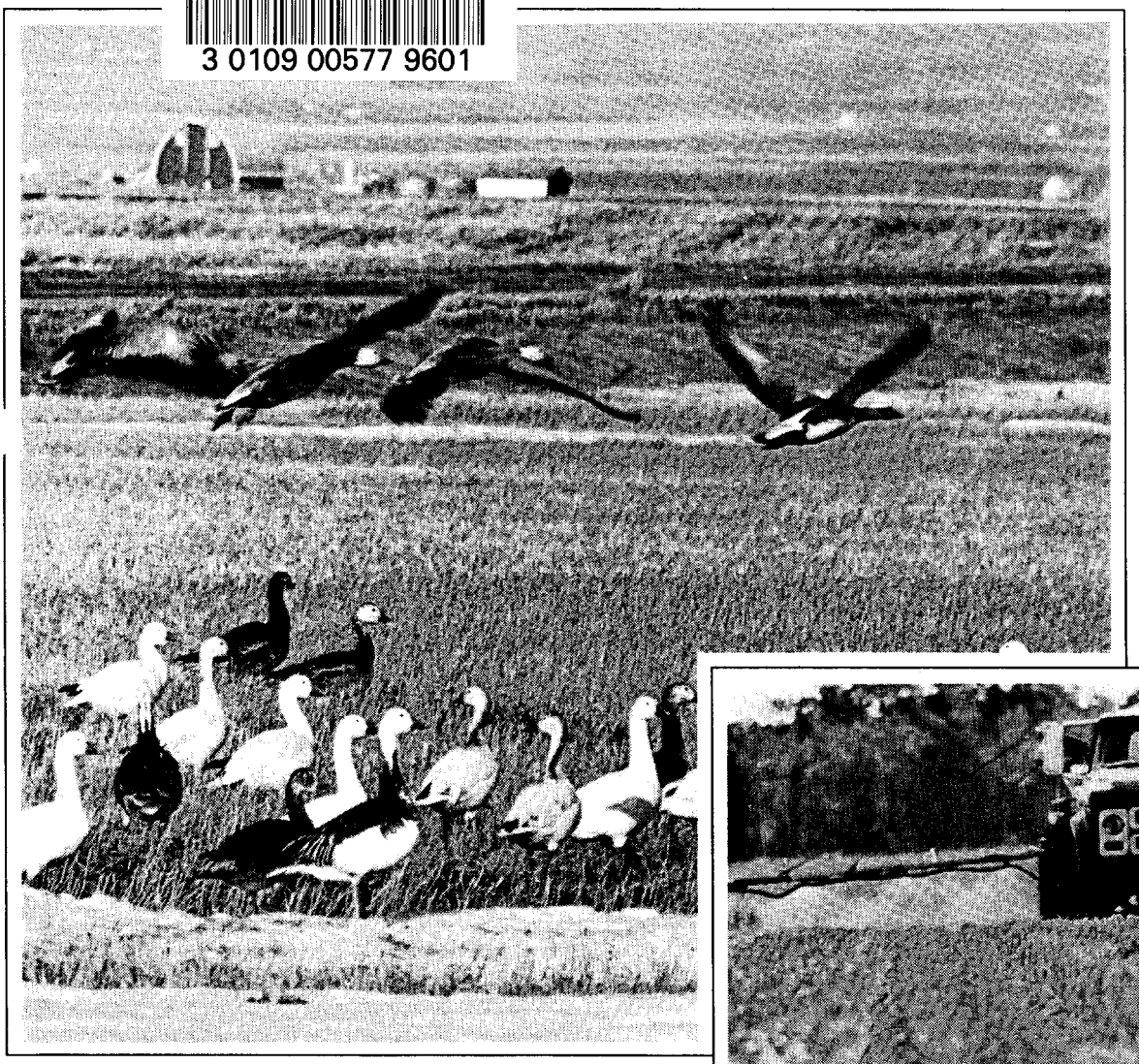
WL-1017

Wildlife and Pesticides

A practical guide to reducing the risk



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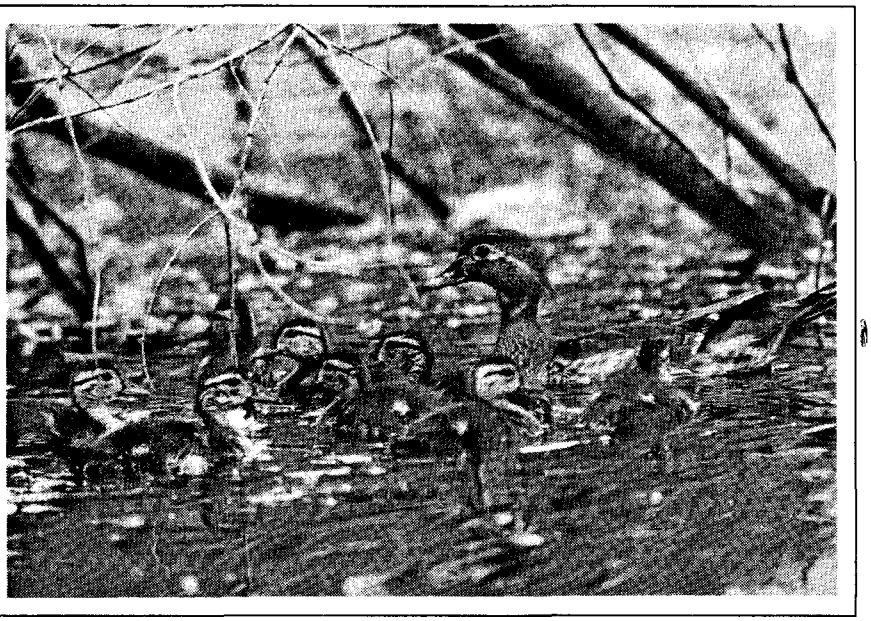
Pesticides are widely used in agriculture today. Producers use pesticides because they are effective and generally reasonably priced. The benefits include reduced yield losses and time savings to the producer, and lower food and fiber costs for consumer.

There are some downside risks to pesticide use. Pesticide poisonings of people, livestock, and wildlife have occurred when proper care was not exercised. Pesticide applicators must be very careful to avoid these risks.

Pesticides, when used with good judgement and care in accordance with label instructions, benefit both agriculture and the environment. Proper use ensures that food and wildlife production objectives can both be realized.

Every pesticide applicator must accept responsibility to prevent or minimize the effects of pesticide applications on nontarget organisms. There are several things you as an applicator can do to reduce the risk of pesticide exposure to nontarget plants, animals and habitats.



The woodduck hen and her brood are one example of a non-target animal. Non-targets are defined as any plant, animal, or other organism that a pesticide application is not intended for, but may accidently be injured by the chemical.

Potential Hazards to Wildlife

In order to better protect wildlife from the risks of pesticide exposure it is necessary to understand what effects pesticides may have on wildlife.

Several hundred different pesticides are used in agriculture today. Each one of these products has different characteristics that can affect the risk posed to different types of wildlife. While a particular pesticide may pose no harm to mammals, it may cause severe harm to aquatic or bird life. Knowing these differences will greatly assist you in making the proper pesticide use decision.

There is much documentation showing that wildlife can be harmed by particular pesticides. The documentation includes laboratory toxicity studies on various types of wildlife, field trials that must be performed in order to register the pesticide, and reports of incidents of wildlife poisoning.

In Oregon in the 1970s, aldrin and mercury treated seed grain killed thousands of wild geese and other wildlife. Thirty-six Canada geese were killed in 1988 as a result of an application of carbofuran (Furadan) and disulfoton (Di-Syston) in Idaho. Phorate (Thimet) was involved in the deaths of hundreds of waterfowl and several bald and golden eagles in South Dakota in 1989.

Many of the incidents involving wildlife kills result from misuse or illegal applications. One such incident occurred in 1990 when an applicator in North Dakota illegally applied carbofuran (Furadan) to carcasses for predator control. He was found guilty of killing several forms of wildlife, possibly including a bald eagle.

Effects of Pesticides in Wildlife

Pesticides' effects on wildlife may be lethal, sublethal, acute, chronic, habitat related, or there may be no effect. In general the risk a pesticide poses to wildlife is related to the pesticide type, its toxicity, the proximity of the application to wildlife habitat, the dose, application rate, number of applications, the persistence of the pesticide in the environment, and its ability to concentrate in the wildlife food chain. These factors interact with food habits and behavior of individual wildlife species to produce a response.

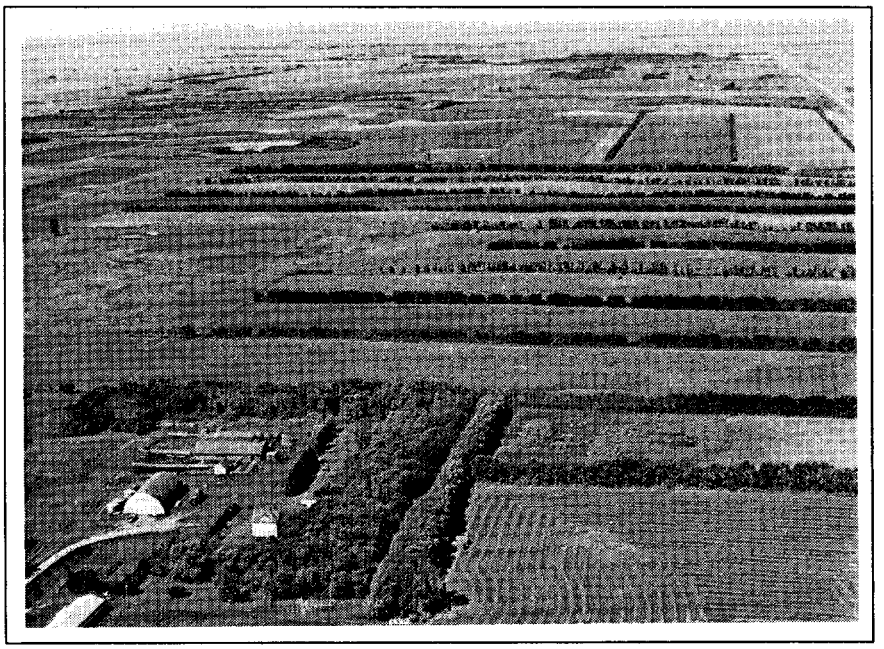
Pesticide Type

In general, insecticides are more toxic to fish and wildlife than herbicides or fungicides. Some herbicides may harm wildlife by damaging the wildlife habitat.

Many of the insecticides currently used are either the organophosphate or carbamate type. These insecticides work by interfering with the central nervous system of insects. The central nervous system of fish or wildlife may be affected the same way. The toxicity of the various organophosphate and carbamate insecticides ranges from slightly toxic products to products that are highly toxic. The more toxic products are generally **restricted use pesticides** which require applicators to be certified by their state regulatory agency to purchase and apply products.

Synthetic pyrethroid insecticide use has been increasing. These synthesized insecticides are based on naturally occurring pesticides, but have been modified to improve performance and persistence. Synthetic pyrethroids also work by interfering with the central nervous system. Synthetic pyrethroids are low to medium in toxicity to mammals and birds because they can quickly detoxify and excrete them. However, fish and aquatic invertebrates can not quickly detoxify or excrete synthetic pyrethroids, so they are highly susceptible to poisoning by these products.

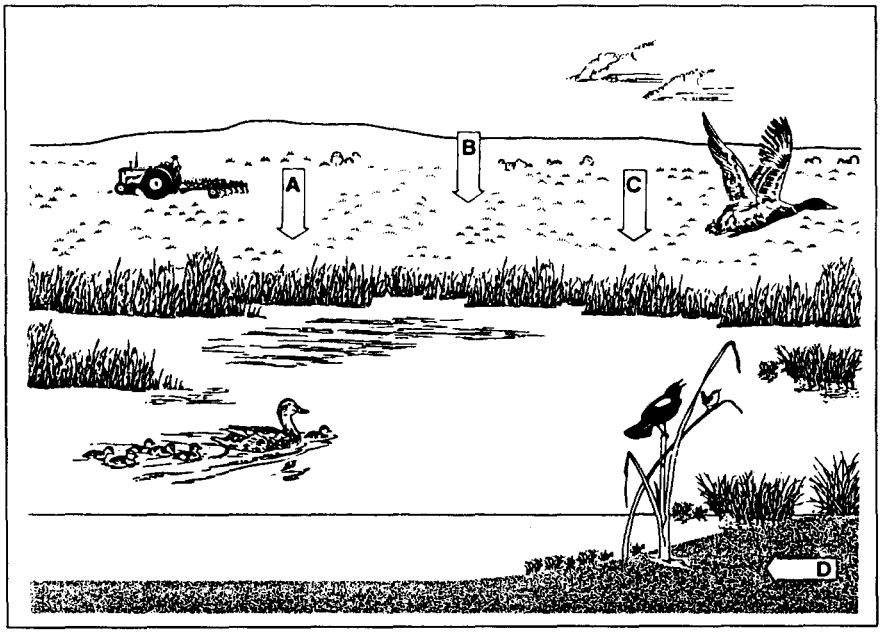
Herbicides and fungicides are generally low to moderately toxic to wildlife. Particular herbicides can have a large impact on the plant life making up the wildlife habitat.



Shelterbelts and windbreaks provide excellent soil and energy conservation benefits. In addition, such areas function as valuable wildlife habitats. Drift from certain herbicides can damage or kill trees, thus impairing the benefits received.

Pesticide Exposure

Wildlife can be exposed to pesticides directly by eating contaminated food or water, breathing pesticides, or by skin absorption. Wildlife may also suffer indirectly due to pesticides in the environment, resulting in disruption of normal food chains.



Wildlife exposure to pesticides can occur as a result of a direct application (A), as drift (B), as surface runoff (C), or through the groundwater (D). The type and magnitude of the effects depends on the type of exposure, the toxicity of the pesticide and the quantity or dose.

The type and magnitude of the effect depends on two factors, the pesticide toxicity and pesticide quantity (dose). If exposure causes the animal's death, it is referred to as a lethal effect. The death of exposed animals (lethal effects) is a common type of direct pesticide effect on wildlife.

Direct Effects

Direct effects result from actual pesticide exposure. Young birds that eat or are fed pesticide treated insects are at great risk of suffering lethal pesticide exposure effects. Sublethal insecticide effects occur when damage to the central nervous system causes an animal to behave in a unusual manner. This behavior may affect the animal's ability to survive or reproduce. Some typical sublethal responses in birds exposed to pesticides include the inability to sing properly, establish a breeding territory, or attract a mate. Adults may be unable to care for themselves or their young properly, resulting in death to the nestlings or increased chance of predation.

This Canada goose gosling and other young birds that eat or are fed pesticide treated insects are at great risk of suffering lethal pesticide exposure effects.

Indirect Effects

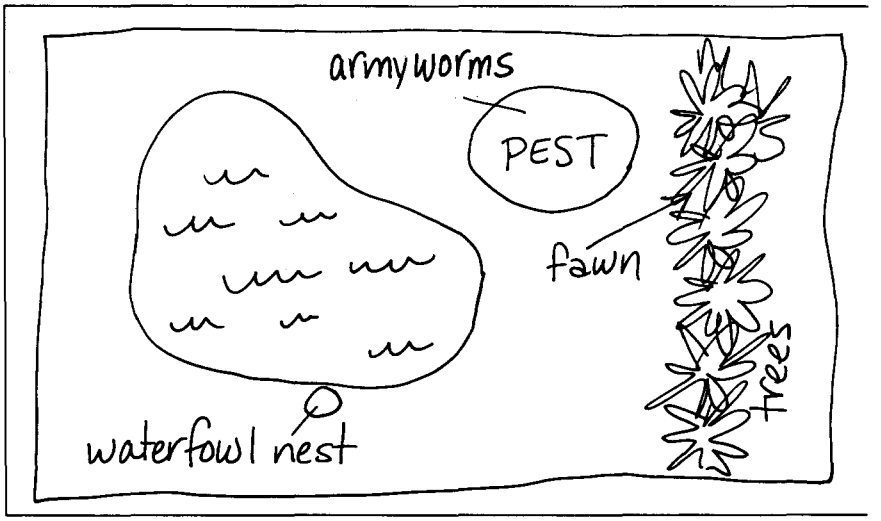
Wildlife in general, and birds in particular, may also experience lethal and sublethal effects without being directly exposed to a pesticide. This typically occurs when a pesticide application destroys or disrupts food sources such as insects. Insects supply the protein necessary for growing birds. Studies indicate that the growth of young birds can be stunted in areas where insecticides have been used heavily, resulting in insect populations too low to meet young bird protein growth demands. Fish that feed on aquatic insects and animals may also show stunted growth in areas of heavy insecticide use because their primary food sources are killed. Inadequate diets also can affect fish reproduction and survival.

The lethal and sublethal effects of pesticides on wildlife and fish may occur from one exposure over a short time period (acute) or they may result from exposures to small amounts over a longer time period (chronic). Pesticides commonly used today do not persist as long in the environment as pesticides used years ago. The tradeoff is that the acute toxicity of some of these modern pesticides is higher than the older, more persistent chemicals.

Terrestrial and aquatic insects (invertebrates) supply the protein necessary for growing birds. Pesticide applications destroy food sources such as the snails in this picture, thus disrupting local food sources, can result in lethal and sublethal effects in wildlife, even without direct exposure.

Assessing Wildlife Risk to Pesticides

To properly assess the need for pesticides and the risk to wildlife, information must be gathered on the condition of the crop, the pest situation, characteristics of candidate pesticides, present and expected weather, and some knowledge about the kinds and behavior of wildlife living in the area. The importance of good judgement, practical experience and common sense cannot be overemphasized. Prior to each and every pesticide application, the overall situation should be evaluated so that the expected benefits of a pesticide application are realized and potential hazards are minimized. Good information is necessary to make good judgements.



Field scouting makes for better decisionmaking when determining if, when, and what pesticide to use to control a particular pest. Careful scouting will also reveal the presence of wildlife. Drawing a map of the field showing locations of pest populations and wildlife along with recognizable landmarks can aid you in developing a pest control plan that achieves your crop production and wildlife protection objectives.

Monitor Fields Regularly

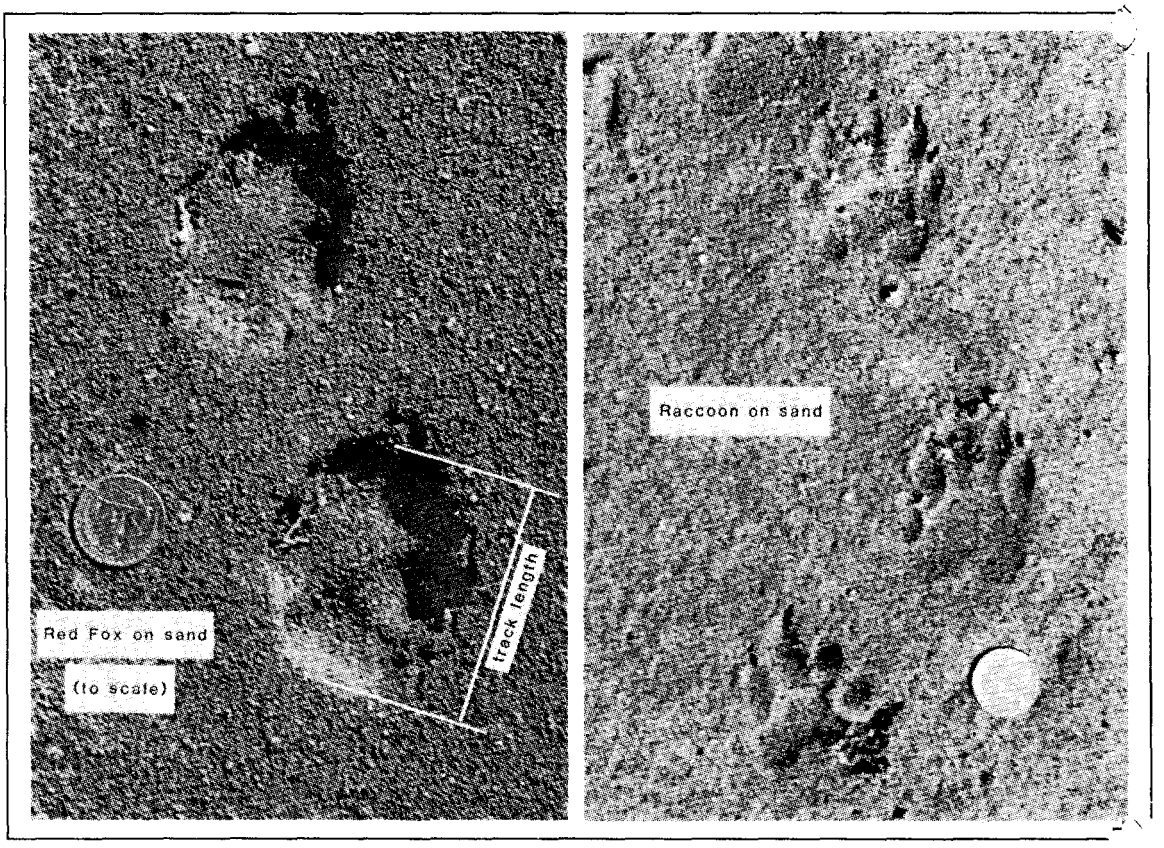
Field scouting ***must be done***. It is important to be aware of the status of the field, the crop stage, general health, and yield potential of the crop, as well as the number and growth stage of the various pests that are present. Careful scouting will reveal any wildlife that may also be present. Most pests and most wildlife do not occur uniformly throughout a field. Drawing a map of the field showing the locations of pest populations and wildlife along with recognizable landmarks can aid you in developing a pest control plan that avoids possible effects on wildlife. (See diagram on page 5.)

Identify Wildlife Signs, Seasons, and Habitats

One way to ensure that wildlife will not be impacted by a pesticide is to make the application when wildlife are not present. Most wildlife signs can be easily determined while scouting the field. Virtually all agricultural crops will support some type of wildlife. A wide assortment of wildlife will likely be visible during most scouting trips.

Areas where wildlife are most likely to be located are field perimeters and other areas where fields may come into contact with windbreaks, wetlands, livestock watering ponds, fencerows, abandoned farmsteads, grasslands or odd areas.

Take note of areas where you actually see animals. Other evidence that wildlife are present and using the area includes signs such as tracks, droppings, or foraging evidence.



Tracks and droppings can provide further evidence of wildlife's presence in or near crops.

If numerous wildlife signs are present, pesticide applicators can reduce potential impacts to wildlife by marking such areas on a field map or leaving a flag in that area of a field. When spraying around sensitive areas, leave a buffer zone of at least one-half the width of a sprayer boom. Another way to minimize potential impacts to wildlife is to restrict spraying activities in these fields between the hours of 10 a.m. and 4 p.m. During this period, many wildlife will seek the protective cover of cropland, particularly taller row crops, as they wait out the day prior to beginning evening and early morning foraging activities.

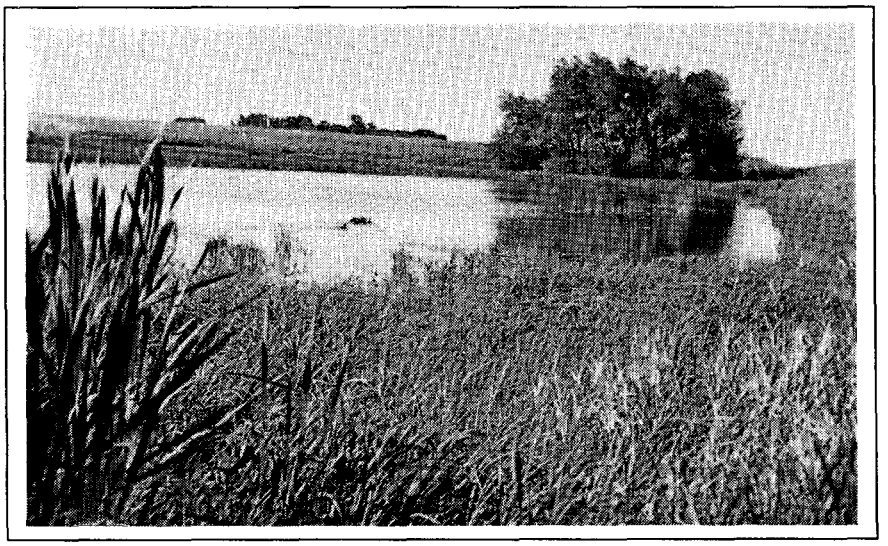
Critical Reproductive Periods and Habitats

Most wildlife reproduction occurs from May 1 to late June and early July. This is perhaps the most critical for many of our resident and migratory wildlife and fish. To complete this reproduction, animals seek out suitable habitats.

These habitats can include wetlands, windbreaks and shelterbelts, fencerows, rangelands, and croplands. Wildlife typically nest, birth, feed, and rear their young in areas that provide not only some type of protective cover from the elements and potential predators, but also sources of food.

The transition zones between habitat types, where one plant community changes to another, are preferred. These edges usually produce the greatest variety of food plants, insects and seeds. This allows wildlife such as grouse, pheasants, and deer to feed without venturing too far from protective cover. For this reason, most upland gamebird nests can be found in or near such edges.

Transition zone between wetlands, windbreaks, shelterbelts, fencerows, rangelands and croplands constitute valuable wildlife habitat. These edges usually provide the greatest variety in foods. Leaving an unsprayed buffer zone around such areas can serve to reduce the potential impacts of a pesticide application on the wildlife that frequent such area.



Wetlands are important habitats for almost all of our migratory and resident waterfowl. Cropland adjacent to wetlands has a tremendous impact on wildlife because agricultural chemicals can enter wetland systems through runoff or draft. In major waterfowl production areas in North Dakota and Iowa, 94 to 100 percent of the wetlands are adjacent to farm fields.

Wetlands are important feeding and brood rearing habitats for waterfowl. Insecticides applied near wetlands by ground sprayers or aircraft can enter the habitat through drift or runoff and contaminate these areas. Depending on the insecticide type, food sources may be destroyed, causing sublethal effects or a direct loss of young wildlife.

Similarly, shelterbelts and windbreaks are important habitats for many songbirds. Herbicide drift that results in injury to trees and other vegetation can impair the ability of such habitats to provide safe, secure nesting sites. Insecticide drift can kill nestlings and adult birds, as well as contaminate important insect food sources.

Reducing Pesticide Exposure Risk

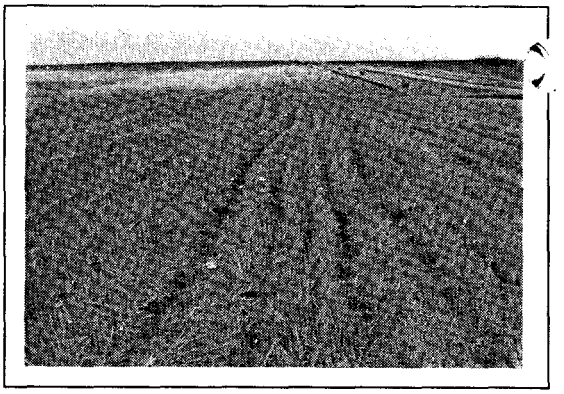
Regular field scouting and a pest control plan should be a part of every producer's operation. Pests are best controlled by manipulating cropping conditions to put pests at a disadvantage to the crop or beneficial organisms. Man and his crops are in competition with pests, and ALL available methods for controlling pests should be considered, not just pesticides.

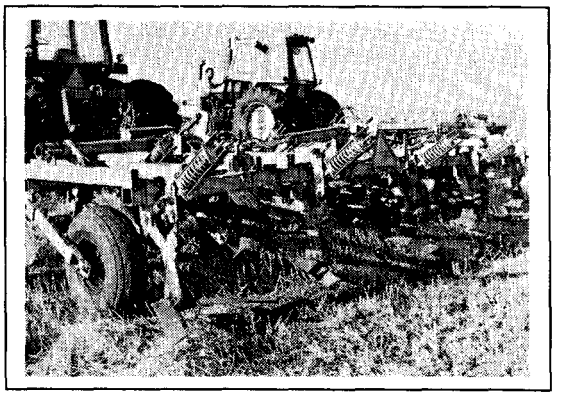
Regular field scouting will eliminate unnecessary pesticide applications further reducing the risk to wildlife.

Eliminate Unnecessary Pesticide Applications Through IPM

Few applicators knowingly apply unnecessary pesticides because pesticides cost money. Every applicator should ask, will this application pay for itself? Growers should not substitute pesticides for good management. Pesticides are necessary but should only be part of a total pest control program, not the entire program.

The best method of reducing risks to wildlife is to use integrated pest management (IPM) practices. IPM incorporates cultural methods such as crop rotation, date of planting, variety choices, and seeding rates with other methods of pest control to maintain pest populations at tolerable levels. Under IPM, pesticides are used only when





Tillage and cultivation employing stubble mulches can reduce the need to apply herbicides. Stubble mulching also maintain important residues providing for soil and water conservation and wildlife nesting and feeding cover.

other methods are not successful and pest damage to crops might otherwise exceed the cost of control.

Many pest management practices can help reduce the need for pesticides. Some additional control methods include crop competition, crop rotation, tillage and cultivation, sanitation, planting resistant varieties, planting weed and disease free seed, and using the natural controls present when possible.

A good example of non-pesticide control is a competitive crop. An early established, well developed crop can do much to help control weeds. Plants emerging first have a competitive advantage over later emerging plants. Anything done to get quick crop emergence that evenly covers the ground early will have a big impact on weeds. Later emerging weeds are at a tremendous disadvantage and may not cause yield and quality losses. The competitiveness of weeds and crops differs between species. Weeds such as wild oats, wild mustard, and kochia are very competitive, while others, such as redroot pigweed and foxtails are generally less competitive. Small grain crops ranked in order of decreasing competitiveness are rye, barley, conventional height wheat, semidwarf wheat, and flax.

Choose the Pesticide Least Toxic to Non-target Organisms

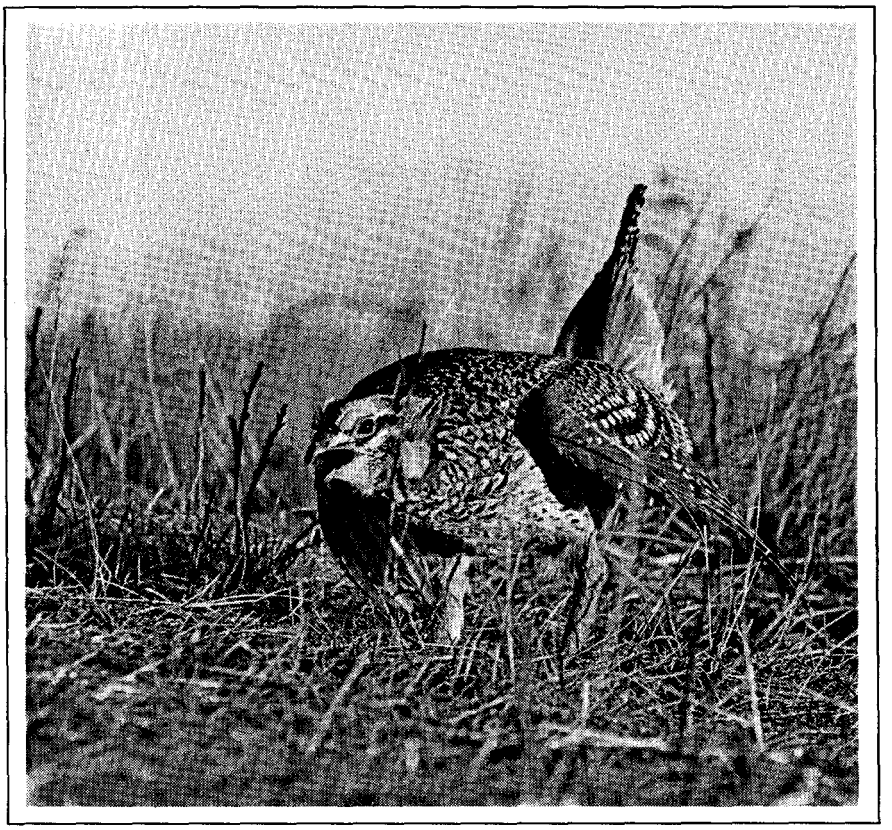
Choose the least toxic pesticide that will control the pest. Often more than one pesticide is registered for control of a particular pest in a particular crop. Take time to compare pesticides and make sure you choose the one BEST suited for the job. Many times the best choice will be the least expensive treatment, but that is not always the case. Sometimes the best choice would be a higher priced pesticide with fewer risks for nontarget plants and animals.

Pesticide Toxicity to Wildlife

Pesticide applicators can plan a pesticide application that is less toxic to wildlife by examining pesticide toxicity and potential for environmental injury to wildlife and wildlife habitats. This information can be found in tables presented in the back of this publication.

When an applicator has identified the specific crop pest situation and checked local crop production guides, a pesticide can be selected that minimizes risk to nontarget plants and animals and still achieves the desired level of control.

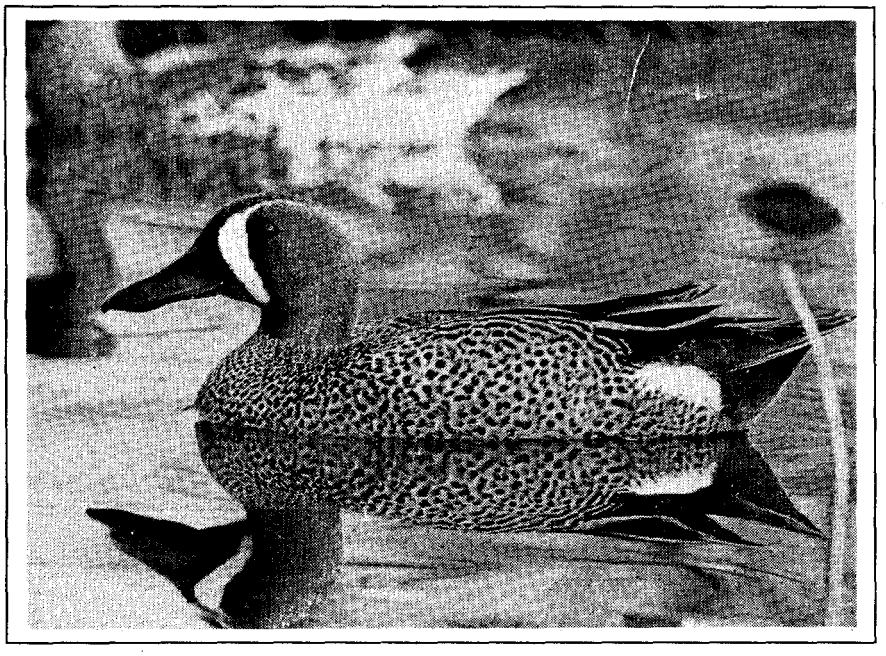
If the selected pesticide still poses a high threat to wildlife, the applicator would at least be aware of the risk and can take the steps to minimize any potential threats by following recommendations in this publication.



Read the Pesticide Label

Certain pesticides pose a risk to wildlife or the environment. Some products are classified as RESTRICTED USE PESTICIDES because of environmental hazards. Restricted use pesticides should only be applied by a certified applicator who has been properly trained.

Pesticides that pose environmental risks are labeled to warn the applicator what the risks could be and what steps should be taken to protect people, animals and the environment. These warnings can be found in the "Precautionary Statements" section of the label. The precautionary section is divided into subsections dealing with **"Hazards to Humans or Domestic Animals," Environmental Hazard"** and **"Physical or Chemical Hazard."** The risks to wildlife and the environment may be found in the "Environmental Hazard" section. It is a violation of federal law to apply pesticides in any way that is not consistent with label instructions.



Hazards to Wildlife

If a particular pesticide is especially hazardous to wildlife, it will be stated on the label. For example:

- This product is highly toxic to bees.
- This product is toxic to fish.
- This product is toxic to birds and other wildlife.

The label may indicate that the product causes undesirable effects in the environment. In this case, the precautionary statement may tell what to avoid doing. Labeling may indicate limitations imposed to protect wildlife, including endangered species. These limitations may include reduced rates, restrictions on types of application, or a ban on the pesticide's use within the species range. The label also may indicate additional sources of information on proper application methods to reduce hazards.

These statements explain special hazards that use of them may pose. They should help when choosing the safest product for a particular job and serve as a reminder to take extra precautions.

General Environmental Statements

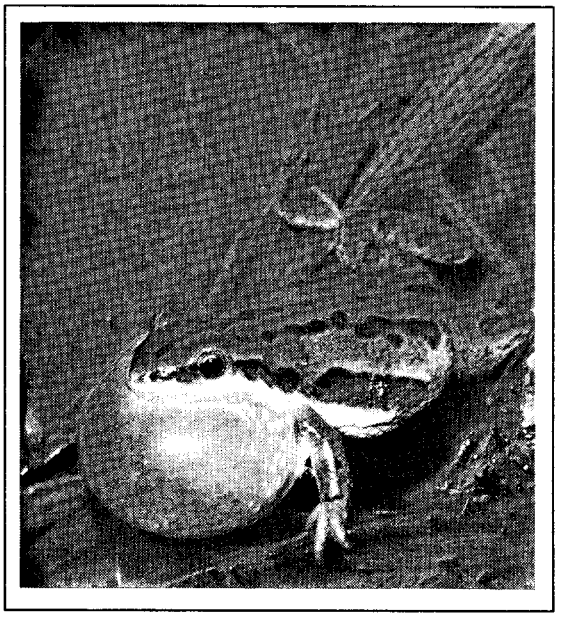
General environmental statements appear on nearly every pesticide label as reminders of common sense actions needed to avoid contaminating the environment. The absence of any or all of these statements DOES NOT change the requirement to take adequate precautions.

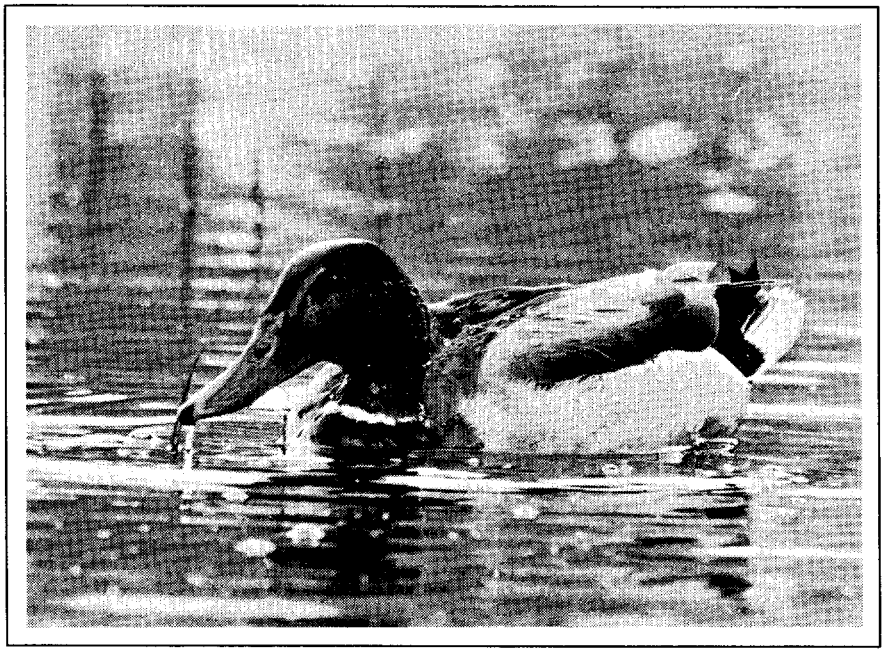
Sometimes the statements will follow a "specific toxicity statement" and provide practical steps to avoid harm to wildlife.

Examples of general environmental statements include:

- Do not apply when runoff is likely to occur.
- Do not apply when weather conditions favor drift from treated areas.
- Do not contaminate water when cleaning equipment or disposing of wastes.
- Keep out of any body of water.
- Do not allow drift on desirable plants or trees.
- Do not apply when bees are likely to be in the area.
- Do not apply where the water table is close to the surface.

Note: **It is the responsibility of every pesticide applicator to read and follow the label directions.**





Use the Lowest Effective Rate

Many times the label will allow a range of rates to control a particular pest. Differences in pest size or stage, pest populations and environmental conditions can affect the amount of pesticide needed. Often pesticide rates at the lower end of the rate range can be used when pests are in sensitive growth stages, at lower populations and the weather and growing conditions are favorable.

Use Buffer Zones

An area between the area sprayed and a sensitive area is called a buffer zone. This area can be a grass strip or may even be part of the crop that is not treated. This buffer area will help trap pesticides and prevent them from entering sensitive areas by spray drift or by runoff.

Spot Spraying

Many times a pest is located only in a portion of the field. Spraying only the area where the pest is found, leaving the rest of the field untreated, reduces potential risks and saves time and money.

Begin Spraying In the Middle of the Field

Most wildlife will be present near the edges of a field. Spraying the field by starting in the middle of the field will allow wildlife time to escape or move out of the field area.

Trap Areas

Some farmers are experimenting with the use of trap areas. Farmers will seed these areas with an early maturing crop variety ahead of normal planting dates. These areas may attract pests and if pest populations develop in the trap area, a pesticide application can be made. Controlling pests in this manner can reduce chances that pesticides will be required on the rest of the field.

Check Weather Conditions

A good applicator always checks the weather conditions before spraying. Weather conditions can greatly affect the pesticide exposure through spray drift or runoff. Don't apply pesticides just before rains because pesticides could run off the treated field with excess rainwater and potentially contaminate sensitive areas. Avoid spraying when weather conditions could cause spray drift into sensitive areas, particularly at wind speeds above 5 mph.

Avoid Spray Drift

Spray drift can cause damage to wildlife or wildlife habitat. The following measures are available to greatly reduce drift.

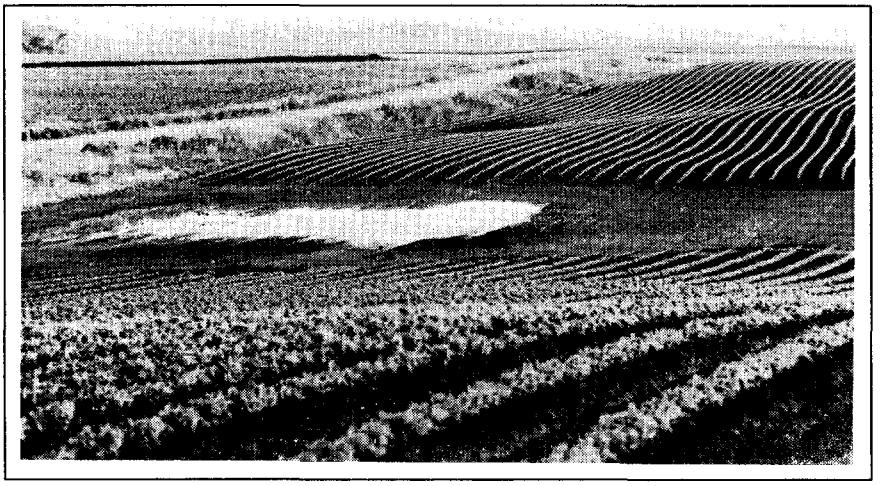
— Avoid spraying on windy days.

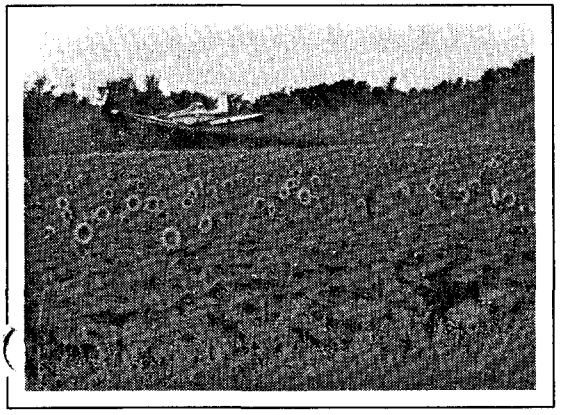
Check the wind speed and direction. If conditions could cause spray drift into sensitive areas, don't spray. If an application must be made you must take every precaution you can to prevent drift from entering sensitive areas.

Another weather condition to avoid is a temperature inversion. Temperature inversions occur when cooler air is near the ground and is beneath warmer air. Very small spray droplets will remain suspended in the air and can move some distance.

— Use a nonvolatile formulation

Some pesticides are volatile and can form vapors, usually on warmer (greater than 70°F) days, which can drift into susceptible areas. If there is an alternative pesticide or formulation that is not volatile and will control the pest, it should be used instead.





Any application or farming practice that allows considerable drift or runoff is potentially harmful to wildlife. Insecticides often are applied aerially and, when applied near wetlands, can contaminate these areas. In 1987, a routine aerial application of ethyl parathion, an organophosphate insecticide, to sunflower fields adjacent to wetlands in North Dakota led to the death of 96 percent of the mallard ducklings in the wetlands. When the pilot was instructed to do his best to avoid contaminating the wetlands, no more ducklings died than in unsprayed areas. However, aquatic insects and zooplankton in the wetland were killed causing sub-lethal effects in wildlife.

— Increase Droplet Size

Spray nozzles produce spray droplets of many different sizes. Larger droplets are heavier and drift less. Practices that increase droplet size will reduce drift, such as increasing nozzle size or water volume, reducing spray pressure or using a drift retardant.

— Use Larger Nozzle

Larger nozzles allow you to apply the same volume of spray with less spray pressure. Spray droplets will be larger than those produced by a smaller nozzle with higher pressure.

— Increase Water Volume

Increasing the water volume will decrease drift because water droplets will be larger and will tend to drift less.

— Use the Lowest Practical Pressure

Lower spray pressure will result in larger spray droplets that drift less than smaller droplets. If spray pressure is reduced too much the spray pattern that results will not be uniform. Newer nozzles such as the "LP" or "XR" type are designed to produce uniform spray patterns with pressures of 15 to 20 pounds per square inch.

— Use a Drift Retardant

A drift retardant will help reduce spray drift by increasing the size of spray droplets. Larger droplets tend to drift less than small droplets.

— Reduce Spray Boom Height

Set spray booms at the lowest height that will give uniform coverage. The closer the boom is to the spray target the less chance there is for drift.

— Use a Shielded Sprayer

Using a shielded sprayer will help reduce spray drift by protecting the spray from wind. Shielded sprayers allow a wider selection of spraying times during the day and more total spraying time per day. These time savers can be used to more precisely target crop areas and avoid sensitive areas. More information on spray drift can be found at your state's Cooperative Extension Service county office.

Summary

The responsibility to prevent or minimize the effects of pesticide applicators on nontarget organisms rests with every pesticide applicator. Information concerning the proper use and application of a pesticide can be found on the product label.

Reducing the risk of pesticide exposure to nontarget organisms requires applicators to incorporate crop scouting and IPM techniques with a knowledge of wildlife life cycles and habitats in developing a farm pesticide application plan. Development of such a plan will insure not only the most cost effective means for controlling crop pest situations, but also result in the greatest reduction of risk of pesticide exposure to wildlife.

Toxicity Tables. These tables provide toxicity comparisons for commonly used pesticides. These comparisons are intended to give applicators the information needed to reduce the risk of an application to wildlife.

INSECTICIDES

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
acephate (Orthene)	Organo-phosphate	III-(Birds and mammals) I-(Fish/aquatic insects)	Moderate to slight acute oral toxicity to birds and mammals Reduction in ChE activity.	Increase water volumes to reduce drift. Avoid use areas of high bird numbers. Use lowest recommended effective rates. Avoid contaminating wetlands, ponds, streams and rivers.
Aldicarb (Temik)	Carbamate	I-Birds, mammals, fish and aquatic insects)	Bird and mammal mortality reported after ingestion of exposed granules. One of the most toxic carbamate pesticides. Extremely toxic to aquatic organisms.	Proper incorporation of granules. Consider weather and terrain to avoid runoff potentials into water areas.
azinphos methyl (Guthion)	Organo-phosphate	I-(Mammals) II-IV (Birds) II -(Fish/ aquatic insects)	Extremely toxic to mammals in formulations containing a high percentage of active ingredient. Highly toxic to fish and aquatic insects.	Scout fields to determine the presence of wildlife. Avoid or delay direct application when wildlife is present. Exercise caution to reduce the risk of direct, drift, or runoff applications to water or wetland areas. Avoid contaminating ponds,lakes, and streams.
carbaryl (Sevin)	Carbamate	III-(Fish and birds) I-(Aquatic insects)	Moderate acute/chronic toxicity to birds,fish, and mammals.Low persistence. Toxic to aquatic insects.	Avoid direct applications to wetlands and other waters. Reduce potentials for drift and runoff by using buffer zones.
carbofuran (Furdan)	Carbamate	I-(All)	Highly toxic to all forms of wildlife even when applied at lowest recommended effective rate.	Avoid applying this chemical when wildlife is present. Use buffer zones when applying near wetlands, other waters, and wooded areas. Use an alternate pestiicide. (Granular carbofuran has been voluntarily cancelled and will be phased out by 1994. Flowable is still registered.)
Diazinon (various)	Organo-phosphate	III-(Mammals) I-(Birds, fish and aquatic insects)	Extremely toxic to birds and moderately toxic to mammals. Toxic to bees,fish, and other aquatic organisms.	Applications should be made only after a careful evaluation. Avoid contaminating wetlands, ponds,lakes, and streams.
chlorpyrifos (Lorsban)	Organo-phosphate	II-(Mammals and birds) I-(Fish and aquatic insects)	Highly toxic to mammals and birds through oral Extremely toxic to fish and aquatic insects.	Avoid contaminating wetlands, lakes, ponds, and streams. Do not apply when wildlife are present.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
dimethoate (Cygon)	Organo-phosphate	I-(Birds, fish, and aquatic insects) III-(Mammals)	Moderate acute oral toxicity to mammals. Extremely toxic to birds, fish, and other aquatic organisms. Pheasants are particularly sensitive to this pesticide.	Low environmental persistence and use registration may reduce exposure to wildlife.
disulfoton (Di-Syston)	Organo-phosphate	I-(All)	Extremely toxic to birds, mammals, fish, bee and aquatic organisms. Secondary poisoning in birds eating treated insects has been reported.	Proper field scouting to include a careful evaluation of potential wildlife exposure will reduce the risk. Do not apply when wildlife is present.
endosulfan (Thiodan)	Chlorinated Hydrocarbon	I-(Fish and aquatic insects) II-IV (Birds) I-II (Mammals)	Fish kills associated with contaminated agricultural runoff. Concentrates of <1.3 ppm were sufficient to cause mortality. Highly toxic to aquatic organisms/ insects.	Caution should be taken to avoid risks associated with agricultural runoff. The use of buffer zone will reduce risk associated with use of thispesticide.
esfenvalerate (Asana)	Pyrethroid	I (Fish) IV -(Bird and mammals)	Highly toxic to fish, aquatic insects. No reported toxicity in birds/mammals.	Measures to reduce the risks to wildlife. Avoid applications (direct, drift, runoff in water bodies/wetlands. Use lowest recommended effective rates and buffer zones near water..
Parathion (methy ethyl) (Penncap-M various)	Organo-phosphate	I-(All)	Ethyl and methyl parathion are extremely toxic to birds, mammals through both acute oral and dermal exposure at recommended application rates. These chemicals are highly toxic to bees fish and other aquatic organisms.	Prior to applying parathion a thorough scouting of the field should be conducted. Field applications of parathion should be made prior to 10 a.m. or after 4 p.m. to minimize drift and leave buffer zone near critical wildlife habitats such as windbreaks and wetlands. Do not apply when wildlife are present.
fenvalerate (Pydrin)	Pyrethroid	I-(Fish) IV-V(Bird and mammals)	See Esfenvalerate	Avoid contaminating wetlands, lakes, ponds and streams.
fonofos (Dyfonate)	Organo-phosphate	I(All)	Highly toxic to fish, mammals and birds due to chemical action, high field use and relatively long persistence. Used as a granular treatment.	Complete incorporation of the product into the soil will minimize wildlife exposure risks. Consider weather and terrain to avoid runoff contamination.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
malathion (Cythion)	Organo-phosphate	III-(Birds and mammals) I-(Fish and aquatic insects)	No documented effects on wildlife (birds/mammals) when used at recommended application rates. Toxic to bees, fish and other aquatic organism.	Avoid application (direct, drift or runoff) on water areas/wetlands. Use near buffer zones near water.
methidathion (Supracide OP)	Organo-phosphate	II(All)	High acute oral toxicity to birds/mammals, bees and fish.	Careful scouting of field to identify the presence of wildlife and the subsequent avoidance of such area and critical wildlife habitats during application will minimize wildlife exposure risks.
phorate (Thimet)	Organo-phosphate	I(All)	Extremely high oral and dermal toxicity has been documented in birds and mammals after exposure to pesticide. Wildlife deaths reported are related to ingestion of improperly incorporated granules, in areas subject to flooding and run off. Uptake of chemical in plants may also cause wildlife exposure.	In areas subject to flooding and runoff and where wildlife are present in large concentrations (migrations) the use of this pesticide should be carefully evaluated. Used as a granular formation, the pesticide must be properly incorporated. Use at recommended label rates will minimize exposure risks.
terbufos (Counter)	Organo-phosphate	I(All)	Extremely toxic to lab mammals. Potential for greatest impact due to ingestion of granules.	If properly applied the risk to wildlife is minimal. Spillage, failure to cover granules, heavy rains or high winds could expose granules increasing the risk. If such conditions exist do not apply if wildlife is present. In areas subject to flooding and runoff and where wildlife are present in large concentrations (migrations) the use of this pesticide should be carefully evaluated. Used as a granular formulation, the pesticide must be properly incorporated. Use at recommended label rates will minimize exposure risk.
permethin (Ambush Pounce)	Synthetic pyrethroid	I-(Fish and aquatic insects) V-(Birds and mammals)	Extremely toxic to aquatic organisms. No documented field effects on birds or mammals.	Prevent direct, applications or drift and runoff into wetlands and other water. Use a buffer zone if applied near water areas.

HERBICIDES

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
2,4-D	Phenoxy	III-(Birds and mammals) II-(Fish and other aquatic organisms)	Moderately toxic to birds and mammals. Highly toxic to insects,fish, birds. A reduction of birds broad-leaved plants from applications can result in a reduction in the nest numbers of waterfowl and other upland nesting birds. Use of a non toxic oil vehicle during application increases toxicity of the chemical to egg embryos. Spray drift can harm wooded areas.	In areas where waterfowl and other upland nest apply with a water based spray mixture. Spot spray where possible to reduce impacts on potential nest cover. Minimize spray drift. Use a buffer zone when applied in wooded areas, or near water.
2,4-D Amine 2,4-D Ester	(see 2,4,-D)			
acifluorfen (Blazer Tackle-plus)	Biphenol ether	V-(Birds and mammals) I-II(Fish and aquatic insects)	No documented impacts on birds or mammals. Toxic to aquatic organisms. May damage susceptible foliage (cover).	Avoid spray drift. Use buffer zones near surface water. Avoid contaminating ponds, lakes, wetlands, and streams.
alachlor (Lasso Bullet)	Acetanilide Bullet	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented impacts on birds and mammals. Highly toxic to aquatic insects and fish.	Avoid spray drift and runoff contamination of wetlands and other water areas by using buffer zones. Avoid contaminating ponds, lakes, wetlands, and streams.
atrazine (various)	Triazine	V-(Birds and mammals) IV-(Fish)	Slightly toxic to birds at high concentrations. Indirect effects on aquatic fauna may result as the chemical impacts aquatic plant species. Toxic to fish and aquatic invertebrates at high concentrations.	To minimize the impacts of agricultural runoff carrying this chemical into wetlands and other waters employ buffer zones. Use at lowest effective rate.Use with caution in areas where groundwater contamination is likely. Avoid contaminating ponds, lakes, wetlands, and streams.
bentazon (Basagran)	Carbamate	IV-(Birds and mammals) III-(Fish)	No documented impacts on birds and mammals. Moderately toxic to Rainbow trout.	Use buffer zones to reduce potential impacts to aquatic habitats. Do not apply when conditions favor drift. Avoid contaminating ponds, lakes, wetlands, and streams.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
bromoxynil (Bronate Buctril Brominal)		I-(Fish and aquatic insects) II-IV Mammals) IV- (Birds)	Extremely toxic to aquatic invertebrates No documented impacts on birds and mammals.	Reduce impacts of agricultural runoff on wetlands and other waters by using grass buffer zones. Avoid contaminating ponds, lakes, wetlands, and streams.
clopyralid (Curtail Confront)	Growth regulator	V-(Birds and mammals)	No documented impacts on wildlife.	Use buffer zones if applying near water areas.Avoid contaminating ponds, lakes, wetlands, and streams.
cyanazine (Bladex)	Triazine	IV-(Birds and mammals)	Slightly toxic to aquatic invertebrates. No documented impacts in birds or mammals.	Use buffer zones if applying near wetland or other waters.Use caution in areas where groundwater contamination is likely.
cycloate (Ro-Neet)	Thio-carbamate	IV-(Birds and mammals) I-(Fish and aquatic organisms)	No documented field effects in wildlife. Low acute oral and dermal toxicity in laboratory mammals. Toxic to fish.	Apply according to label instructions. Avoid contaminating wetlands, ponds, lakes, and streams.
desmedopham (Betanex)	Carbamate	V-(Birds and mammals) I-(Fish and aquatic insects).	No documented field effects in wildlife. Low toxicity to laboratory animals. Toxic to fish.	Apply according to label instructions. Avoid contaminating wetlands, ponds, lakes, and streams.
dicamba (Banvel)	Growth regulator	IV-(Birds mammals, fish, and aquatic insects)	No documented field effects on wildlife. Slightly toxic to aquatic invertebrates.	Avoid contaminating wetlands, ponds, lakes, and streams.
diclofop (Hoelon)	Growth regulator	IV-(Birds mammals, fish, and aquatic insects)	No documented field effects on wildlife. Slightly toxic to aquatic invertebrates.	Avoid contaminating wetlands, ponds, lakes, and streams.
difenzoquat (Avenge)	Biperi delum	IV-(Birds mammals, fish, and aquatic insects)	No documented field effects on wildlife. Slightly toxic to aquatic invertebrates.	Avoid contaminating wetlands, ponds, lakes, and streams.
DPX-M6316 (Harmony-extra)	Sulfonyl-urea	IV-(Birds mammals, fish, and aquatic insects)	No documented field effects on wildlife. Slightly toxic to aquatic invertebrates.	Avoid contaminating wetlands, ponds, lakes, and streams.
EPTC (Eptam)	Thio-carbamate	IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
ethalfluralin (Sonalan)	Dinitro-anilide	IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
fenoaprop (Whip)	Phenoxy-phenoxy	IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
fluazifop (Fusilade)		IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
glyphosate (Round-up)		IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds nd mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
(Rodeo)		III-IV Fish and aquatic insects.	Rodeo is slightly toxic to aquatic organisms unlike its counterpart Round-up.	Apply according to label instructions.
imaze-methabenz (Assert)		IV-V (Birds and mammals) II-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
MCPA-Amine MCPA-ester	Growth regulator	III-IV (Birds and mammals) I-III(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams. Use drift precautions. Apply the amine formulation in areas where drift. is a concern.
metsulfuron	Sulfuron	IV-V (Birds and mammals) II-III (Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
paraquat (Cyclone)		I (Fish and aquatic organisms) III (waterfowl embroyos, mammals/bird)	Toxic to fish and other aquatic organisms, duck egg embryos. slightly toxic to mammals and birds.	Use a buffer zone when applying near wetlands or other water areas. Avoid direct applications to wildlife and nests.
pendimetholin	Dinitro-anilion	IV-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife.	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds and streams.
picloram (Tordon)	Growth regulator	IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.Toxic to early life stage of fish and invertebrates.	Avoid contaminating wetlands, ponds, lakes, and streams. Use buffer zones when applying near water areas. Should not be used where groundwater contamination is likely.
quizalofop (Assume)	Phenoxy	IV-V (Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
sethoxydim (Poast)		IV-V (Birds and mammals) IV-(Fish and aquatic insects)	No documented field effects on wildlife. Low toxicity in lab birds and mammals.	Avoid contaminating wetlands, ponds, lakes, and streams.
triallate (Fargo)		IV-(Birds and mammals) I-II-(Fish and aquatic insects)	Very low acute and subacute toxicity to birds and mammals. Highly toxic to fish and aquatic insects.	Avoid contaminating wetlands, ponds, lakes, and streams. Use buffer zones when applying near water areas.
trifluralin (Treflan)		IV-(Birds and mammals) I-(Fish and aquatic insects)	High toxicity to aquatic invertebrate and fish.	Use buffer zone when applying near wetlands or other water areas.

FUNGICIDES

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
benomyl (Benlate)	Benzimida-zole	V-(Birds and mammals) I-(Fish)	Toxic to fish and aquatic insects.	Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
mancozeb (Dithane, Manzate, Penncozeb)	Ethylenebis dithio-carbamate	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife.	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
chlorothalonil (Bravo)	Aromatic	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife.	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
propiconazole (Tilt)	Triazole	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
thiabendazole (Mertect)	Benzimida-zole	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
triadimefon (Bayleton)	Triazole	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.
iprodione (Rovral)	Dicarboxi-mide	V-(Birds and mammals) I-(Fish and aquatic insects)	No documented field effects on wildlife	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.

Pesticide (Trade name)	Family	Toxicity class	Documented effects on wildlife	Best measures to reduce the risk of exposure
thiophanate methyl (Topsin-M)	Benzimida-zole	V-(Birds and mamals) I-(Fish and aquatic insects)	No documented field effects on wildlife	Apply according to label instruction. Avoid contaminating wetlands, lakes, ponds, and streams. Use a buffer zone when applying near water.

Toxicity class data is based on acute oral rate median lethal dose (LD5O) values for acute toxicity comparisons among chemical. The five toxicity classes used are:

Class		
I	- Extremely toxic	LD5O < 40 mg/kg
II	- Highly Toxic	LD5O 41-200 mg/kg
III	- Moderately Toxic	LD5O 201-1,000 mg/kg
IV	- Slightly toxic	LD5O 1001-5000 mg/kg
V	- Relatively nontoxic	LD5O > 5,000 mg/kg

RESOURCE MATERIAL

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