, and possible effects on the environment—must be considered and prioritized before choosing a control strategy.
- (2) C (3) B
- (4) Collect a sample of the pest and look at it under magnification. Check it against a book with pictures and descriptions. If still uncertain, submit the sample to MSU for identification.
- (5) The threshold level is the point at which the pest or its damage becomes unacceptable.
- (6) When the value of the crop is less than the cost of the control procedure.
- (7) Pesticides kill beneficial organisms as well as pests.
- (8) D (9) B (10) A (11) True
- (12) False. Biological control organisms are also sensitive to pesticides.
- (13) D
- (14) To determine if the strategies were effective.
- (15) D (16) D
- (17) Observations about where pests first showed up, what kinds of natural enemies were observed, where and when specific treatments were applied, and what the results were.
- (18) True

Chapter 2 Minimizing Pesticide Impact

- (1) D (2) D (3) True (4) A
- (5) False. FIFRA regulates the registration, distribution, sale, and use of all pesticides.
- (6) B (7) True (8) D (9) A
- (10) False. Point source pollution is easier to trace back because it is from a specific site; non-point source pollution is from a generalized area or weather event.
- (11) False. Keeping pesticides from polluting groundwater is easier than cleaning up polluted water.
- (12) False. Pesticide use may be part of an IPM program. IPM allows minimization of the use of pesticides.
- (13) True
- (14) B (15) A (16) B (17) C (18) C (19) True
- (20) A (21) True (22) B

- (23) False. Resistance management practices can be used to prevent, delay, or reverse the development of resistance.
- (24) A
- (25) To avoid creating situations of conflict and confrontation with those who may be near or affected by a pesticide application.
- (26) D

Chapter 3 Application Methods and Equipment

- (1) D
- (2) Nature and habits of the target pest, the site, the pesticide, available equipment, cost, efficiency.
- (3) C (4) A (5) A (6) True (7) D (8) C
- (9) False. You must choose a pump made of materials resistant to corrosion by pesticides.
- (10) A
- (11) False. A mechanical agitator consists of a shaft with paddles located near the bottom of the tank. Hydraulic agitators discharge the spray mixture at a high velocity in the tank.
- (12) B (13) B (14) C
- (15) False. Strainers need to be checked for clogs and rinsed frequently.
- (16) A
- (17) It controls pressure, thereby protecting pump seals, hoses, and other sprayer parts, and it bypasses the excess spray back into the tank.
- (18) C (19) True
- (20) False. Low-pressure sprayers often use roller-type pumps on small tanks or centrifugal pumps on large tanks. High-pressure sprayers have piston pumps that can deliver up to 50 gallons of spray per minute.
- (21) B (22) D (23) A (24) C
- (25) False. Tree injectors treat only one tree at a time.
- (26) True
- (27) 1. Check for leaks and see if all parts are working properly by filling the tank with water and pressurizing the system; 2. calibrate the sprayer.
- (28) False. When making emergency repairs or adjustments in the field, wear all protective clothing listed on the label as well as chemical-proof gloves.
- (29) C (30) B

Chapter 4 Calibration

- (1) Because each spraying system is a unique combination of components.
- (2) True (3) B (4) C (5) C (6) B (7) D
- (8) A (9) C (10) B (11) A (12) A (13) D
- (14) D (15) B (16) D (17) C (18) A (19) C
- (20) B (21) A (22) B (23) D (24) A (25) D
- (26) C (27) A
- (28) False. The range should be between 9.12 and 10.08. Twelve ounces is greater than a 5 percent difference.
- (29) False. Drop-through spreaders are more precise (less chance for pesticide to be distributed beyond the target boundaries).

Chapter 5 Forest Types in Michigan

- (1) True (2) C (3) D
- (4) False. It is rarely economically feasible or environmentally favorable to apply pesticides to large acreages of forestland.
- (5) A (6) D (7) C
- (8) False. *Hypoxylon* canker is found in aspen-birch forests.
- (9) A (10) D (11) B (12) B (13) A
- (14) False. There are a number of pest problems in oak-hickory forests that occur periodically (perhaps every 15 to 20 years) that have caused localized areas of mortality throughout the state.
- (15) A (16) A (17) D (18) B (19) B

Chapter 6 Disease Management

- (1) C (2) B (3) True (4) A (5) A
- (6) False. Chemical control measures must be applied to the plant when infection is most likely to occur.
- (7) The most important principle in forest protection is that preventing attack by an insect or disease pest and/or preventing further development of the pest problem is far more effective than attempts to stop the damage after it is underway.
General methods of silvicultural control may include:
 - Decay reduction through rotation.
 - Fire prevention and care when logging.
 - Reduction of disease through timber stand improvement operations and the use of partial cutting methods.
 - Use of prescribed burning.
 - Maintenance of high stand densities where applicable.
 - Salvage to reduce losses.

- (8) False. Vigorous early growth is no assurance of satisfactory long-term development. The impact of disease will become increasingly important as more planting is done and as plantations become older. The critical period for most stands is from about 20 to 40 years of age, the period when the stands make the greatest demands on the site.
- (9) A (10) B (11) C (9) C (12) B (13) B
- (14) D (15) A (16) True (17) D
- (18) D (19) C
- (20) Diagnostic symptoms include wilting, yellowing, and then browning of leaves, and drying up of foliage on affected portions of the crown. Diseased branches develop brown streaking in the wood that is evident when the bark is peeled back. Vectors breed only in weakened, dying, or dead elms with tight bark.
- (21) B (22) True (23) D
- (24) False. *Scleroderris* canker is easily controlled with fungicide sprays in nurseries.
- (25) B (26) A (27) D
- (28) On pine: swollen branches and/or main stem; spindle-shaped cankers eventually form; resin flows from bark cracks on the canker and hardens in masses. Girdled branches will have brown and drooping dead needles called flags. In May and June, blisters filled with yellow-orange spores appear on the cankered areas of the pines.
On alternate host: spots on the underside of the leaf; orange masses form on the leaf spots in early summer, followed by brownish, hairlike projections that produce spores to infect pines in the fall.
- (29) D (30) D (31) A (32) C (33) D (34) A
- (35) B (36) D (37) B (38) C
- (39) A (40) B
- (41) Use integrated control strategies.
Limit the use of pesticides as much as possible.
Rotate different brands and classes of fungicides.

Chapter 7 Insect Management

- (1) Proper decisions can be made after trees have been monitored for the level of pest activity, injury potential has been evaluated, and a cost-benefit analysis has been made.
- (2) A (3) True
- (4) Any one of the following:
Insectivorous vertebrates such as rodents, skunks, and birds.
Predaceous insects such as ladybird beetles, ground beetles, ants, and lacewings.
Parasitic wasps and flies.
Insect diseases caused by microorganisms such as viruses, bacteria, and fungi.

- (5) Any one of the following:
 Climatic factors, including heat, cold, and too much or too little moisture.
 Topographic barriers such as mountain ranges and bodies of water.
 Soil conditions, such as compaction, physical makeup, and moisture content.
 Disturbances such as wildfire, prescribed fire, thinning, or harvesting.
- (6) A (7) D (8) C (9) E (10) A (11) B
 (12) C (13) D (14) D
 (15) F (16) D (17) C (18) F (19) B (20) A
 (21) E (22) D (23) E (24) D (25) C (26) C
 (27) B (28) C (29) D
- (30) False. The European elm bark beetle is a more important vector of Dutch elm disease because of its breeding dominance over the native beetle.
- (31) E (32) D (33) B (34) G (35) A (36) C
 (37) F (38) D (39) B
 (40) A (41) C (42) C (43) B (44) A (45) A
- (46) Management of seed and cone insects may include cultural strategies and insecticides. Prescribed fire can be used to control insects that overwinter in the litter. Insects that overwinter in cones can be controlled by removing or destroying cones on the trees and on the ground. In some high-value seed orchards, registered insecticides may be applied at regular intervals to protect seed trees from a complex of seed and cone insects.
- (47) Cross-resistance occurs when an insect population that has developed resistance to a certain pesticide also develops resistance to other related or unrelated pesticide compounds to which it has never been exposed.
- (3) A (4) B (5) C (6) A (7) B
 (8) False. Mechanical control is not suited to all sites. The major obstacles to the use of mechanical vegetation management are unsuitable terrain, the likelihood of soil erosion, and relatively high operating costs.
 (9) C (10) True (11) D
 (12) Evaluation of vegetation management is ongoing to allow for adjustments in rates, products, and timing of herbicide applications, and to plan any additional control measures that may be needed.
 (13) Any four or five of the following:
 Increasing survival, nutrition, and growth of newly planted trees by eliminating competition.
 Reducing rodent damage.
 Developing better quality foliage on the lower part of the tree by eliminating the shading effect of weed growth.
 Permitting easier and higher quality shearing.
 Reducing the probability of foliage diseases.
- (14) C (15) B (16) D (17) A
 (18) Application rate, soil texture (particularly clay content), soil organic matter content, soil moisture level, and herbicide solubility.
 (19) A (20) True (21) True
 (22) A. Application rate—the amount of herbicide required per acre to obtain effective control. Too little will result in lack of control; too much will result in environmental or plant damage.
 B. Equipment calibration—equipment must be properly calibrated to ensure the proper application rate.
 C. Application method—must be considered to ensure uniform coverage.
 D. Targeted vegetation—because of differences in anatomy and physiology, some plants are more affected by herbicides than others.
 E. Soil-site characteristics—soils with high clay or organic matter contents require a heavier application rate of residual herbicide than coarse-textured sands or gravelly soils.
 F. Weather conditions—cool and cloudy weather following application of foliar herbicides will reduce their effectiveness. Lack of rain following soil-application of herbicides may allow weeds to grow and germinate before the herbicide moves into the soil solution. Heavy rain, however, may leach the herbicide from the upper soil or wash it to low-lying areas. In both cases the herbicide is less effective and may damage non-target plants.
- (23) False. Annual weeds and grasses are easily controlled with preemergent products; perennial grasses and weeds, particularly those with deep root systems, are more difficult to control chemically.

Chapter 8 Weed Management

- (1) To manage timber species, ground vegetation, and wildlife so that each component is maximized yet balanced.
- (2) Any five of the following:
 Removing unwanted vegetation from planting sites to favor the planted trees.
 Releasing more desirable species from less desirable overtopping species.
 Thinning excess plants from a stand.
 Preventing disease movement through root grafts.
 Preventing invasion of herbaceous and/or woody vegetation into recreational areas and wildlife openings.
 Controlling vegetation along forest roads and around buildings and facilities.
 Eliminating poisonous plants from recreational areas.
 Controlling production-limiting weeds in a seed orchard or tree nursery.

- (24) True
- (25) False. Triazine-resistant common lamb's-quarters has been confirmed in sites throughout most of the corn-producing regions of Michigan.
- (26) 1) Scout regularly and identify weeds present.
 2) Combine mechanical control practices such as cultivation with herbicide treatments.
 3) Rotate herbicides using herbicides with differing modes of action. Do not make more than two consecutive applications of herbicides with the same mode of action against the same weed unless other effective control practices are also included in the management system.
 4) Apply herbicides in tank-mixed, prepackaged, or sequential mixtures that include multiple modes of action. Combining herbicides with different modes of action and similar persistence in soil will help prevent herbicide resistance.

Chapter 9 Vertebrate Pests

- (1) C (2) B (3) B (4) D (5) A (6) E (7) C
 (8) A (9) C (10) D (11) D (12) C
- (13) Any one of the following:
 Physical barriers to individual trees such as sheet metal, wire mesh, or plastic around the trunk.
 Area barriers: permanent 8-foot-high woven wire fences or 7- or 8-wire high tensile strength steel electric fences are examples of area barriers.
- (14) Any one of the following:
 Increasing the size of irregularly shaped clearcuts to produce more seedlings than a deer herd can consume.
 Growing species or varieties of trees less palatable to wild animals.
 Eliminating vole habitat in nurseries and plantations.
- (15) Dogs (preferably two males) are confined to a tree area by electric shock collars and a perimeter antenna wire. The dogs must be housed, watered, and fed within the perimeter wire and must be trained not to cross the wire.
- (16) Modify the dam to permanently reduce or eliminate the beaver pond by properly using and installing perforated plastic pipe.
- (17) B (18) True (19) True
- (20) A change in the numbers of one animal could produce changes in numbers or behavior of another animal so that one problem is traded for another. For example, shrews may damage a seed or seedling bed, but choosing a control strategy that eliminates shrews may result in an increase in their prey—mice and voles—which can be far more destructive.

Chapter 10 Laws and Regulations

- (1) Exotic pests can cause severe damage to forests where there are no natural enemies to keep them in check. They may also displace native insect species.
- (2) False. It is unlikely that all exotic pests will be intercepted, given the volume of international trade that occurs.
- (3) A regulatory pest is a plant-feeding exotic insect that has become established in a particular state or region so that management of the pest is subject to certain federal or state regulations. Gypsy moth and pine shoot beetle are two important regulatory pests that affect Christmas tree production.
- (4) A (5) C (6) C (7) A
- (8) 1. Use the pesticide with the least impact on beneficial insects.
 2. Use the regulatory spray for more than one purpose.
 3. Use good cultural practices.
- (9) Cultural practices such as destruction of brood material and use of trap logs to reduce beetle populations within a field are included in the program. These practices are effective and are less harmful to most beneficial insects than repeated sprays of broad-spectrum insecticide throughout the summer.
- (10) C
- (11) False. The WPS requirements apply to those who apply pesticides or who work in pesticide-treated areas of agricultural establishments—on farms and in forests, nurseries, and greenhouses. These include Christmas tree operations, wood fiber and timber products operations, tree nurseries, and seed orchards.
- (12) B
- (13) False. These workers are defined as pesticide handlers, according to the WPS.
- (14) 1. Pesticide safety training—for workers and handlers. Michigan pesticide applicator certification credentials satisfy the requirement for both worker and handler training.
 2. Pesticide safety poster—to be displayed for workers and handlers.
 3. Access to labeling information—for pesticide handlers and early-entry workers.
 4. Access to specific information—a centrally located application list of pesticide treatments on the establishment.
- (15) A
- (16) Decontamination sites—providing handlers and workers an ample supply of water, soap, and towels for routine washing and emergency decontamination, and a change of clothing for handlers.
 Emergency assistance—making transportation available to a medical care facility if an agricultural worker or handler may have been poisoned or injured by a pesticide, and providing information about pesticide(s) to which the person may have been exposed.

APPENDIX B

GLOSSARY

Glossary of Terms for Forest Pest Management

ABSORPTION—The movement of a chemical into plants, animals (including humans), and/or microorganisms.

ACARICIDE—A pesticide used to control mites and ticks. A miticide is an acaricide.

ACTIVE INGREDIENT—The chemical or chemicals in a pesticide responsible for killing, poisoning, or repelling the pest. Listed separately in the ingredient statement.

ACUTE TOXICITY—The capacity of a pesticide to cause injury within 24 hours following exposure. LD₅₀ and LC₅₀ are common indicators of the degree of acute toxicity. (See also *chronic toxicity*.)

ADJUVANT—A substance added to a pesticide to improve its effectiveness or safety. Same as additive. Examples: penetrants, spreader-stickers, and wetting agents.

ADSORPTION—The process by which chemicals are held or bound to a surface by physical or chemical attraction. Clay and high organic soils tend to adsorb pesticides.

AGGREGATION PHEROMONE—See *pheromone*.

AEROSOL—A material stored in a container under pressure. Fine droplets are produced when the material dissolved in a liquid carrier is released into the air from the pressurized container.

ANTI-SIPHONING DEVICE—A device attached to the filling hose that prevents backflow or back-siphoning from a spray tank into a water source.

ANTICOAGULANT—A chemical that prevents normal blood clotting—the active ingredient in some rodenticides.

ANTIDOTE—A treatment used to counteract the effects of pesticide poisoning or some other poison in the body.

AQUIFER—A natural water-bearing stratum of permeable rock, sand, or gravel in which groundwater is stored.

ARACHNID—A wingless arthropod with two body regions and four pairs of jointed legs. Spiders, ticks, and mites are in the class Arachnida.

ARTHROPOD—An invertebrate animal characterized by a jointed body and limbs and usually a hard body covering that is molted at intervals. For example, insects, mites, and crayfish are in the phylum Arthropoda.

ATTRACTANT—A substance or device that will lure pests to a trap or poison bait.

AVICIDE—A pesticide used to kill or repel birds. Birds are in the class Aves.

BACTERIA—Microscopic organisms, some of which are capable of producing diseases in plants and animals. Others are beneficial.

BACTERICIDE—Chemical used to control bacteria.

BAIT—A food or other substance used to attract a pest to a pesticide or to a trap.

BAND APPLICATION—The application of a pesticide in a strip or band of a certain width, usually done in row crops.

BROADCAST APPLICATION—The uniform application of a pesticide to an entire area.

BENEFICIAL INSECT—An insect that is useful or helpful to humans; usually insect parasites, predators, pollinators, etc.

BIOLOGICAL CONTROL—Control of pests using predators, parasites, and disease-causing organisms. May be naturally occurring or introduced.

BIOMAGNIFICATION—The process whereby one organism accumulates chemical residues in higher concentrations from organisms it consumes.

BOTANICAL PESTICIDE—A pesticide produced from chemicals found in plants. Examples are nicotine, pyrethrins, and strychnine.

BRAND NAME—The name or designation of a specific pesticide product or device made by a manufacturer or formulator; a marketing name.

CALIBRATE, CALIBRATION OF EQUIPMENT—The measurement of dispersal or output and adjustments made to control the rate of dispersal of pesticides.

CARBAMATES (N-methyl carbamates)—A group of pesticides containing nitrogen, formulated as insecticides, fungicides, and herbicides. The N-methyl carbamates are insecticides and inhibit *cholinesterase* in animals.

CARCINOGENIC—The ability of a substance or agent to induce malignant tumors (cancer).

CARRIER—An inert liquid, solid, or gas added to an active ingredient to make a pesticide dispense effectively. A carrier is also the material, usually water or oil, used to dilute the formulated product for application.

CERTIFIED APPLICATORS—Individuals who are certified to use or supervise the use of any restricted-use pesticide covered by their certification.

CHEMICAL NAME—The scientific name of the active ingredient(s) found in the formulated product. This complex name is derived from the chemical structure of the active ingredient.

CHEMICAL CONTROL—Pesticide application to kill pests.

CHEMOSTERILANT—A chemical compound capable of preventing animal reproduction.

CHEMTREC—The Chemical Transportation Emergency Center has a toll-free number (800-424-9300) that provides 24-hour information for chemical emergencies such as a spill, leak, fire, or accident.

CHLORINATED HYDROCARBON—A pesticide containing chlorine, carbon, and hydrogen. Many are persistent in the environment. Examples: chlordane, DDT, methoxychlor.

CHOLINESTERASE, ACETYLCHOLINESTERASE—An enzyme in animals that helps regulate nerve impulses. This enzyme is depressed by N-methyl carbamate and organophosphate pesticides.

CHRONIC TOXICITY—The ability of a material to cause injury or illness (beyond 24 hours following exposure) from repeated, prolonged exposure to small amounts. (See also *acute toxicity*.)

COMMON NAME—A name given to a pesticide's active ingredient by a recognized committee on pesticide nomenclature. Many pesticides are known by a number of trade or brand names, but each active ingredient has only one recognized common name.

COMMUNITY—The various populations of animal species (or plants) that exist together in an ecosystem. (See also *population* and *ecosystem*.)

CONCENTRATION—Refers to the amount of active ingredient in a given volume or weight of formulated product.

CONTACT PESTICIDE—A compound that causes death or injury to insects when it contacts them. It does not have to be ingested. Often used in reference to a spray applied directly on a pest.

CONTAMINATION—The presence of an unwanted substance (sometimes pesticides) in or on plants, animals, soil, water, air, or structures.

CULTURAL CONTROL—A pest control method that involves manipulating the environment to make it more favorable for the plant and less favorable for the pest, such as good site selection, planting resistant varieties, and selective pruning.

CROSS-RESISTANCE—Cross-resistance occurs when pest populations that have become resistant to one pesticide also become resistant to other chemically related pesticides. (See also *resistance*.)

DECONTAMINATE—To remove or break down a pesticidal chemical from a surface or substance.

DEGRADATION—The process by which a chemical compound or pesticide is reduced to simpler compounds by the action of microorganisms, water, air, sunlight, or other agents. Degradation products are usually but not always less toxic than the original compound.

DEPOSIT—The amount of pesticide on treated surfaces after application.

DERMAL TOXICITY—The ability of a pesticide to cause acute illness or injury to a human or animal when absorbed through the skin. (See *exposure route*.)

DESICCANT—A type of pesticide that draws moisture or fluids from a pest, causing it to die. Certain desiccant dusts destroy the waxy outer coating that holds moisture within an insect's body.

DETOXIFY—To render a pesticide's active ingredient or other poisonous chemical harmless.

DIAGNOSIS—The positive identification of a problem and its cause.

DILUENT—Any liquid, gas, or solid material used to dilute or weaken a concentrated pesticide.

DOSE, DOSAGE—Quantity, amount, or rate of pesticide applied to a given area or target.

DRIFT—The airborne movement of a pesticide spray or dust beyond the intended target area.

DRIFT MANAGEMENT PLAN—A written plan required of commercial and private applicators by Michigan Regulation 637 whenever there is a chance of a spray application drifting from the target onto non-target and off-site sensitive areas.

DUST—A finely ground, dry pesticide formulation containing a small amount of active ingredient and a large amount of inert carrier or diluent such as clay or talc.

ECOSYSTEM—A system made up of *communities* of plants, animals and microorganisms and their interrelated physical environments. It includes both the organic and inorganic aspects involved in the cyclic processes of life. An ecosystem includes communities (of *populations*) with the necessary physical (habitat, moisture, temperature) and biotic (food, hosts) supporting factors.

EMULSIFIABLE CONCENTRATE—A pesticide formulation produced by mixing or suspending the active ingredient (the concentrate) and an emulsifying agent in a suitable carrier. Adding it to water forms a milky emulsion.

EMULSIFYING AGENT (EMULSIFIER)—A chemical that aids in the suspension of one liquid in another that normally would not mix together.

EMULSION—A mixture of two liquids that are not soluble in each other. One is suspended as very small droplets in the other with the aid of an emulsifying agent.

ENCAPSULATED FORMULATION—A pesticide formulation with the active ingredient enclosed in capsules of polyvinyl or other materials; principally used for slow release.

ENDANGERED SPECIES—A plant or animal species whose population is reduced to the extent that it is near extinction and that a federal agency has designated as being in danger of becoming extinct.

ENTRY INTERVAL—See *reentry interval*.

ENVIRONMENT—All of our physical, chemical, and biological surroundings, such as climate, soil, water, and air, and all species of plants, animals, and microorganisms.

ENVIRONMENTAL PROTECTION AGENCY OR EPA—The federal agency responsible for ensuring the protection of humans and the environment from potentially adverse effects of pesticides.

EPA ESTABLISHMENT NUMBER—A number assigned to each pesticide production plant by the EPA. The number indicates the plant at which the pesticide product was produced and must appear on all labels of that product.

EPA REGISTRATION NUMBER—An identification number assigned to a pesticide product when the product is registered by the EPA for use. The number must appear on all labels for a particular product.

ERADICATION—The complete elimination of a (pest) population from a designated area.

EXOSKELETON—The external hardened covering or skeleton of an insect to which muscles are attached internally; periodically shed.

EXPOSURE ROUTE OR COMMON EXPOSURE ROUTE—The manner—dermal, oral, or inhalation/respiratory—by which a pesticide may enter an organism.

FIFRA—The Federal Insecticide, Fungicide, and Rodenticide Act—the federal law and its amendments that control pesticide registration and use.

FLASHBACK—When a herbicide injected directly into a tree moves through root grafts to other untreated adjacent trees and kills them.

FLOWABLE—A pesticide formulation in which very finely ground solid particles are suspended (not dissolved) in a liquid carrier.

FOG TREATMENT—A fine mist of pesticide in aerosolized droplets (under 40 microns). Not a mist or gas. After propulsion, fog droplets fall to horizontal surfaces.

FOREST TYPE—One or more tree species growing together because of similar environmental requirements and tolerance to light (examples: maple-beech, aspen-birch, oak-hickory, elm-ash-soft maple, and pine).

FORMULATION—The pesticide product as purchased, containing a mixture of one or more active ingredients, carriers (inert ingredients), and other additives making it easy to store, dilute, and apply.

FRASS—Solid larval insect excrement; mixed with wood fragments in wood-boring and bark-boring insects.

FUMIGANT—A pesticide formulation that volatilizes, forming a toxic vapor or gas that kills in the gaseous state. Usually, it penetrates voids to kill pests.

FUNGICIDE—A chemical used to control fungi.

FUNGUS (plural, fungi)—A group of small, often microscopic, organisms in the plant kingdom that cause rot, mold, and disease. Fungi need moisture or a damp environment (wood rots require at least 19 percent moisture). Fungi are extremely important in the diet of many insects.

GALL—A swelling or outgrowth of tissue induced by a pathogen or insect on a plant.

GENERAL-USE (UNCLASSIFIED) PESTICIDE—A pesticide that can be purchased and used by the general public. (See also *restricted-use pesticide*.)

GRANULE—A dry pesticide formulation. The active ingredient is either mixed with or coated onto an inert carrier to form a small, ready-to-use, low-concentrate particle that normally does not present a drift hazard. Pellets differ from granules only in their precise uniformity, larger size, and shape.

GROUNDWATER—Water sources located beneath the soil surface from which spring water, well water, etc., are obtained. (See also *surface water*.)

HAZARD—see *risk*.

HERBICIDE—A pesticide used to kill plants or inhibit plant growth.

HOST—Any animal or plant on or in which another lives for nourishment, development, or protection.

IGR, INSECT GROWTH REGULATOR JUVENOID—A pesticide constructed to mimic insect hormones that control molting and the development of some insect systems affecting the change from immature to adult. (See *juvenile hormone*.)

INERT INGREDIENT—In a pesticide formulation, an inactive material without pesticidal activity.

INGREDIENT STATEMENT—The portion of the label on a pesticide container that gives the name and amount of each active ingredient and the total amount of inert ingredients in the formulation.

INHALATION—Taking a substance in through the lungs; breathing in. (See *exposure route*.)

INSECT GROWTH REGULATOR—see *IGR*.

INSECTICIDE—A pesticide used to manage or prevent damage caused by insects. Sometimes generalized to be synonymous with pesticide.

INSECTS, INSECTA—A class in the phylum Arthropoda characterized by a body composed of three segments (head, *thorax*, and abdomen) and three pairs of legs.

INSPECTION—To examine for pests, pest damage, other pest evidence, etc. (See *monitoring*.)

INTEGRATED PEST MANAGEMENT (IPM)—A planned pest control program in which various methods are integrated and used to keep pests from causing economic, health-related, or aesthetic injury. IPM includes reducing pests to a tolerable level. Pesticide application is not the primary control method but is an element of IPM—as are cultural, mechanical, and biological methods. IPM

programs emphasize communication, monitoring, inspection, and evaluation (keeping and using records).

JUVENILE HORMONE—A hormone produced by an insect that inhibits change or molting. As long as juvenile hormone is present, the insect does not develop into an adult but remains immature.

LABEL—All printed material attached to or on a pesticide container.

LABELING—The pesticide product label and other accompanying materials that contain directions that pesticide users are legally required to follow.

LARVA (plural larvae)—An early developmental stage of insects with complete metamorphosis. Insects hatch out of the egg as larvae before becoming *pupae* (resting stage) and then adults.

LC₅₀—Lethal concentration. The concentration of a pesticide, usually in air or water, that kills 50 percent of a test population of animals. LC₅₀ is usually expressed in parts per million (ppm). The lower the LC₅₀ value, the more acutely toxic the chemical.

LD₅₀—Lethal dose. The dose or amount of a pesticide that can kill 50 percent of the test animals when eaten or absorbed through the skin. LD₅₀ is expressed in milligrams of chemical per kilogram of body weight of the test animal (mg/kg). The lower the LD₅₀, the more acutely toxic the pesticide.

LEACHING—The movement of a substance with water downward through soil.

MESOTHORAX—The second segment of an insect's *thorax*. One pair of legs and usually one pair of wings are attached.

METAMORPHOSIS—A change in the shape or form of an animal. Usually used when referring to insect development.

METATHORAX—The third segment of an insect's *thorax*. One pair of legs and often one pair of wings are attached.

MICROBIAL DEGRADATION—Breakdown of a chemical by microorganisms.

MICROBIAL PESTICIDE—Bacteria, viruses, fungi, and other microorganisms used to control pests. Also called biorationals.

MICROORGANISM—An organism so small it can be seen only with the aid of a microscope.

MITICIDE—A pesticide used to control mites. (See *acaricide*.)

MODE OF ACTION—The way in which a pesticide exerts a toxic effect on the target plant or animal.

MOLT—Periodic shedding of the outer layer (e.g., an insect's *exoskeleton* is shed periodically).

MONITORING—On-going surveillance. Monitoring includes inspection and record keeping. Record keeping during monitoring allows evaluation of pest population suppression, identification of pest infestations, prediction

of pest outbreaks from weather data, and management of the progress of the control program.

NECROSIS—Death of plant or animal tissues that results in the formation of discolored, sunken, or necrotic (dead) areas.

NON-POINT SOURCE POLLUTION—Pollution from a generalized area or weather event, such as land runoff, precipitation, acid rain, or percolation rather than from discharge at a single location. (See *point source pollution*.)

NON-RESIDUAL PESTICIDE—Pesticides applied to obtain effects only during the time of treatment.

NON-TARGET ORGANISM—Any plant or animal other than the intended target(s) of a pesticide application.

NYMPH—The developmental stage of insects with gradual metamorphosis that hatches from the egg. Nymphs become adults.

ORAL TOXICITY—The ability of a pesticide to cause injury or acute illness when taken by mouth, one of the common exposure routes.

ORGANOPHOSPHATES—A large group of pesticides that contain the element phosphorus and inhibit *cholinesterase* in animals.

PARASITE—A plant, animal, or microorganism living in, on, or with another living organism for the purpose of obtaining all or part of its food.

PARASITOID—An organism that lives during its development in or on the body of a single *host* organism, eventually killing it.

PATHOGEN—A disease-causing organism.

PERSONAL PROTECTIVE EQUIPMENT (PPE)—Devices and clothing intended to protect a person from exposure to pesticides. Includes such items as long-sleeved shirts, long trousers, coveralls, suitable hats, gloves, shoes, respirators, and other safety items as needed.

PEST—An undesirable organism (plant, animal, bacterium, etc.); any organism that competes with people for food, feed, or fiber, causes economic damage, is a public health concern, reduces aesthetic qualities, or impedes industrial or recreational activities.

PESTICIDE—A chemical or other agent used to kill, repel, or otherwise control pests or to protect from a pest.

pH—A measure of the acidity/alkalinity of a liquid—acid below pH 7; basic or alkaline above pH 7 (up to 14).

PHEROMONE—A substance emitted by an animal to influence the behavior of other animals of the same species. Examples are sex pheromones (to attract mates) and aggregation pheromones (to keep members of the same species together in a group). Some pheromones are synthetically produced for use in insect traps.

PHOTODEGRADATION—Breakdown of chemicals by the action of light.

PHYTOTOXICITY—Injury to plants caused by a chemical or other agent.

PLANT SUCCESSION—The replacement of one plant community by another.

POINT SOURCE POLLUTION—Pollution from a specific site that contaminates water. (See *non-point source pollution*.)

POISON CONTROL CENTER—A local agency, generally a hospital, that has current information on the proper first aid techniques and antidotes for poisoning emergencies. Centers are listed in telephone directories.

POPULATION—Individuals of the same species. The populations in an area make up a community. (See *ecosystem*.)

POSTEMERGENT HERBICIDE—Applied after weeds have emerged to kill them by contact with the foliage. (See *preemergent herbicide*.)

PRECIPITATE—A solid substance that forms in a liquid and settles to the bottom of a container; a material that no longer remains in suspension.

PREDATOR—An animal that attacks, kills, and feeds on other animals. Examples of predaceous animals are hawks, owls, snakes, many insects, etc.

PREEMERGENT HERBICIDE—Applied before emergence of weeds to kill them as they sprout. (See *postemergent herbicide*.)

PROPELLANT—The inert ingredient in pressurized products that forces the active ingredient from the container.

PROTHORAX—The first segment of an insect's *thorax*. One pair of legs is attached.

PUPA (plural: pupae)—The developmental (resting) stage of insects with complete metamorphosis where major changes from the larval to the adult form occur.

RATE OF APPLICATION—The amount of pesticide applied to a plant, animal, unit area, or surface; usually measured as per acre, per 1,000 square feet, per linear foot, or per cubic foot.

RECHARGE WATER—Water that seeps through the soil from rain, melting snow, or irrigation and adds to the amount of water in the ground.

REGULATORY PEST—Plant-feeding exotic insects that have become established in some states or regions and are, therefore, subject to regulatory controls.

REENTRY INTERVAL—The length of time following an application of a pesticide when entry into the treated area is restricted.

REGISTERED PESTICIDES—Pesticide products that have been registered by the Environmental Protection Agency for the uses listed on the label.

REPELLENT—A compound that keeps insects, rodents, birds, or other pests away from humans, plants, domestic animals, buildings, or other treated areas.

RESIDUAL PESTICIDE—A pesticide that continues to remain effective on a treated surface or area for an extended period following application.

RESIDUE—The pesticide active ingredient or its breakdown product(s) that remain in or on the target after treatment.

RESTRICTED-USE PESTICIDE—A pesticide that can be purchased and used only by certified applicators or persons under their direct supervision. A pesticide classified for restricted use under FIFRA, Section 3(d)(1)(C).

RESISTANCE—The inherited ability of a pest to tolerate the toxic effects of a particular pesticide.

RISK—A probability that a given pesticide will have an adverse effect on humans or the environment in a given situation.

RODENTICIDE—A pesticide used to control rodents.

RUNOFF—The movement of water and associated materials on the soil surface. Runoff usually proceeds to bodies of *surface water*.

SHADE-INTOLERANT—Tree species that require full sunlight to grow and survive (examples: aspen and jack pine). (See *tolerance*.)

SHADE-TOLERANT—Tree species that grow best under low-light conditions (examples: beech and hemlock). (See *tolerance*.)

SIGNAL WORDS—Required word(s) that appear on every pesticide label to denote the relative toxicity of the product. Signal words are DANGER-POISON, DANGER, WARNING, and CAUTION.

SITE—Areas of pest infestation. Each site should be treated specifically or individually.

SOIL INJECTION—The placement of a pesticide below the surface of the soil.

SOIL DRENCH—To soak or wet the ground surface with a pesticide. Large volumes of the pesticide mixture are usually needed to saturate the soil to any depth.

SOIL INCORPORATION—The mechanical mixing of a pesticide product with soil.

SOLUTION—A mixture of one or more substances in another substance (usually a liquid) in which all the ingredients are completely dissolved. Example: sugar in water.

SOLVENT—A liquid that will dissolve another substance (solid, liquid, or gas) to form a solution.

STOMACH POISON—A pesticide that must be eaten by an animal to be effective; it will not kill on contact.

SUPPLEMENTAL LABELING—Pesticide label information that appears on a separate piece of paper and contains information regarding the site, pest, rate, etc. Supplemental labeling may be supplied at the time of purchase or requested from the dealer.

SURFACE WATER—Water on the earth's surface: rivers, lakes, ponds, streams, etc. (See also *groundwater*.)

SUSPENSION—Pesticide mixtures consisting of fine particles dispersed or floating in a liquid, usually water or oil. Example: wettable powders in water.

TARGET—The plants, animals, areas, or pests at which the pesticide or other control method is directed.

TECHNICAL MATERIAL—The pesticide active ingredient in pure form as it is manufactured by a chemical company. It is combined with inert ingredients or additives in formulations such as wettable powders, dusts, emulsifiable concentrates, or granules.

THORAX—The middle part of an insect's body between the head and the abdomen. It is divided into three segments—the *prothorax*, *mesothorax*, and *metathorax*. A pair of legs is attached to each thoracic region.

THRESHOLD LEVEL—The level of pest density at which the pest or its damage becomes unacceptable and control measures are required.

TOLERANCE—The necessary amount of light cast onto the forest floor for tree species to germinate or sprout, grow, and thrive. Tree species range from *shade-intolerant* (e.g., aspen, jack pine) to *shade-tolerant* (e.g., beech and hemlock). Midtolerant species include many oaks and white pine.

TOXIC—Poisonous to living organisms.

TOXICANT—A poisonous substance such as the active ingredient in a pesticide formulation.

TOXICITY—The ability of a pesticide to cause harmful, acute, delayed, or allergic effects. The degree or extent to which a chemical or substance is poisonous.

USE—The performance of pesticide-related activities requiring certification include application, mixing, loading, transport, storage, or handling after the manufacturing seal is broken; care and maintenance of application and handling equipment; and disposal of pesticides and their containers in accordance with label requirements. Uses not needing certification are long-distance transport, long-term storage, and ultimate disposal.

VAPOR PRESSURE—The property that causes a chemical to evaporate. The higher the vapor pressure, the more volatile the chemical—the easier it will evaporate.

VECTOR—A carrier, an animal (e.g., insect, nematode, mite) that can carry and transmit a pathogen from one host to another.

VERTEBRATE—Animal characterized by a segmented backbone or spinal column.

VIRUS—Ultramicroscopic parasites composed of proteins. Viruses can multiply only in living tissues and cause many animal and plant diseases.

VOLATILITY—The degree to which a substance changes from a liquid or solid state to a gas at ordinary temperatures when exposed to air.

WATER TABLE—The upper level of the water-saturated zone in the ground.

WETTABLE POWDER—A dry pesticide formulation in powder form that forms a suspension when added to water.

For further definition of terms consult:

- Pesticide Applicator Core Training Manual, E-2195, Michigan State University Extension.
- The Federal Insecticide, Fungicide, and Rodenticide Act, as amended. Public Law 92-516, October 21, 1972, as amended by Public Law 94-140, November 28, 1975, and Public Law 95-396, September 30, 1978.
- Federal Register, November 7, 1990, Part II Environmental Protection Agency 40, CFR Part 171 Certification of Pesticide Applicator; Proposed Rule.
- Region V Office of the EPA, Chicago, Ill.
- Michigan Department of Agriculture State Plan for Commercial and Private Applicators.
- Federal Agency Secretary's Office (for federal employees using restricted pesticides in performance of official duties).
- Local, state, and national pest control associations.

APPENDIX C

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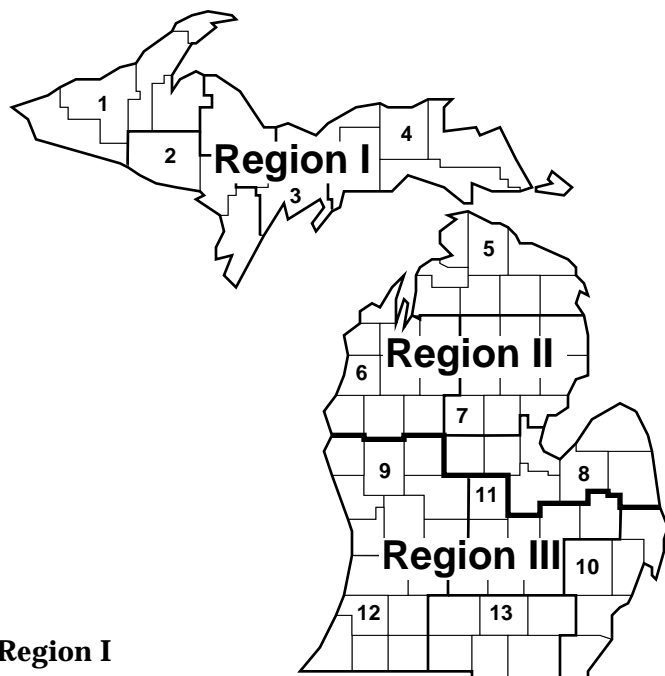
APPENDIX D

RESOURCES

For vertebrate pest control permits:

Permit Coordinator
DNR, Wildlife Division
Box 30444, Lansing, MI 48909-7944
517-373-1263

Or, contact a district wildlife or law enforcement supervisor at one of the district offices.



Region I

District 1:
North US-41
Box 440
Baraga, MI 49908
906-353-6651

District 2:
1420 Hwy. US-2 West
Crystal Falls, MI 49920
906-875-6622

District 3:
6833 Hwy. 2, 41 and M-35
Gladstone, MI 49837
906-786-2351

District 4:
Newberry Operations Service Center
Route 4, Box 796
Newberry, MI 49868
906-293-5131

Region II

District 5:
Box 667
1732 West M-32
Gaylord, MI 49735
517-732-3541

District 6:
8015 Mackinaw Trail
Cadillac, MI 49601
616-775-9727

District 7:
Box 939
191 S. Mt. Tom Road
Mio, MI 48647
517-826-3211

District 8:
503 North Euclid
Suite 1
Bay City, MI 48706
517-684-9141

Region III

District 9:
State Office Building
Sixth Floor
350 Ottawa Street, N.W.
Grand Rapids, MI 49503

District 10:
38980 Seven Mile Road
Livonia, MI 48152
313-953-0241

District 11:
10650 S. Bennett
Morrice, MI 49080
616-685-6851

District 13:
301 E. Louis Glick Hwy.
Jackson, MI 49201
517-780-7900

Web site for Material Safety Data Sheets:
<http://www.ilpi.com/msds/index.chtml>



PESTICIDE EMERGENCY INFORMATION

For any type of an emergency involving a pesticide, immediately contact the following emergency information centers for assistance.

Current as of August 2000



Human Pesticide Poisoning

M I C H I G A N P O I S O N C O N T R O L S Y S T E M

From anywhere in Michigan, call

1 - 8 0 0 - P O I S O N 1
1 - 8 0 0 - 7 6 4 - 7 6 6 1

Special Pesticide Emergencies

Animal Poisoning Your veterinarian:	Pesticide Fire Local fire department:	Traffic Accident Local police department or sheriff's department:	Environmental Pollution Pollution Emergency Alerting System (PEAS), Michigan Department of Environmental Quality:	Pesticide Disposal Information Michigan Department of Environmental Quality, Waste Management Division. Monday – Friday: 8 a.m.-5 p.m. (517) 373-2730
Phone No. _____ or Animal Health Diagnostic Laboratory (Toxicology) Michigan State University: (517) 355-0281	Phone No. _____ and Fire Marshal Division, Michigan State Police: M – F: 8-12, 1-5 (517) 322-1924	Phone No. _____ and Operations Division, Michigan State Police: (517) 336-6605	District MDEQ Office Phone No. _____ and For environmental emergencies: * 1-800-292-4706 also * 1-800-405-0101	
* Telephone Number Operated 24 Hours		Michigan Department of Agriculture Spill Response		

National Pesticide Telecommunications Network
Provides advice on recognizing and managing pesticide poisoning, toxicology, general pesticide information and emergency response assistance. Funded by EPA, based at Oregon State University
7 days a week; excluding holidays
6:30 a.m. – 4:30 p.m. Pacific Time Zone
1-800-858-7378
FAX: 1-541-737-0761